
ASSET AND LIABILITY MANAGEMENT (ALM)

Introduction

Asset/Liability Management (ALM) is the process of managing the composition and pricing of a corporate credit union's (corporate's) assets, liabilities, and off-balance sheet instruments. It also encompasses controlling exposure to financial risk with the goal of maximizing the efficiency of capital over the long term. ALM, therefore, includes the processes by which an institution: (1) manages and prices its funds, (2) controls its exposure to financial risk, and (3) manages its net interest margin and net economic value.

ALM centralizes management oversight of the above functions to ensure the common goal of achieving the corporate's financial objectives. ALM recognizes no individual asset, liability, or off-balance sheet portfolio exists in a vacuum. Rather, ALM explicitly considers each portfolio to be a critical link in the integrated and dynamic process of balance sheet management, and an integral part of the corporate's overall risk/return profile.

The ALM process includes both the decision-making processes and analytical systems involved in managing a corporate's risk/return profile. The decision making process should be comprehensive, and should include the Asset/Liability Committee (ALCO), policies, procedures, and controls to support the ALM function. Analytical systems (i.e., asset/liability models) should provide for comprehensive, timely, and accurate analyses of an institution's global risk/return profile, as well as those of potential strategies.

In assessing an institution's ALM, the examiner's general focus should be to:

1. Ascertain whether the ALM decision-making framework (ALCO, policies, procedure, controls, etc.) is sufficient to guide the major financial functions (listed above).
2. Verify the analytical systems and instruments available to management are properly implemented and used appropriately in managing the institution's risk/return profile.

Setting Financial Goals: The Risk/Return Profile

A corporate's overall financial return objectives are generally stated in terms of earnings (net interest margin) or value (net economic value) maximization, within the constraints imposed by risks from external and internal factors. Risk is generally characterized as the variability of returns. The greater the risk embedded in individual assets, portfolios, or the overall institution, the greater may be the variability of returns over time.

Management is constantly faced with the fact that, at any given point in time, higher returns (earnings or value) are expected if the corporate takes on greater risk; this is the risk/return tradeoff. Whether to position for a higher expected return at the risk of greater variance in realized return is the issue that confronts the management of each of the financial functions overseen by ALM.

For example, when the Treasury yield curve is relatively steep, a corporate can enhance current and expected earnings by borrowing short-term funds and investing in longer term assets. However, rising yields will immediately reduce net economic value and result in reduced realized earnings over time (all other things being equal). If a corporate has derivative authority, it may choose to reduce its overall interest rate risk (IRR) exposure by synthetically extending its liability duration with a pay-fixed interest rate swap; in this case, the reduced risk will lower the expected return and the expected variance of returns.

This tradeoff between risk and return heightens the difficulty of consistently achieving overall financial goals. Short-term earnings targets may be met by accepting greater risk, but long-term earnings objectives may be compromised. As a result, a rational decision-making process for determining a corporate's optimal risk/return profile and analyzing the impact of numerous risk/return alternatives is crucial to successful financial management. This process is called the ALM decision making process.

ALM is therefore a process of optimization, in which the risk/return tradeoffs of potential strategies are analyzed, and only those that most efficiently support the achievement of the institution's overall financial objectives should be implemented.

Measures of Return

An institution's overall financial objectives with respect to return are usually stated in terms of earnings or market value maximization. In specifying these goals, a number of specific measurement gauges may be appropriate, either individually or in combination. These include both earnings-based and market value-based performance measures, as shown in Table 1.

Corporates traditionally specified financial objectives in terms of earnings-oriented performance measures. While earnings-oriented performance measures are still commonly used in the corporate credit union industry, market value-oriented measures are also viewed as critical indicators of corporate financial strength.

Table 1

| Measures of Return Performance | |
|--|--------------------------|
| A. Earnings-oriented measures | 1. Net interest margin |
| | 2. Core income |
| | 3. Net income |
| | 4. Return on assets |
| | 5. Return on equity |
| B. Market value-oriented measures | 1. Market capitalization |
| | 2. Liquidation value |
| | 3. Going-concern value |
| | 4. Net economic value |
| C. Both--Total Return | |

Earnings-Based Measures

Net Interest Income (NII) - NII is interest income minus interest expense. NII is the primary source of income for a corporate and a key indicator of earnings performance and stability. This measure makes no adjustment for assets that earn no interest or liabilities that bear no explicit interest cost.

Net Interest Margin (NIM) - Net interest income is called NIM when expressed as an annualized percent of moving daily average net assets (DANA). A corporate can optimize its net interest margin by effectively allocating resources among earning and non-earning assets, maintaining low levels of non-performing assets, providing adequate liquidity funding, and maintaining a strong capital position. In a volatile interest rate environment, large changes in NIM may indicate a significant exposure to IRR and potential risk management concerns.

Core Income - Core income includes NII and fee-based income less operating expenses. It excludes non-recurring income and expense items so a measure of the institution's fundamental current earning power can be attained.

Net Income - Net income is still the performance measure most utilized by investors, even though it is one of the least meaningful. It is very short-term in focus and can be easily manipulated to generate the appearance of favorable earnings trends. For example, non-recurring gains can be recognized to inflate earnings or to mask the impact of negative underlying developments. Reliance on these gains will negatively affect future earnings (all other things being equal).

Return on Assets (ROA) - ROA is net income divided by average assets. To the extent the numerator is distorted by the shortcomings noted above, this measure should be used cautiously or adjusted to account for non-recurring items. As a ratio measure, the ROA is convenient for other comparative analysis, as is the return on equity measure (below).

Return on Equity (ROE) - ROE is net income divided by average equity. The usefulness of this measure is also dependent on the accuracy of the numerator. The ROE is widely used by institutional investors as the key measure of performance.

Market Value-Based Measures

The measures of return discussed so far are based on reported earnings (i.e., accounting data). In contrast, market value measures reflect economic value.

Market Capitalization - Market capitalization is equity shares outstanding times the price per share. Since corporates are mutual organizations, this measure is not applicable.

Net Economic Value (NEV) - NEV is equal to the difference between the market value of assets and liabilities, plus the termination value (mark-to-market value) of off-balance sheet instruments. The NEV may be computed under different assumptions. NEV represents, in effect, the present value of long-term earnings streams. By focusing on stabilizing its market value, a corporate will also stabilize its long-term earnings. For this reason, market value measures have gained acceptance in financial institutions.

The overriding management objective is the efficient use of capital. The more efficiently capital is employed by a corporate, the more value is added to members in terms of dividend rates, services and protection from adverse events. Optimization of NEV is a management goal that serves the members' demand for a satisfactory return on their investment (ownership in the corporate). Return on capital flows directly to the members in the form of dividends on shares and indirectly in the form of NEV increases and services (to the extent that they are offered at or below a member's alternative cost).

A corporate computes NEV using its own assumptions, models, and methodologies. The corporate examiner should review this process, particularly the assumptions, for reasonableness. NEV must be produced at least quarterly, and as frequently as monthly, depending on the level of expanded authorities and/or amount of unmatched embedded options in the balance sheet. NEV is measured for a base case as well as a series of permanent, instantaneous and parallel shifts of the Treasury yield curve. During times of extremely low interest rates, the required downward shock tests may be suspended per guidance from the Director of the Office of Corporate Credit Unions. This analysis of NEV sensitivity is an invaluable tool in the assessment of IRR exposure.

Liquidation Value - Liquidation value is the residual value that would remain if all assets, liabilities, and off-balance sheet instruments were sold, terminated, or offset today (or in the short term). Current market prices are used to value all assets, liabilities, and off-balance sheet instruments for which market prices are available. If prices are not readily available for certain items, then the value is computed based on a discounted cash flow analysis using current market factors.

Liquidation value is the "bottom line" to an insurance fund, such as the National Credit Union Share Insurance Fund (NCUSIF), because to the extent the proceeds from asset sales are not sufficient to cover the balance of deposits, the fund will experience losses.

Going Concern Value - The going concern value generally assumes an institution must value not only its existing portfolios, but also those additions to the portfolio that can be expected as growth occurs or run-off is reinvested. In other words, the institution can be assumed to be a going concern, as opposed to being liquidated on a one-time basis.

Total Return

Total return has long been the accepted measure of performance for investment securities, but it has only recently gained acceptance in the depository institution industry as a performance measure. Total return incorporates earnings and market value appreciation in the assessment of performance. The total return concept thus considers both short-term and long-term earnings levels and stability.

Selecting a Measure for Returns

Each corporate must determine the relative merits of each performance measurement, then clearly state and internally communicate the return objectives for the overall institution, as well as each financial function. Just as importantly, the institution must clearly enumerate the constraints (risks) within which those return objectives must be achieved. In this regard, the framework for identifying and measuring risk exposure also must be determined.

Measuring Risk Exposure

Sources of Risk Exposure

The most significant sources of risk to a corporate are interest rate, liquidity and credit risks. Interest rate and liquidity risks are most relevant to the ALM process. In addition, widening credit spreads have periodically caused material increases in risk exposure and this risk must be adequately managed. Other risks include operational risk, fraud, and the risk of disasters or catastrophes. Since the measurement of these risks is discussed in more detail in other Guide sections, they are only briefly described here.

IRR - IRR is the primary focus of the ALCO and the ALM decision-making process. It arises from three primary sources: (1) the mismatch between the maturities or durations of assets, liabilities, and off-balance sheet instruments; (2) option risk including, the risk asset/liability durations will change as interest rates change; and (3) basis risk, the risk asset and funding/hedging rate spread relationships will change.

Mismatch risk is the most prevalent source of IRR. Option risk arises from the prepayment, cap, floor, and other options embedded in underlying mortgages, CMO tranches, adjustable-rate loans, term deposits, and other products. These options heighten the difficulty of hedging IRR because they contribute to the volatility of underlying asset and liability durations.

Basis risk occurs when unhedged or unhedgeable changes in interest rate spread relationships (between assets and liabilities or hedges) contribute to the instability of net interest earnings or value. For a typical corporate, this risk usually arises when it buys assets indexed to LIBOR, PRIME or COFI and issues liabilities to members based upon Treasuries or Fed Funds. Basis risk tends to have less of an impact on corporates than changes in the general level of interest rates.

These three sources of IRR, and the measurement and management of IRR, are discussed in the IRR Management section of this chapter (Page 202-31).

Liquidity Risk - Liquidity risk is the risk funds may not be available to meet cash outflows when they arise. This may occur because of insufficient cash flow, insufficient borrowing sources or because the assets designated as cash equivalents are not able to be sold quickly without causing a considerable loss due to a decline in the market value. Liquidity risk also can become significant if the financial condition of an institution is deteriorating and members, depositors, and/or creditors begin to withdraw or demand payment of their funds. Section 704.9 requires corporates to regularly monitor sources of internal and external liquidity and to model projected liquidity through a series of successively deteriorating

scenarios. No explicit liquidity ratios or measures are specified in the regulation. However, it is important corporate credit unions develop meaningful liquidity measures and monitor them regularly.

A corporate should strive to maintain an amount of liquidity that is most efficient given its overall economic situation which in turn reflects the anticipated funding demands of its members. As a practical matter, corporates should maintain liquidity in excess of their projected day-to-day requirements. Additionally, corporates are considered bankers' banks and cannot incur daylight overdrafts at the Federal Reserve Banks. Therefore, daily liquidity management is of paramount importance. The maintenance of minimum liquidity levels represents a constraint on ALM. These and other aspects of liquidity management are discussed later in this chapter (Page 202-39)

Credit Risk - Credit risk is the risk due to uncertainty in a counterparty's ability to meet its obligations. It includes a counterparty's failure to repay principal and interest and/or perform on a derivative contract in a timely manner. This type of risk encompasses the exposure to loss as a result of a decline in market value stemming from a downgrade of an issuer or counterparty, or a change in the perception of the probability of default (widening credit spreads).

The impact credit risk can have on market value affects NEV and liquidity. Therefore, it is important the credit risk management process be reviewed by the ALCO. This process includes: asset quality review (including credit ratings, financial performance, level of credit enhancements, etc.); underwriting policies and guidelines; restructurings/workouts; and reserving levels. Credit risk involving investments is discussed further in Chapter 201, Investments.

Other Risks - Operational risk, fraud, and disaster risks have not traditionally been managed or overseen by the asset/liability manager or the ALCO. However, these risks should be considered within the overall risk management function. Since the ALM function will direct the corporate wide flow of funds, adequate procedures and controls must be installed to avoid inefficiency and fraud. Also, ALM applications and data must be backed up frequently and stored in an off-site location to enable the continuation of ALM operation in the event of a disruption. Thus, the ALCO must have reasonable assurance management responsibilities, internal controls, and information systems are adequate to provide clear guidance and control in the execution of balance sheet strategies.

Quantifying Risk Exposure

The risk of a given ALM strategy is typically quantified through the use of asset/liability models to perform simulation or sensitivity analyses. Important assumptions used in the projection of earnings or valuation of assets and liabilities are altered, and the change in expected returns (earnings or value) is determined. Asset/liability modeling is discussed in more detail later in this Section under "Asset/liability Modeling and Analysis" (Page 202-14).

Recent advances in computer technology have made risk quantification feasible for virtually any individual portfolio or balance sheet. Of course, risk analysis is only as good as the data and assumptions (including those not subjected to the sensitivity analysis) used in the model. Examiners must therefore review and critique the risk quantification methodology used by the corporate. Additionally, the corporate should obtain an independent third party validation of the implementation of its risk measurement system. All corporates are required to conduct a fair value (NEV) assessment of the balance sheet for a variety of rate scenarios. Other assessments should also be performed.

Once a methodology has been developed for measuring the risks in a corporate's balance sheet, limits for risk exposure must be established. Then management can concentrate on identifying and executing the most "efficient" strategies. Efficient strategies are those that best support the achievement of the institution's optimal risk/return profile. This may be done on a total balance sheet basis or for discreet portfolios, sometimes termed "books of business."

Optimization: Achieving an Efficient Risk/Return Profile

Once the institution's return objectives and risk constraints have been established, management must select strategies that most efficiently support attainment of goals. This process is called "optimization." The best optimization framework results in the selection of strategies with the highest return for the same (or similar) level of risk. Since the expected returns are quantifiable, and the variability of expected returns (risk) can be quantified through sensitivity analysis, a relatively objective selection framework results. Comparing two strategies with the same quantified risk exposure, the strategy with the higher return is considered most efficient, or that with the highest risk-adjusted return. By adjusting expected returns for the level of anticipated risk (variability of expected returns), this framework puts all the alternatives on a common measurement basis to facilitate decision making.

The cornerstone of a successful ALM/ALCO process is a technically rigorous asset/liability model that allows management to quantify risk/return tradeoffs. Optimization leads to the risk/return profile most desired by the board and management. The optimization framework is at the top of the ALM decision making process, which includes the ALCO, ALM policies, and related procedures and controls.

The ALM Decision-Making Process

The ALM decision-making process consists of:

1. the ALM policy framework;
2. the Asset/Liability Committee;
3. a comprehensive asset/liability model; and
4. related procedures and controls.

A shortfall in any of these process components can potentially disrupt the entire ALM function. If, on the other hand, these components are well designed and utilized, an institution will most likely attain its desired risk/return profile and overall financial objectives.

Examiners should review the ALM policies and asset/liability modeling process. It is usually very instructive to observe an ALCO meeting during the examination, since this is the core of the ALM decision-making process.

The ALM Policy Framework

Board policy and delegated authorities are crucial to the ALCO and the ALM function. Every portfolio in the corporate is affected by the ALM process, and each decision has an impact on both current and

future profitability. Elements of an acceptable ALM policy are outlined in Table 2.

Table 2

General Outline of Asset/Liability Management Policy

- I. Objectives of ALM
 - A. Implement Board-Approved Policies
 - B. Integrate the Financial Functions
 - C. Determine Desired Risk/Return Profile
 - D. Analyze Risk/Return Tradeoffs of ALM Proposals
 - II. Delegation of Authority from Board of Directors
 - III. The ALCO
 - IV. Asset/Liability Management Functions
 - A. ALCO Support
 - B. Asset/Liability Modeling and Analysis
 - C. Execution of ALM Strategies
 - V. Risk Limitations
 - A. IRR
 - B. Liquidity Risk
 - C. Credit Risk
 - D. Other Risks
-
- VI. Internal Controls/Guidelines
 - A. Internal Controls (position limits, transaction authority, authorized dealers, etc.)
 - B. Guidelines (approved security/instrument types, transaction/position limits, etc.)

The ALM policy legitimizes the ALM function within a corporate and provides a formal framework for its operation. Therefore, examiners should review the ALM policy of every corporate. Some corporates may alternatively refer to their ALM policy as the investment policy or funds management policy.

Examiners should determine whether: (1) the policy limits are reasonable given the corporate's financial condition and expertise of staff, (2) management is complying with the board-approved policies, and (3) periodic reports to the board are adequate.

The Asset/Liability Committee

The ALCO is at the core of an integrated, centralized ALM process. The objectives of the ALCO are to:

1. Implement board-approved policy.

2. Oversee and integrate the financial functions, and ensure a centralized approach to funds management, risk management, and earnings/capital management.
3. Set overall return objectives and quantify risk constraints, thereby defining the institution's risk/return profile.
4. Review the risk/return tradeoffs of potential ALM strategies to ensure they most efficiently support the achievement of the desired risk/return profile.

The ALCO decision-making process is just as important for small corporates as large ones. Relative to asset size, many asset/liability decisions in small corporates frequently have a greater impact on funds availability and earnings than those of their larger counterparts. The larger corporates tend to have a greater depth of personnel to staff an ALCO, but small corporates must rely on a few key managers and volunteers to carry out this critical function.

Part 704 requires corporates to have a formal ALCO. The committee should be comprised of key managers and must include at least one director. A typical ALCO will include the CEO, the CFO, the investment personnel (risk takers), the asset/liability and credit risk managers (risk monitors), and any other senior managers who routinely participate in the financial activities and strategies of the corporate.

The ALCO structure should be assessed by the examiner on a case-by-case basis, and recommendations should be made if it becomes evident during an examination that decision making is hampered or the representation on the committee is not adequate. The ideal size and composition of the ALCO will depend upon the strategic direction of a corporate and the relative size or importance of various portfolios. Sometimes a committee that is too large is more of an impediment than a benefit to the decision-making process.

In some large corporates, the ALCO is further broken down into an internal or management ALCO and a board ALCO. By having a management ALCO, a corporate can have more frequent and technical discussions regarding the execution of strategies approved by the board ALCO. Board ALCO meetings tend to coincide with the monthly board meetings and permit officials who are not formal members of the committee to attend. This dual structure can permit the board to expeditiously review and challenge ALM reports without having to wade through technical details not directly related to strategic goals and risk oversight.

ALCO Meetings

A board ALCO should meet at least monthly. A management ALCO, if constituted, customarily meets more frequently and should be available to meet on short notice, if necessary, to respond to financial market developments. Participation on either ALCO is a major commitment to the institution. ALCO attendance should be mandatory and a quorum should be established to facilitate decision making in the absence of one or more members.

Examiners should verify appropriate emphasis is placed on the ALCO decision-making process. For example, if the CEO often fails to attend the ALCO meetings, or if the ALCO is otherwise relegated to a secondary status, the committee is unlikely to achieve its objectives. This situation may occur even if the corporate has a well-structured ALCO, good ALM policies, and a proficient modeling capability. The ALCO should function as a risk management body and not as an investment committee simply dedicated to analyzing perceived market opportunities.

Training for ALCO (and board) members is an important component of a strong ALCO process. Periodic training is necessary to keep abreast of market trends, products, and contemporary best practices in risk management. Training may be conducted by the staff of the corporate but should be augmented from time to time with professionals from outside the company who are known or regarded experts on the topic presented. The ALCO should keep a formal log of its training sessions and it should be reviewed by the examiners.

ALCO Functions

The functions of the typical ALCO are presented below. Depending on the size of the institution, complexity of its portfolio, and its asset/liability mix, the ALCO process may vary. The following functions should be considered.

1. Receive direction from and facilitate oversight by the board of directors. Provide periodic reports to the board regarding policy compliance, such as IRR exposure reports, earnings/capital projections and analysis. Periodically review ALM policy and recommend changes to the board;
2. Determine financial objectives and establish policy for each of the financial functions;
3. Coordinate funding of investments, lending (if any), and other activities. Project and review, at each meeting, the funding surplus/deficit with comprehensive short-term and long-term cash flow forecasts. Optimize cash resources, investment of liquid funds, and access to borrowed funds;
4. Coordinate product pricing. Oversee product-pricing mechanisms to ensure spread requirements are achieved and maintained. Set product prices on an incremental basis in conjunction with funding costs;
5. Direct proposed ALM strategies or transactions through technically rigorous simulation and scenario analysis;
6. Direct computation and monitoring of NEV. Ensure the reconciliation of NEV calculations to book value, and review economic and earnings effects of ALM decisions;
7. Set limits with regard to IRR exposure, both in the context of NEV and NII sensitivity (if NII measures are required by policy). Identify and approve measurement methodologies for the quantification of IRR;
8. Oversee investment portfolio management activities. Ensure excess liquid funds are optimally invested in securities that complement the institution's overall risk/return profile;
9. Monitor the economic environment, including regional and national economic conditions, interest rates, prepayment trends, volatility, and related regulatory developments;
10. Direct hedging operations (if any), including hedge analytics, related policy development, and integration with the overall risk/return profile. Specify the range of instruments that can be used to hedge the various kinds of risk exposures;
11. Direct capital market activities, including raising capital, debt issuance, dividend policies, and merger/acquisition analysis. Ensure these activities are integrated with the management of the overall risk/return profile; and
12. Ensure product development activities support the institution's overall risk/return objectives.

Examiners should review the ALCO's performance. It is important the ALCO function be centralized. A lack of centralization weakens the control of risk. Thus, the responsibilities detailed above should not be managed outside of this process by staff whose authority supersedes the ALCO.

Asset/Liability Modeling and Analysis

Asset/Liability Modeling

The ALM decision-making process should be centered around quantified measurements of the institution's overall risk/return profile and those of potential ALM strategies and instruments. Management should use a reliable asset/liability model in its ALM operations. An institution's asset/liability model should allow the asset/liability manager and the ALCO to identify and further analyze efficient ALM strategies. The model serves both strategic and risk monitoring objectives.

A model must be able to:

1. Accept a wide variety, and potentially a large volume, of data input and assumptions;
2. Accurately measure the risks associated with all instruments on the corporate's balance sheet.
3. Perform sensitivity and simulation analyses (described below) under different scenarios;
4. Generate concise and decision-oriented summary reports;
5. Allow for quick turnaround of "what if" analyses; and
6. Accommodate new instruments and products.

Examiners should review the ALM modeling process to determine whether the corporate's model (if any) is capable of performing the above tasks. Management should maintain its asset/liability model(s) commensurate with the scope and complexity of their activities.

Most asset/liability models have the same general design. Data concerning the institution's current balance sheet position (and off-balance sheet items) are entered (either manually or through an automated process) with the key earnings and value parameters for each portfolio. For example, the earnings parameters for fixed-rate mortgage related securities include the expected cash run-off (determined using a prepayment assumption) in each forecast period, the weighted-average coupon, and expected incremental activity in the portfolio.

Next, assumptions concerning future interest rates, prepayment conditions, spreads, volatility, and incremental activity are entered. Many of these assumptions are "shocked," or altered by certain amounts to enable the corporates to view their impact on earnings and net economic value. Then, decision-oriented reports are generated to support the ALCO function and ALM decision making.

Asset/liability models are used to perform sensitivity and simulation analyses in the measurement of IRR exposure and the analysis of proposed strategies. Sensitivity analyses are used to study the impact of strategies and assumptions on NEV in different environments. Simulation analyses review the impact of different strategies and assumptions on earnings. Ideally, a corporate's asset/liability model will be capable of quickly generating numerous sensitivity and simulation analyses. Such models allow for the analysis of both risk and return, within the context of both market value and accounting earnings. This kind of comprehensive analysis best facilitates the identification of the desired risk/return profile, and the analysis of risk/return tradeoffs.

Some corporates perform asset/liability modeling only to meet regulatory requirements pertaining to IRR measurement, rather than to support management analysis and decision making. Others have limited ability to model dynamic assets with embedded options yet they are inclined to buy such instruments. Also, some institutions do not have an adequate process in place to check or edit the model after manual data entries have been made (discussed earlier). Any such shortcomings should be noted in the examination report if identified by the examiners.

Another frequent problem in the asset/liability modeling area is unnecessarily cumbersome reports are generated for the ALCO, rather than summary-level analytical reports. The ALCO reports must contain useful information, not unintelligible reams of data. Sometimes, the computers used to run asset/liability software are too slow to support iterative sensitivity or simulation analysis. In such cases, the ALCO gets only a limited analysis, and may limit its requests for additional analysis, due to the lack of sufficient computer power. The need for and benefits of comprehensive analysis should drive the analytical process. Therefore, management should be made aware of computer power or report generation limitations that needlessly impede ALM analytics. In such cases, management should be encouraged to upgrade its capabilities. Examiners should be concerned when the ALCO has an appetite for risk-taking strategies, but is unwilling to implement an adequate model for cost or other reasons.

Other problems that become evident in the examination of the A/L modeling function include:

1. Overreliance on outside consultants;
2. Use of overly simplistic assumptions (example: basing all liability pricing off one key or index rate);
3. Overreliance on manual data entry;
4. Overly complex or condensed chart of accounts in asset/liability model (aggregation of instruments); and
5. Inexperienced personnel involved in the modeling function.

Other Modeling/Analytical Requirements

In addition to the asset/liability model, which is used to measure institution-wide IRR and the impact of traditional balance sheet ALM strategies, other models will likely be necessary to value specific instruments or to project assumptions for the asset/liability model or other purposes.

Those models may include:

1. Mortgage-derivative analysis (e.g., Bloomberg or other servicers);
2. Off-balance sheet derivatives:
 - a. interest rate swaps;
 - b. options;
 - c. futures contracts; and
 - d. forward agreements;
3. Mortgage (or other) prepayment forecasting;
4. Volatility term structures;
5. Hedge analytics (hedge ratio calculations, regression analysis);
6. Interest rate projection (forward Treasury yield curve analysis, cost of funds index projection);
7. Secondary marketing analysis (net exposure calculations, fallout projection);
8. Trading portfolio (technical analysis, charting, program trading);
9. Product profitability (transfer pricing, functional cost analysis); and
10. Budgeting.

Examiners should review most, if not all of these models, especially if they have a material impact on the ALM function. The review process should basically be the same as the review of the asset/liability model. In many cases, institutions rely on outside vendors, brokers, or consultants to perform analyses or calculations. Generally speaking, the over-reliance on an outside party for analysis used in an institution's key decision-making processes should be

considered an unsafe and unsound practice. If the corporate does rely heavily on vendors, it should have a strong vendor management process and contingency procedures in place.

If the output from outside models is used in conjunction with the corporate's asset/liability model, the information or data provided should be reviewed for reasonableness. The utilization of automated interfaces between models limits input error and should be used whenever possible. The external models and the assumptions used must be consistent with the asset/liability model, otherwise, incongruence may undermine the process.

IRR Models

Measures of IRR require reliable information on the amount and timing of the cash flows generated by an institution's assets, liabilities, and off-balance sheet instruments. Because this information is not always known with certainty, assumptions must be made to perform the analysis. Depending on the type of analysis, these assumptions may include: (1) how market interest rates will change (over the period of analysis); (2) how instruments with rate dependent cash flows vary with interest rate changes; (3) how management will administer interest rates that are under its control (such as rates on shares and membership capital), when the general level of interest rates changes; and (4) in NII models, how management will reinvest interest and principal cash flows.

Two types of models are commonly used by depository institutions to estimate the interest rate sensitivity of NII: maturity gap models and NII simulation models. Likewise, there are two types of models commonly used to estimate the sensitivity of NEV: duration gap models, and NEV simulation models.

Maturity gap and simple duration gap models are similar in that they implicitly make assumptions about the way interest rates and cash flows behave. Perhaps the most serious shortcoming of these models is they assume cash flows do not change in response to interest rate changes. For example, the model assumes adjustable-rate loans do not reprice again after their next reset and mortgage prepayment rates as well as share decay rates do not vary. The result is the estimated change in NII or the change in the NEV of the institution is the same for a given increase in rates as it is for an equivalent decrease. However, in reality, the prepayment option embedded in mortgage assets results in asymmetric price changes for mortgages. That is, price increases when rates fall tend to be less than price declines when rates rise. The value of most corporate balance sheets shows a similar sensitivity. This sensitivity cannot be accurately estimated by gap and duration models that assume cash flows are the same in all interest rate environments.

NII and NEV simulation models, on the other hand, permit these assumptions to vary, but necessarily rely more heavily on the analyst to make choices about certain behavioral relationships incorporated into the model. Even though they rely more heavily on parameters set by analysts, NII and NEV simulation models can be much more accurate than their less sophisticated counterparts if appropriate assumptions are used.

When assessing any measure of IRR of a corporate, the examiner should carefully evaluate the reasonableness of the assumptions used in the analysis.

Maturity Gap Models

Maturity gaps are relatively easy to calculate compared to other measures of IRR, and during the 1980s were the most commonly used measures of IRR in depository institutions.

Maturity gap analysis measures the difference, or "gap," between the dollar value of assets and liabilities maturing or repricing during a given time period. The dollar gap is often expressed as a percentage of assets. When multiplied by a hypothetical change in interest rates, the dollar maturity gap gives a rough estimate of the effect of such a rate change on NII.

To calculate the maturity gap, principal balances of interest-earning assets and interest-bearing liabilities are categorized by maturity/repricing intervals or "buckets" (e.g., under one year, one to three years), depending on when the principal cash flows will be received or when their

interest rate will next be adjusted. In more sophisticated gap models, the timing of the principal cash flows is adjusted by incorporating the effects of asset amortization, mortgage prepayments, core share decay, and the effects of off-balance sheet hedging instruments.

As an example of a maturity gap calculation, assume a corporate with \$10 million in assets estimates \$3 million will reprice during the next year (by having principal mature, prepay, amortize, or having the coupon adjust). Further, it is estimated \$6 million of liabilities will reprice during this time. This institution is said to have a “one-year gap” equal to negative 30 percent $[(\$3m - \$6m) / \$10m]$.

$$\text{GAP} = \frac{(\$ \text{Assets Repricing}) - (\$ \text{Liabilities Repricing})}{\$ \text{Total Assets}}$$

To estimate the effect a change in interest rates has on an institution's interest margin, the gap as a percent of assets is multiplied by the hypothetical rate change. For example, the estimated effect of a 1 percent rise in interest rates on NII over the next year would be approximately 0.30 percent or 30 basis points $(1.0 \text{ percent} \times -30 \text{ percent} = -0.30 \text{ percent})$. Given assets of \$10 million, this decrease in interest margin would translate to a reduction in NII of \$30,000 over this period.

Although maturity gaps are relatively easy to measure and do provide a rough measure of NII sensitivity, they have a number of well-known shortcomings including the following:

1. Maturity gap models typically focus exclusively on near-term NII. This focus hides the risk to NII of longer-term repricing mismatches. This ignores potentially adverse effects on not only earnings but also liquidity.
2. The repricing intervals chosen for analysis are arbitrary and there may be significant mismatches within a repricing interval that will be ignored in the analysis. The most common repricing interval analyzed by depository institutions is the one-year gap and the one to three-year gap. A cash flow to be received in one year should have a different effect on interest-rate exposure of an institution than an identical cash flow to be received in two and one-half years. Yet the one to three-year gap model would treat these two cash flows as equivalent in terms of their effect on the IRR of the institution.
3. Using maturity gaps to estimate the change in NII resulting from a change in interest rates assumes all interest rates change by the same amount--an unlikely occurrence. When the general level of interest rates increases by 1 percent for example, some interest rates, such as those paid on short-term transaction accounts, typically increase by a smaller amount, if at all.
4. It is not possible to properly incorporate the effect of exchange-traded options or the options embedded in many financial instruments such as early withdrawal options on share certificates, the caps and floors in ARMs, and mortgage prepayment options. These options have a significant effect on the rate sensitivity of a financial instrument, neglecting to incorporate them into the analysis will misstate the IRR of an institution.

NII Simulation Models

NII simulation models project interest-related cash flows of all assets, liabilities, and off-balance sheet instruments in an institution's balance sheet in order to estimate future net interest earnings over some chosen period of time. They are often referred to as “dynamic” NII simulation models because changes in operating strategies, relative interest rates, early withdrawal of shares, and prepayments can be built into the model.

NII sensitivity is calculated as follows. First, “base case” NII is projected for the current interest rate environment. Cash flows for each instrument are projected using assumptions about amortization characteristics, prepayment rates on mortgages, and share decay rates. Assumptions must be made regarding how the principal and interest cash flows received during the period of analysis will be reinvested.

Next, various simulations are done under alternative interest rate scenarios. For example, many models estimate the value of NII over the next year if interest rates were to increase or decrease by 100, 200, or 300 basis points. As in the base case scenario, interest cash flows are projected over the period of analysis, and will depend on assumed share decay rates, prepayment rates, and on how rates on adjustable-rate assets and shares are assumed to change in each interest rate scenario. (To project how the coupons on adjustable-rate assets will change, information on the time to first reset, reset frequency, and the presence of any rate caps or floors is needed.)

The larger the differences in projected earnings between the base case and the alternative interest rate scenarios, the higher the level of IRR.

NII Simulation offers the following advantages:

1. NII simulation models can provide more accurate estimates of the effect of changing interest rates on the future interest income of instruments with embedded options by varying prepayment rates according to the interest rate scenario being simulated. The value of other embedded options (e.g., lifetime caps on ARMs) and off-balance sheet instruments in an institution's balance sheet can be similarly assessed.
2. Interest rates on different instruments can be assumed to change by different amounts when there is a change in the general level of interest rates. For example, changes in rates on core shares can be assumed to lag behind changes in other rates.

Simulation analysis also has a disadvantage. Like gap analysis, NII simulation models typically measure the effect of a change in interest rates over only short periods of time, such as one year. Models that project NII over longer periods of time sometimes aggregate these future cash flows in a manner that implies cash flows received in the distant future are as valuable as those received in the near future. For example, a model may indicate if rates increase by 100 basis points, an institution will lose \$100 during the next year but will gain \$100 in year two of the analysis. In fact, the present value of the \$100 received in two years is less than the value of \$100 received in year one. NII models projecting NII over long periods should take the time value of money into account.

Analysis of the Sensitivity of Net Economic Value

The net economic value "N" equals the estimated present value (or "economic value") of assets "A," less the present value of liabilities "L," plus or minus the present value of all off-balance sheet items "O."

Thus,

$$N = A - L + O$$

Two types of models are commonly used to analyze the sensitivity of NEV: the duration gap model and the NEV sensitivity model. Both models require detailed information on the amount and timing of all future cash flows deriving from all financial instruments in the balance sheet as well as the specification of appropriate discount rates.

Duration Gap Analysis

Duration gap is the difference between the weighted-average duration of assets and liabilities, adjusted for the net duration of all off-balance sheet instruments. It is a measure of the percentage change in the NEV that would be expected if interest rates were to change by 100 basis points. This measure is a "point" estimate and is accurate for only small changes in interest rates.

To calculate the duration gap, the duration of each item in the balance sheet is separately calculated. The duration "D" of each instrument is weighted by the ratio of its market value to the net value of the balance sheet, and the weighted durations of all assets, liabilities, and off-balance sheet instruments are netted as follows.

$$D_N = D_A(A/N) - D_L(L/N) + D_O(O/N)$$

There are several different forms of the duration measure including simple (or Macaulay) duration and modified duration. Modified duration is the measure most often used to calculate the duration gap, and because it requires calculation of simple duration, both measures are described below.

Simple Duration

Simple duration was developed to provide a measure of the average time to receipt of the cash flows of a financial instrument. It measures the weighted average time until payments are received, where the weights are the proportion of the total present value of the instrument received in each period.

Calculation of the simple duration of an instrument requires three steps. First, calculate the present value of each cash flow (principal and interest) by discounting them by the instrument's required yield. (The sum of these present values equals the estimated price or market value of the instrument.) Second, multiply each present value by the number of years until it occurs, and sum these time-weighted present values. Third, divide the sum of the time-weighted present values from step two by the sum of the unweighted present values from step one.

Modified Duration

Modified duration is a measure of the interest rate sensitivity of an instrument and is obtained by dividing simple duration by $1 + (\text{Yield-To-Maturity} / \text{Number of Coupon Periods per Year})$. Modified duration indicates the expected percentage change in the price of a bond for every one percent change in market interest rates. The formula is presented below:

$$D_{\text{mod}} = \frac{D}{(1 + (\text{YTM}/n))}$$

where D_{mod} = modified duration;
 D = simple duration of the instrument;
 YTM = yield to maturity; and
 n = number of coupon periods per year.

For example, if a security had a modified duration of 2.566, the market price of the security would change inversely by 2.566 percent for every 1.00 percent change in market interest rates. After the duration of each item in the balance sheet has been calculated, each instrument's duration is weighted by the ratio of the market value of that instrument to the NEV, and netted.

One difficulty in calculating the duration gap lies in obtaining economic values for each instrument. If market price quotes cannot be obtained, the economic values may be calculated using present value analysis as described in the next section on the NEV sensitivity model. Book values are sometimes used to calculate the duration gap when market values are not available or not easily estimated. When economic values diverge significantly from book values, the use of book values may result in significant error in the estimation of the interest rate sensitivity of balance sheet value. Other drawbacks of duration gap analysis are listed below.

1. Duration gap analysis provides accurate estimates of price sensitivities of instruments only for small changes in interest rates, those less than 100 basis points. Modified duration assumes the percentage price change due to a rate change of a given magnitude will be the same when rates rise or fall (although opposite in sign). However, this is not true when rates change by a large amount. For a simple bond with no embedded options (such as a non-callable Treasury security), a large decrease in rates will result in a larger percentage increase in price than the percentage decrease in price that would result from an equal increase in rate (this phenomenon is known as convexity). The analysis is further complicated when analyzing financial instruments with embedded options such as

mortgage loans. Because borrowers tend to prepay their loans when refinancing rates fall below the coupon on the loans, the value of the loan will not rise as much as it would have had borrowers not prepaid (negative convexity).

2. Duration does not take the shape of the yield curve into account. The present values in the modified duration computation are usually calculated using the same discount rate (the required yield) for each future cash flow irrespective of when that cash flow will occur. This causes long maturity cash flows to be overvalued and short maturity cash flows to be undervalued, biasing the estimated duration.

NEV Sensitivity Analysis

The measure of IRR deemed most important by NCUA is the sensitivity of the NEV to changes in interest rates. A corporate's NEV is defined as the present value of assets minus the present value of liabilities plus the net market value of off-balance sheet contracts. The sensitivity of NEV is the change in a corporate's NEV that would result from a shift, or shock, in the term structure of interest rates, for example, by plus or minus 100 basis points.

Unlike simple duration gap, this measure may be used to estimate the change in economic value for substantial changes in interest rates, like 100 or 200 basis points or more. These larger changes in interest rates allow the measure of IRR to depict the corporate's economic exposure across a wider range of possible outcomes.

The remainder of this section is devoted to a brief overview of NEV sensitivity analysis. In particular, two methods of measuring the economic value of financial instruments are discussed.

Measuring NEV: Static Discounted Cash Flow Approach

The value of a financial instrument can be estimated by projecting the amount and timing of the future net cash flows generated by the instrument, and discounting those cash flows by appropriate discount rates. This procedure is commonly referred to as discounted cash flow analysis, or present value analysis.

The basic formula for the present value of a financial instrument is as follows:

$$PV = CF_1/(1+i_1) + CF_2/(1+i_2)^2 + \dots + CF_m/(1+i_m)^m$$

CF_1 is the estimated amount of the first cash flow generated and i_1 is its discount rate. The discount rate used for each projected cash flow is the yield currently available to investors from cash flows resulting from alternative instruments of comparable risk and duration.

The accuracy of any valuation derived from the discounted cash flow analysis depends on the accuracy of both the cash flow estimates and the discount rates used. These cash flows and discount rates must be estimated not only for the current scenario, but for each of the alternate interest rate scenarios being estimated.

1. Estimating Cash Flows

Under each interest rate scenario, a single path of future interest rates is assumed, based on future rates implied by the current term structure of interest rates. (In fact, this analysis is referred to as "static" cash flow analysis because each scenario depicts a single hypothetical path of interest rates, as opposed to the numerous paths used in the option adjusted spread [OAS] analysis described below.) Cash flows are calculated within each scenario based upon the assumed path of interest rates depicted in that scenario.

Cash flows may differ across scenarios for two reasons. First, mortgage prepayments and share attrition rates will differ since mortgage holders and share holders can be expected to make different decisions about these actions under different interest rate environments. Such differences in behavior are modeled by specifying a relationship between the interest rate scenario and the rates of prepayment and attrition, thereby changing the magnitude and timing

of principal and interest cash flows. Second, the magnitude of interest cash flows differs across scenarios as adjustable-rate instruments (such as ARMs or demand accounts) reprice in future periods and receive different future coupon rates under different scenarios.

2. Discount Rates

The rate used to discount a cash flow should represent the yield obtainable in the market for a cash flow of similar maturity and risk.

There are two common methods for arriving at the discount rates for a particular instrument. The simpler method is to discount every projected cash flow by the yield of comparable instruments. In this case, each of the “ i s” in the preceding equation would equal the current market yield of the instrument for which cash flows are being discounted.

A more complex, and more accurate method is to use non-constant discount rates based on the yields of zero-coupon instruments with maturities equal to those of each respective cash flow. In practice, this is done by calculating for each cash flow a discount rate that has two components: a risk-free component, which is represented by the zero-coupon Treasury yield for the same maturity, and a fixed spread, which compensates investors for prepayment, credit, and liquidity risk. This fixed spread is calculated as an increment to each of the risk-free components that causes the sum of the discounted cash flows to equal the observed market price of the instrument.

For either of the methods used, the discount rates in the alternate interest rate scenarios are typically adjusted by adding or subtracting the amount of the interest rate shock (e.g., for a plus 100 basis point scenario, add 100 basis points to each discount rate).

Measuring NEV: Option-Based Pricing

An option-based pricing approach is a more sophisticated approach to valuing assets (and, less frequently, liabilities) that contain embedded options.

The most important options in corporates' balance sheets are the prepayment options in mortgage securities and the caps and floors in adjustable-rate mortgage securities. When mortgage rates fall, mortgage prepayments typically accelerate, forcing corporates to reinvest the proceeds at lower yields. Interest rate caps and floors prevent the coupon rates of adjustable-rate assets from moving above or below a certain level when interest rates change. Both of these types of options can have a significant effect on the interest rate sensitivity of the instruments in which they are embedded.

In large part, the values of these options depend on the volatility of interest rates. When mortgage rate volatility increases, there is a greater chance that mortgage rates will fall sufficiently below the rates on existing mortgages so as to induce prepayment. Likewise, the greater the volatility of the index on which adjustable-rate loans are based, the more likely the coupon will be constrained by any rate cap or floor.

Option-based pricing models, also known as OAS models, use an interest rate simulation program to generate numerous (hundreds or even thousands) random interest rate paths that, in conjunction with a prepayment model, are used to estimate mortgage cash flows along each path. These cash flows are then discounted and averaged to arrive at a single mortgage price.

OAS models provide more accurate estimates of the value of these embedded options (and, therefore, of the mortgages themselves) than static discounted cash flow models. In a static cash flow analysis, the option has no value unless it is “in the money” (i.e., the prepayment option is exercised because rates have fallen and the homeowner chooses to refinance, or the rate cap or floor is effective). In fact, like exchange-traded options, these options have value

even when they are not in the money, because it is possible they will be in the money at some future date. Market participants will pay more or less for the instrument containing the option depending on the likelihood of exercise.

The sensitivity of NEV is a valuable measure of IRR because it estimates how the economic value of an institution changes when interest rates change. In addition, the results are easy to interpret. However, it is a complex measure that requires extensive modeling, and, as with any measure of IRR, the results are sensitive to the assumptions used.

Procedures and Controls

To ensure the integrity of the ALM decision-making process, internal procedures and controls must provide for efficient data flows. This is especially important because of the need to receive and input cash flow data from every major department in the corporate, and to make coordinated decisions affecting the entire institution based on the analysis of that data. The size of the corporate and the volume of transactions should be taken into consideration by examiners.

If the ALM process is not functioning properly, examiners should focus on the related operating procedures and internal controls. In a large institution, the documented procedures typically will need to be quite extensive to accommodate a large volume of data flow from numerous functional areas to the asset/liability manager.

Internal Procedures

Procedures must be documented and in place that allow for the smooth and timely flow of data to the asset/liability modeling function, the ALCO, and other areas. Flow charts documenting this physical flow of data from all departments are usually very informative. If such flow charts do not exist, management should be encouraged to develop them.

Procedures also must be developed to verify data entry required in the asset/liability modeling, cash flow forecasting, pricing analysis, and other key computational ALM operations. Required analytical processes for certain strategies, such as hedge ratio calculations or mortgage-derivative analytics, should also be documented. Processes should be in place to confirm individual strategies or transactions are not in violation of NCUA Regulations and those of other agencies.

The corporate must develop formal procedures to investigate unusual changes in security pricing and option adjusted spreads. Such anomalies may indicate an error or a problem. By having formal investigative procedures for this process, the corporate ensures timely and consistent treatment of any such issues.

Other procedures are necessary to accommodate the ALM function at certain institutions. These should be assessed on a case-by-case basis.

Internal Controls

In small corporates, internal controls are more important as it is more likely an individual may be performing multiple incompatible functions (i.e., a senior manager may not only be involved in ALCO decisions, but may also execute transactions, oversee the disbursement of cash, and authorize the related accounting entries). Examiners should take exception where the organizational structure does not provide for sufficient segregation of duties and adequate compensating controls have not been established. Critical responsibilities must be properly separated to ensure adequate internal control to the extent possible.

Examiners should also verify internal controls in the ALM function are adequate in the following areas: transaction authorizations - both internal (officers authorized to transact business) and external (e.g., approved dealers); position/transaction limits; regulatory requirements or limits; and other guidelines. Policies and procedures for the individual financial functions usually elaborate on these control features.

Executing ALM Strategies & Decisions: The Financial Functions

Structured appropriately, the ALM decision-making process should result in effective strategies to guide an institution toward achieving its overall financial objectives. These strategies are then implemented by the financial functions which are the portfolio-level operations that carry out three elements of the ALM process: (1) funds management and pricing; (2) risk management; and (3) earnings/value management.

Examiners should review the procedures for communicating actionable decisions to the functional areas, and the reports generated for the board which summarize the nature and purpose of each major transaction. Additionally, examiners should look to the policies and procedures in each of the functional operations to verify the strategies selected by the ALCO have been executed efficiently.

The Three Elements of the ALM Process

Funds Management and Pricing

This element consists of the functions involved in the origination, purchase, sale, maturity, and/or other activities involving the flow of funds. Therefore, asset (primarily investments) and liability management falls into this category. To ensure the most efficient and profitable movement of funds, cash management and liquidity management fall into this area.

The pricing of assets and liabilities is an integral part of funds management. Share and loan products are generally priced by management, while investments and borrowed funds are dictated by the market, hence, to a lesser extent controlled by management. As a result, pricing effects the management of funds in all portfolios (books of business), and the increase or decrease in the net funds flow.

The primary purpose of the ALM function is to coordinate funding and pricing decisions in order to optimize the integration of the financial functions. These decisions will then pave the way for the maximization of capital and the control of risk exposure.

Risk Management

The attributes of the asset, liability, and off-balance sheet portfolios will have a direct bearing on an institution's overall risk exposure. The maturity and pricing characteristics of each portfolio affect overall IRR exposure, while earnings and capital strength impact liquidity risk.

Interest rate and liquidity risks are the primary risk management concerns of the ALCO. The measurement of IRR is discussed in the IRR Management section (below). Hedging and/or derivatives can be used to offset IRR exposure.

Earnings/Value Management

A corporate's financial objectives are met by achieving desired returns, as measured by earnings or economic value, and by minimizing the variability of those returns. In the ALM context, earnings management primarily entails the management of the net interest margin (also called spread management), and value management refers to the management and stabilization of net economic value. The risk/return tradeoffs constantly facing management will have different implications for earnings and NEV.

Earnings and NEV management are closely related to pricing and risk management (discussed above). If, for example, the ALCO chooses to invest in only short-term Treasuries, these assets will be less profitable than more risky alternatives. However, the limited credit risk associated with this strategy will promote the stability of earnings and value. Another example, if the ALCO chooses a strategy that results in greater IRR exposure, then future earnings variability will be heightened.

The spread management function is designed to maintain the net interest margin requirements of the institution. In this regard, it is crucial that share pricing is under the purview of the ALM function. Finally, the management of capital markets activities and the computation of net economic value are crucial to the management and monitoring of an institution's overall NEV.

IRR Management

Introduction

IRR can be defined as the sensitivity of a depository institution's earnings and NEV to changes in interest rates. IRR results from the differences in the way the value of assets, liabilities, and off-balance sheet instruments are affected by interest rate changes.

The interest rate sensitivity of a corporate's balance sheet depends on the characteristics of the financial instruments comprising the balance sheet. Corporates' liabilities include a large percentage of overnight shares. Since shares typically reprice faster than investment assets, most corporates are exposed to rising interest rates. This means their NEV and earnings decline when interest rates rise and increase when interest rates fall. However, there are some institutions that experience decreased earnings and declining net worth when interest rates fall, due to their balance sheet composition.

The interest rate sensitivity of a financial instrument depends on many factors including: (1) maturity (generally, of two otherwise identical instruments, the one with the longer maturity will be more interest rate sensitive); (2) repricing characteristics (instruments such as adjustable-rate bonds that reprice frequently to market interest rates are typically less interest rate sensitive than fixed-rate instruments); and (3) the presence of embedded options (such as prepayments, interest rate caps, and deposit withdrawal options that affect the timing of the cash flows generated by the instruments).

To properly evaluate the IRR exposure of a corporate, the effect of interest rate changes on the entire balance sheet must be analyzed. It can be extremely misleading to conclude an institution is significantly exposed to IRR on the basis of a few very rate sensitive instruments. In fact, the interest rate sensitivity of those instruments may be offset by other instruments in the balance sheet less rate-sensitive, or inversely affected by rate changes. Corporate investments may have a corresponding liability that has substantially similar characteristics and this permits the risks associated with the asset to be transferred to the holder of the liability (a "matched" transaction).

Both the board of directors and management of a corporate are responsible for the management of IRR.

In general, IRR management involves the following steps: choosing target measures (e.g., NII and NEV); setting limits on acceptable levels of interest rate exposure for each target measure; estimating the interest rate sensitivity of each target measure; and restructuring or hedging the balance sheet if the estimated interest rate sensitivity exceeds the established exposure limits.

Summary of Section 704.8 (Limits on IRR)

The objective of IRR management is to control an institution's exposure to changes in interest rates to maintain adequate levels of earnings and capital over a range of possible interest-rate environments. Requirements for the management of IRR are established in 704.8(d). The board of directors is responsible for the development of a policy for controlling IRR. It is management's responsibility to ensure the policy is successfully implemented by establishing adequate guidelines and procedures. Further, management is responsible for reporting the implementation and monitoring of such policy to the board on a periodic basis (at least quarterly for base case corporates). The board shall review the results of operations and make adjustments to the policy as needed.

It is important to understand the responsibilities of management and the board of directors regarding the measurement and management of IRR. The following sections summarize those responsibilities.

Policy Statement

The board's policy statement shall include established limits on the institution's IRR exposure, identify the contents of reports to be made by management to the board, and specify the frequency the directors will review IRR management (at least quarterly per Section 704.8(d)). The delegation of responsibility for managing the institution's exposure to IRR should be clearly defined in the board's policy statement. Specific authorizations and restrictions should be provided regarding the institution's investment and trading activities (if any), the use of derivatives and synthetic instruments (corporates with Part IV authority), and hedging strategies.

Periodic Review

Periodic reports by management to the board of directors should demonstrate compliance with the exposure limits. Table 3 illustrates the type of interest rate sensitivity analysis management should prepare to demonstrate compliance with its board's exposure limits. In columns [3] and [5], XYZ's management is reporting neither NII nor NEV would be reduced by more than the percentages permitted by the board of directors, shown in columns [2] and [4], under any of the prescribed interest rate environments. Finally, the levels of NII and NEV used as denominators in calculating columns [3] and [5] should be reported as memo items.

Measurements of the sensitivity of the institution's NII and NEV will be necessary for management to demonstrate compliance with the board of directors' limits on exposure (as in columns [3] and [5] of Table 3). A corporate should be able to explain the reasons for any large differences between their own NEV sensitivity estimates and those produced by a periodic independent third party review.

Table 3
Current Exposure of XYZ Corporate to
Hypothetical Changes in Interest Rates

| [1] | [2] | [3] | [4] | [5] |
|--|---------------------------------------|--|--------------------------------------|---------------------|
| Change In Interest Rates (in basis points) | Net Interest Income Board Limit | Percentage Change Projected Change | Net Economic Value Board Limit | Projected Change |
| +300 | -75 | -70 | -50 | -40 |
| +200 | -50 | -30 | -25 | -15 |
| +100 | -20 | -10 | -10 | -5 |
| 0 | 0 | 0 | 0 | 0 |
| -100 | -20 | 15 | -10 | 10 |
| -200 | -50 | 35 | -25 | 15 |
| -300 | -75 | 40 | -50 | 15 |

Note:

Net interest income projected under constant interest rates: \$400

Net economic value under current interest rates: \$1,000

Because any system of IRR management will rely on certain assumptions, management should document the assumptions underlying its interest rate sensitivity analysis and demonstrate to the board they are reasonable. For example, management would need to explain how prepayments would be expected to behave under various interest rate scenarios and how they would affect the sensitivity measures. If more elaborate sensitivity analysis is used, the assumptions being made in that analysis should be discussed with the board and documented.

Requirements for NEV Models

This section describes the minimum requirements NEV models used by institutions for regulatory compliance should meet. The requirements concern three general areas: (1) the items that are properly included in the NEV measure, (2) how cash flows are estimated in the

base case interest rate environment and the alternate interest rate environments, and (3) what discount rates should be used in the base case and alternate rate scenarios.

Items Included in NEV Measure

NEV should include the estimated present value (or economic value) of all existing assets, liabilities, and off-balance sheet items associated with the corporate's balance sheet. For example, the estimates will not include the value of new investments management projects it would make under the various interest rate environments, or the value of new share accounts they believe the corporate will attract. It, however, should include the value of all off-balance sheet instruments and any forward settling investment transactions already executed at the cutoff date.

For their internal use, institutions may want to produce estimates of the interest rate sensitivity of their balance sheets on a going concern basis, taking into account future business (e.g., interest rate "ramps"). For regulatory purposes, however, NEV should include only the value of existing instruments.

Estimation of Cash Flows

The cash flows of all instruments must be estimated separately for each interest rate scenario. The cash flows of many financial instruments held by corporates change depending on the course of interest rates. It is not acceptable for institutions to estimate the cash flows of these instruments for the base case and assume those same cash flows would also be realized in the alternate interest rate environments. NEV models should consider the fact coupons on adjustable-rate investments and shares, mortgage prepayment rates, and core share decay rates will change depending on the interest rate scenario. Institutions should document mortgage prepayment rates and deposit decay rates assumed in each interest rate scenario.

To the extent possible given their data systems, institutions should use disaggregated data to estimate the economic market value of their instruments. If sufficient information is available, each individual balance sheet component (investment, share, etc.) can be valued separately using information on amortization, coupon, maturity, and any options embedded in the instrument to estimate future cash flows. Corporates should disaggregate instruments to the extent practical, grouping only very similar instruments together.

For example, if not valued separately, fixed-rate mortgage-backed pass-through securities, at a minimum, should be stratified into several coupon ranges (e.g., 7 to 8 percent; 8 to 9 percent, etc.). Adjustable-rate mortgage-backed securities (ARMs) should be segregated by index type, adjustment frequency, and distance to the lifetime cap (for example, those close to their lifetime cap should be valued separately from those with rates, say 2 percentage points from their cap). Shares should be segregated by type. This stratification permits the application of appropriate parameters (prepayment rates, decay rates, etc.) to each type of instrument and will result in more accurate economic value estimates.

Discount Rates

When estimating economic values, institutions should choose discount rates that reflect the risks of holding a particular instrument, including credit and liquidity risks. There are a number of possible methods of determining appropriate discount rates for financial instruments. The most common but least accurate method is to discount all future cash flows of a particular instrument by a constant discount rate that reflects the required yield of the instrument. For a typical upward-sloping term structure, this method overvalues long-term cash flows and undervalues short-term cash flows. A more accurate method involves discounting cash flows of different maturities by different discount rates. Under this method, the discount rate of any particular cash flow of a given maturity is equal to the estimated "risk-free" rate plus a fixed spread that compensates investors for the risk of holding the instrument. The risk-free rate for any given maturity cash flow is represented by the U.S. Treasury zero-coupon yield of the same maturity. The responsibility for choosing a particular discounting method resides with the institution. Like other assumptions necessary to calculate the NEV

sensitivity estimates, the details and the rationale for the method chosen should be documented by the institution.

Management Strategy

The board and management are responsible for the institution's IRR management strategy and its implementation. They must understand the strategy and its possible effects on the short- and long-term financial health of the institution.

In formulating an IRR strategy, the board and management should consider the level of expertise needed to implement the strategy. A prudent IRR management strategy should be within the scope of existing management expertise. The corporate should not rely on speculative plans to remedy an excessive IRR exposure, nor should it incur excessive credit or liquidity risk to do so.

Steps taken to manage IRR may conflict with other business goals. To ensure such conflicts are minimized, management's IRR strategy should be developed in conjunction with the creation of a comprehensive business plan for the institution. It may well be the profitability, financial structure and IRR targets an institution would choose independently of one another are not attainable simultaneously. By developing these targets and the plans for achieving them as part of a single process, management can determine which combinations of targets are feasible and can make an informed choice among them.

Evaluating IRR Exposure

To be able to make meaningful judgments about the exposure of an institution to changes in interest rates, it is helpful to measure and compare its exposure with that of other institutions under a standardized framework. The framework adopted by NCUA for this purpose is to examine exposure in the context of how an institution's NEV would be affected by an instantaneous, adverse shift in interest rates of plus or minus 300 basis points. An adverse rate shock is defined as a 300 basis point increase or decrease in interest rates, whichever results in the larger decline in an institution's NEV.

The effect on NEV of an adverse rate shock is viewed relative to the size of the estimated present value of the institution's assets. An institution's NEV ratio is defined as its NEV divided by the present value of its assets (PVA), or:

$$\text{NEV Ratio} = \frac{\text{NEV}}{\text{PVA}}$$

Table 4

| | Interest Rate Scenario | | |
|---------------------------------|------------------------------------|----------------------|------------------------------------|
| | <u>-300 Basis Point Change</u> | <u>Base Case</u> | <u>+300 Basis Point Change</u> |
| Present Value of Assets | \$105 | \$100 | \$80 |
| Present Value of Liabilities | -99 | -95 | -77 |
| NEV | 6 | 5 | 3 |
| NEV Ratio | 5.7% | 5% | 3.8% |

To detect excessive exposure, it is important to determine both the level to which an institution's NEV ratio is expected to decline as a result of an adverse change in interest rates as well as the magnitude of the decline in the ratio. This can be done through the use of two

measures: an exposure measure, which is also referred to as the “post-shock NEV ratio,” and a sensitivity measure, which is the decline in the NEV ratio due to shocking.

Exposure Measure

The post-shock NEV ratio is simply an institution’s NEV ratio in the aftermath of an adverse interest rate shock.

$$\begin{aligned}\text{Post-Shock NEV Ratio} &= \frac{\text{NEV after Shock}}{\text{PVA after Shock}} \\ &= \frac{\text{NEV} + 300}{\text{PVA} + 300} \text{ or } \frac{\text{NEV} - 300}{\text{PVA} - 300} \text{ whichever is lower}\end{aligned}$$

The calculation of the post-shock NEV ratio is illustrated in Table 4, which shows the estimated change in the present value of the assets, liabilities, and capital accounts of XYZ Corporate resulting from a 300 basis point increase and decrease in interest rates.

In Table 4, the adverse scenario is the one in which rates increase 300 basis points. Under that scenario, XYZ’s NEV ratio declines to 3.8 percent. Thus, XYZ’s post-shock NEV ratio is 3.8 percent.

Again, the post-shock NEV ratio is simply the NEV ratio that results from the most adverse 300 basis point shift in rates. This ratio measures the capital cushion expected to be left in a corporate should an adverse change in interest rates occur.

The post-shock NEV ratio is a function of the sensitivity of NEV to changes in rates and the size of the NEV cushion in the base case scenario. Thus, an institution’s post-shock NEV ratio could be low either because its balance sheet is very sensitive to changes in interest rates, causing it to lose a large portion of its NEV in an adverse interest rate move, or because its base case NEV is low. Thus, a low post-shock NEV ratio is not necessarily an indication of high IRR; it may merely indicate the corporate’s base case NEV ratio is low.

Sensitivity Measure

The decline in NEV ratio due to shock measures the magnitude of loss an institution would suffer from a specified, adverse move in interest rates. More specifically, it is the absolute percentage point decline in the NEV ratio that would result from a hypothetical 300 basis point change in interest rates. In the preceding example, XYZ’s NEV ratio declines from the base case level of 5.0 to 3.8 percent as a result of a 300 basis point increase in rates, a decline of 120 basis points. The decline in the NEV ratio is simply the difference, expressed in basis points, between an institution’s base case NEV ratio and its post-shock NEV ratio (e.g., its NEV ratio under the adverse 300 basis point shift in rates).

Taken alone, a large decline in the NEV ratio is not necessarily indicative of excessive risk. An institution with a strong capital position could experience a sharp decline in its NEV ratio, as a result of a 300 basis point rate shock, and still be left with a substantial capital cushion. In summary, exposure analysis can be viewed as a two-dimensional problem that involves estimating both the level to which an institution’s NEV ratio will decline as a result of an adverse rate shock, as well as the extent of the decline.

Methods to Reduce IRR

Institutions that project declines in earnings and NEV when interest rates increase may lower exposure by increasing the duration of liabilities or decreasing the duration of assets. This can be accomplished through balance sheet restructuring or hedging. Examples of measures such institutions might undertake include the following:

1. Sell securities;
2. Increase the proportion of short-term and adjustable-rate assets on the balance sheet;
3. Replace short-term funding with longer-term shares and borrowings;

4. Retain core shares, which are typically less interest rate sensitive than CDs; and
5. Use derivative instruments (Part IV expanded authority), such as futures, options, interest rate swaps, and caps, to lower exposure to IRR.

Although the majority of corporates are exposed to rising interest rates, there may be corporates exposed to falling rates. These institutions could lower their exposure by restructuring their balance sheets to lengthen the duration of their assets or decrease the duration of their liabilities.

Liquidity Risk**Asset/Liability Perspective****Management and****Contingency Funding**

Corporate credit unions are first and foremost liquidity centers. Prudent asset/liability management requires a corporate to monitor cash flow and to manage liquidity risk. Cash flow refers to the process by which a corporate obtains and allocates its cash over time. Liquidity risk is the probability a corporate will be unable to: honor members' requests for share withdrawals, meet lines of credit or commitments already approved for members, fund forward purchase agreements, pay bills when due, repay maturing share and borrowed money liabilities, or pledge additional collateral for borrowing money. Liquidity risk management encompasses assets, liabilities, commitments, and collateral.

Liquidity Requirements

Liquidity management is the process a corporate uses to allocate its assets and structure its liabilities to provide sufficient liquidity to meet its needs and its members' demands.

Liquidity management provides the foundation for a corporate's asset/liability system. Corporates provide credit and share services to accommodate members. An illiquid corporate may lose the confidence of its members and the financial markets. Managers must analyze growth, cyclical, seasonal, random, competitive, and regulatory elements to ensure the risk of illiquidity does not outweigh pro forma earnings. Regulators must evaluate how management measures, monitors, and plans its cash flow and liquidity.

Cash flow analysis is related to earnings, but the two are not the same. A corporate may be in a positive earnings status but not liquid, or it may be liquid but not in a positive earnings status. Accounting accruals do not necessarily coincide with cash flow as illustrated below.

1. A zero-coupon or original issue discount security may have been purchased to generate a 10 percent yield. Although the accounting system may periodically accrete the discount to maturity as income, no cash is received. The corporate will generate substantial cash inflow at maturity from the same security that is far in excess of that instrument's yield. Interest income and cash inflow are not synonymous.
2. A corporate might pay 7 percent for savings and share certificates. If shareholders do not require the interest expense to be paid monthly because the interest is credited, the cash paid will be substantially less than interest expense accrued. The corporate will suffer a significantly greater cash outflow than interest expense when the shares are withdrawn. Interest expense and cash outflow are not necessarily synonymous.
3. A corporate with Part IV authorities may hedge its assets or liabilities with a short position in interest rate futures. If interest rates increase (decrease), the corporate will receive (pay) cash flow immediately, but must defer the gains (losses) over the life of the instrument hedged. Hedging does not necessarily generate cash flows that are the opposite of the targeted instrument for an IRR reduction.
4. Certain expenses such as depreciation and amortization are not actual cash flows, rather they are the recognition over time of previous expenditures. These items must be added back when determining net cash flows.

From a financial perspective, management must provide an asset/liability structure that generates positive earnings based on accrual accounting and sufficient cash flow to meet the demands imposed by members, the financial markets, and regulations.

Cash flow is also related to IRR management; however, the two are not the same. The potential repricing of an asset or liability does not imply the instrument is maturing. Similar to cash flow and earnings, the two factors are partially related as illustrated below.

1. A corporate might purchase an MBS backed by adjustable-rate mortgages (ARMs) with a one-year repricing interval. If the ARMs' interest rate index increases, the monthly cash inflow from the loans will increase up to the ceiling imposed by annual and lifetime rate caps (if caps exist in the structure). However, the corporate still has its funds invested in ARMs and does not have the same asset flexibility as if the loans were paid off or called at the end of the year.
2. Most mortgage loans backing MBS include a prepayment option. Mortgagors are much more (less) likely to exercise that option when interest rates decrease (increase). Consequently, corporates receive (back) relatively more cash when prepayment activity is high and reinvestment alternatives are poor, yet receive relatively less cash when prepayments slow down and reinvestment alternatives are good. Cash flow can move in a contrary direction from what is otherwise desired to manage IRR.
3. Fixed-rate shareholders are more likely to withdraw accounts and incur substantial early withdrawal penalties if interest rates have increased sufficiently to make it attractive to reinvest funds elsewhere. A fixed-rate, long-term account may become rate sensitive and require payout when a corporate least wants to locate another source of funds, in a high interest rate environment. By contrast, high rate shares are rarely withdrawn early when rates drop.
4. Corporates with derivatives authority may hedge their IRR exposure by a variety of instruments. For example, a corporate might purchase a put option or an interest rate cap. In either case, a corporate pays an initial fee in cash and may later receive cash (back) if interest rates increase sufficiently beyond a strike price or threshold level. The cash outflow precedes any later potential protection and cash inflow.

From a financial perspective, management must recognize that an asset/liability structure capable of controlling IRR does not necessarily generate an adequate cash flow.

Finally, cash flow relates to capital management. Corporates operating with significant levels of reserves and undivided earnings do not have the same cash flow pressure as highly leveraged corporates. For example:

1. Capital accounts generally do not have a stated maturity. No return of capital is required.
2. Dividend payments on contributed capital (member capital) and repurchase of member capital is discretionary. No return on member capital is specified (dividend is on an ability-to-pay basis). Paid-in capital may also be repurchased (called) on a discretionary basis but the dividend is more likely to be contractually specified.

These preceding statements cannot be interpreted to indicate capital is an entirely free source of funds. Management and shareholders expect capital to be used efficiently with good NEV appreciation and a satisfactory level of share dividends (remember members receive their return on investment through dividends on their shares as well as growth in NEV). However, the return need not necessarily result in a cash outflow as needed to pay contractual interest on debt and to repay contractual principal at maturity. Some shareholders prefer management retain earnings if the corporate is able to generate a high return on equity (better rates and services may result from a stronger capital base). It should be evident cash flow and liquidity management are integrally affected by a corporate's asset/liability structure.

Members' Role in Liquidity Management

Most corporate business is member oriented. Consequently, the role of borrower and shareholder must be understood clearly by a corporate if liquidity is to be managed. Examiners should recognize cash flow and liquidity requirements may differ among corporates based on the type of member relationships.

Corporates solicit shares from members and invest in high quality marketable securities or deposits. The least expensive funds a corporate receives are often derived from short-term shares. When members initiate and control short-term share behavior, liquidity management becomes more difficult. A corporate must be prepared to respond to an immediate surge in member withdrawals and/or demand for borrowed funds since it specifically serves that fiduciary role for its members. Corporates can only maintain longer term liquidity by obtaining longer term liabilities from members and storing it in assets that have cash convertibility (may be sold or pledged as collateral). If corporates have only short-term funds subject to immediate withdrawal, liquidity management requires assets be highly liquid.

While a corporate does not have to respond to the specific needs of each member, it must respond to aggregate shifts in which members' funds movement are not nullified in the aggregate. Differences in the growth rate of shares and the structure of investments may precipitate liquidity problems.

When a corporate mismatches overnight funds with longer duration assets and experiences withdrawals, it must shift the burden of liquidity management to the investment and funding operations conducted in the open financial markets. The corporate may have to draw down cash, sell securities, or borrow money. These actions may reduce observable liquidity (i.e., cash and short-term marketable securities) as well as less apparent liquidity (i.e., remaining borrowing capacity). When shares are growing, a corporate may be: receiving excess funds, replenishing cash, purchasing securities, and repaying borrowed funds.

Management's Responsibilities in Liquidity Management

A corporate must ensure sufficient liquidity is always available. Sufficient liquidity depends on the overall asset/liability structure of the corporate, the condition of the economy, the activities of financial service competitors, and the requirements of its own members.

An examiner must evaluate a corporate's cash flow and liquidity management to determine the following:

1. Reports measure the anticipated excess/deficient cash position of the corporate relative to member needs;
2. Policies that address how a corporate expects to manage its current and potential liquidity position; and
3. Pro forma financial statements that accompany a business plan reflecting adequate available liquidity to effect strategic change.

Liquidity management requires a corporate use sound financial and marketing techniques. The subsequent sections identify more fully the cash flow characteristics of assets, liabilities, and commitments within a corporate. The topics are addressed within a return/risk trade-off. These include:

1. Relative maturity schedules of assets and liabilities;
2. Options included in asset/liability products that complicate liquidity management;
3. Off-balance sheet commitments outstanding;
4. Interest income/expense associated with assets and liability products of varying liquidity; and
5. Operating expenses associated with products of varying liquidity.

A corporate needs cash and access to liquidity when needed, but not excessive cash or liquidity since earnings may be reduced.

Section 704.5(a)(2) of NCUA Rules and Regulations requires a corporate's investment policy address reasonable and supportable concentration limits for limited liquidity investments in

relation to capital. Limited liquidity investments are defined as a “private placement or funding agreement.” Since such securities do not trade as efficiently in the markets as public offerings, limiting their concentration is a prudent liquidity strategy.

Assets and Liquidity

Measurement

To maximize its net interest margin, a corporate should make adequate, but not excessive, liquidity provisions. Earnings and liquidity are often conflicting objectives. By making excessive provision for liquidity, management may forgo potential earnings. By making inadequate provision for liquidity, management could threaten the existence of the corporate.

Liquidity is a relative quality. There is a wide spectrum of relative liquidity in both assets and in liabilities. Asset liquidity may be measured two ways. First, how easily can an asset be converted to cash by sale in a secondary market or by using it as collateral to borrow money? Second, what certain cash flows will assets generate?

Marketability

Marketability allows a corporate to obtain cash prior to an asset’s maturity. The liquidity of an asset is characterized by the speed with which a security can be sold at a price near the last trade. Liquidity is influenced by the asset’s market depth, breadth, and resiliency. Deep, broad, resilient markets are liquid.

1. Depth is illustrated by the existence of orders above and below the price at which a security is trading. A deep market also may be characterized by a large order size for the best bid and best offer.
2. Breadth is illustrated by the existence of a substantial volume of potential investors. Broad markets are more stable than markets dependent on a few key investors when transitory order imbalances occur.
3. Resiliency is illustrated by the speed with which new orders occur from a price change or order imbalance. Liquid markets are characterized by small price impacts as a large order is executed in sequential transactions.

Asset liquidity (i.e., depth, breadth, and resiliency) is affected by the market in which it is bought and sold. Assets tend to be most liquid in auction and dealer markets, less liquid in broker markets, and least liquid in a direct-search market. Examiners should evaluate how management selects and monitors assets according to the market in which they trade.

Maturity and Duration

Maturity is a key attribute of relative liquidity of an asset. A short-term asset is inherently more liquid than a long-term one. The secondary market for U.S. Treasury securities is deep, broad, and resilient. Notwithstanding, longer term U.S. Treasury Bonds carry a risk of a larger loss than short-term U.S. Treasury Bills when interest rates increase. A corporate may be reluctant to record an accounting loss in its financial statements. Therefore, long-term securities are less likely to be converted to cash when interest rates increase, as they do during a period of economic expansion or inflation. Further, less cash is received from the sale of a long term bond after an interest-rate increase. Table 5, illustrates how the price of several bonds of different maturity might react to an interest rate change. Short-term securities may be considered liquid because they either mature quickly or may be sold with little loss given a minimal increase in required yields.

The potential price change of a security is heavily influenced by maturity. However, the percentage price change of a security is more closely related to its duration than maturity. Duration measures the time weighted cash flows of a security where the weighting is provided by present value. Short duration assets, not simply short-maturity assets, generally are more

liquid than long-duration assets. The duration of an asset is shorter with a short-term maturity, high periodic interest or principal receipts and frequent cash flows.

Table 5

| Security Price Change and Interest Rate Shift: Maturity | | | | |
|--|---------|-------------------|--------------------|---------|
| (\$1,000 Par, 8% Coupon Security) | | | | |
| Maturity | @ 8 % | \$ Price @ 9 % | \$ Price Change | % Price |
| 1 Year | | \$1,000 | \$990 | 1.0 % |
| 5 Year | | \$1,000 | \$960 | 4.0 % |
| 20 Years | \$1,000 | \$908 | | 9.2 % |

Table 6 shows how the percentage price change of three bonds might react to a 1 percent increase in interest rates. The short-term maturity bond has the largest percentage price reaction because it has the longest duration. The maturity, the level of contract payments or coupon, and the payment frequency all affect asset liquidity. Duration provides a more comprehensive surrogate for cash flow than maturity. Either measure significantly affects the cash flow of assets. Examiners should evaluate how management measures and monitors the relative maturity and/or duration of assets.

Table 6

| Security Price Change and Interest- Rate Shift: Duration | | | | |
|---|--------|-------------------|-------------------|-------------------|
| (\$1,000 Par) | | | | |
| Maturity | Coupon | \$ Price @ 8 % | \$ Price @ 9 % | % Price Change |
| 7 Years | 0 % | \$ 534 | \$ 494 | 7.5 % |
| 10 Years | 8 % | 1,000 | 935 | 6.5 % |
| 12 Years | 15 % | 1,534 | 1,435 | 6.4 % |

Credit Risk

Another factor affecting cash flow and liquidity management is the default risk of an asset. Assets with more certainty of return enhance liquidity. For this reason, default free securities, issued or guaranteed with the full faith and credit of the U.S. Treasury (e.g., U.S. Treasury bills, notes, and bonds and Government National Mortgage Association [GNMA] securities) are more liquid than similar securities that are privately issued. Next, securities issued or guaranteed by Government Sponsored Enterprises (GSEs) (e.g., Federal National Mortgage Association [FNMA], Federal Home Loan Mortgage Corporation [FHLMC], and Federal Home Loan Bank [FHLB]) are viewed as default remote).

Obligations of financial institutions (e.g., federal funds, certificates of deposit [CDs], and bankers acceptances), corporations (e.g., commercial paper or corporate bonds), and state and local governments (e.g., general obligation or revenue bonds) must be evaluated for credit risk.

An investment-grade bond suitable for providing liquidity means the security has low market and credit risk. As illustrated in Table 7, the top four letter grades assigned to corporate bonds by Moody's Investors Service and Standard & Poor's Corporation are defined to indicate a level of credit risk.

Table 7

| Credit Quality and Rating Grades | | |
|---|-----|----------------|
| Moody's | S&P | Credit Quality |
| Aaa | AAA | Prime Quality |
| Aa | AA | High Grade |
| A | A | Upper Medium |
| Baa | BBB | Medium Grade |

The differential in yield and risk is most pronounced between the third and fourth grades. If a medium grade bond is downgraded to Ba or BB, the market no longer considers it investment quality. In general, a corporate may not retain low-grade bonds. However, there are some circumstances under which a corporate may be able to retain a low-grade security. For example, depending upon the individual corporate's expanded and/or operating authority level, and the specific security, Section 704.10 (Investment Action Plans) provides for the possibility of retaining low-grade securities. For the most part, corporates are limited to high-grade instruments which afford the greatest relative liquidity within the credit risk spectrum.

Investment-grade corporate bonds do default. For example, Johns Manville, LTV, and Braniff, among many other issuers, have defaulted on their bonds even though they were each once assigned a single-A or better grade. Recent market events also proved that highly rated securities (AAA) can be downgraded to non-investment grade very rapidly, thus greatly reducing their liquidity. There is a distinct difference in credit quality and yield between a prime quality bond (AAA or Aaa) and a medium-grade bond (BBB or Baa).

Liquidity from cash flow requires assets to have not only a short duration but low credit risk. Management must set limits on the credit risk exposure of its assets. Securities with high credit risk are more likely to have cash flow problems. By definition, low-grade corporate bonds have a higher probability of default and, therefore, could suffer an interruption of cash flow.

Most corporates have some credit exposure that results from corporate bonds, commercial paper, asset-backed securities, federal funds sold, or certificates of deposit from insured banks. The FDIC periodically has favored a policy under which uninsured shareholders face losing a portion of their funds when a troubled bank is liquidated. Banks traditionally had a low rate of failure, compared with other industries, until the early 1980s. Although economic factors affect bank liquidation, variations in operating performance usually can be traced to management. Ratios that measure the financial condition and operations of a bank have been found to have limited predictive power to discriminate problem and failed banks from sound institutions.

Uneven earnings are a key factor indicating the riskiness of a commercial bank. An approved list of acceptable commercial banks should be based on financial ratios and should incorporate some analysis of the accompanying risks. A simple method of managing credit risk of banks by corporates is to restrict investment to the insured portion. Such a strategy may not be practical for larger corporates.

Each corporate with uninsured bank deposit exposure should establish, monitor, and update an approved list of accepted commercial banks. The approved list should include commercial banks displaying adequate capital, consistent earnings, acceptable credit quality, prudent growth, and multiple sources of liquidity. The list should be reviewed at least annually (quarterly for banks where large demand deposits, federal funds sold, or CD exposure exist).

Liquidity risk and credit risk are highly correlated. Examiners should see how management categorizes its assets according to credit risk and classification standards.

Prepayment

All corporate institutions investing, trading, or selling MBS must be concerned with the anticipated life of such instruments. Prepayments affect the investment life, pricing, earnings, and value of loans. Prepayments also affect cash flow. Loans prepaying provide a cash flow earlier than scheduled amortization.

A mortgage may be prepaid due to a variety of factors, including:

1. Seasoning - when mortgagors have paid their mortgage for several years and are more likely to seek a new home or to refinance;
2. Refinancing - when mortgagors are able to obtain a new loan at least 150-200 basis points less than their existing contract rate;
3. Default - which tends to remain high until a fixed payment loan is seasoned with three years or more of satisfactory payments; and
4. Disaster - which may occur from destruction of the property by fire or flood, or from death or disability of the owner.

Prepayment experience also is affected by legal, geographic, and seasonal factors. For example, GNMA securities backed by FHA/VA loans tend to prepay more slowly than other agency pass-through securities because the FHA/VA mortgages historically are less mobile and the underlying loans are smaller; therefore, there is not as great a dollar incentive to refinance. Similarly, certain geographic areas that experience growth, high professional employment mobility, property value appreciation, or retirement migration patterns also prepay more quickly. Variations in a region's economic base can change prepayment activity. Finally, the peak housing activity during the spring and summer months translate directly to prepayment seasonality.

Long-term corporate bonds with embedded options are also subject to prepayments. A call option allows a bond's issuer to retire a bond prior to maturity. Calls are often exercised when interest rates have declined and allow the issuer to refinance the debt prior to maturity at a lower coupon than currently being paid. A put option allows an investor to resell the bond to the issuer, typically at par, prior to maturity should interest rates increase. Calls are very similar to prepayments of mortgage-backed securities (MBS); a corporate receives (back) cash when it is least advantageous to reinvest the proceeds.

As illustrated in Table 8, the relative cash flow and liquidity of assets vary according to a continuum. As management invests in more liquid assets, interest income tends to decline.

Table 8

| Asset Liquidity Characteristics | | | | |
|--|-------------|--------------------------|-------------|---------------|
| Attribute | Most Liquid | | Liquid | Least Liquid |
| Maturity | <1 Year | | <5 Years | >Than 10 Yrs. |
| Coupon | High | Low | | 0 |
| Payment | | | | |
| Frequency | | Monthly | Semiannual | No Coupons |
| Credit Risk | | U.S. Treasury/ Agency | Top 4 Grade | Low Grade |
| Market | | Auction/Dealer | Broker | Direct Search |

Management Considerations

A corporate should increase its asset liquidity, short-term, default free or remote, and highly marketable securities when other parts of asset/liability structure are less liquid or place

uncertain liquidity demands on the corporate. For example, strong financial arguments exist to increase the proportion of liquid assets when the amount of:

1. Long-duration assets (e.g., zero-coupon bonds) increase;
2. Fixed assets (e.g., equipment, furnishings, or real estate) increase;
3. Assets trading in a broker market (e.g., derivative MBS) increase;
4. Lines of credit or standby letters of credit issued increase;
5. Assets available for pledging against a liability are few;
6. Capital is low or negative and member confidence is threatened;
7. Funding by short-term brokered CDs or uninsured CDs increases;
8. Funding by repurchase agreements or dollar rolls increase;
9. Funding by collateralized borrowed money increases;
10. Hedging with interest rate futures increases; or
11. IRR, as measured by NEV, increases.

Corporates should commit relatively more funds to highly liquid assets whenever the following occur:

1. A large portion of other assets are less marketable or have distant cash flows;
2. Liabilities or shares are subject to disintermediation;
3. Significant commitments to purchase securities or originate loans are outstanding;
4. Little additional access to the financial markets is likely; or
5. Market and member confidence is threatened.

More liquid assets may be used to balance the risk of other financial assets or financial liabilities that are designed to enhance earnings, yet carry more risk.

Such an investment strategy mitigates some of the liquidity pressure otherwise present. The earnings penalty incurred by investing in liquid assets often is offset by other illiquid assets with a long duration, little marketability, or high credit risk exposure that carry higher yields. Further, short-term liabilities and wholesale shares often cost less than longer-term accounts and also may offset the earnings penalty from the additional investment in liquid assets.

Management need not only increase the proportion of short-term, default free assets to enhance liquidity. Liquidity carries a potential earnings penalty. The following are examples of how a corporate can enhance liquidity, while not increasing its investment in short-term, default free instruments:

1. Emphasize core member accounts and intermediate-term shares;
2. Emphasize securities that have predictable, consistent, and homogeneous prepayment or call risk;
3. Maintain assets suitable for pledging against a wholesale corporate advance or a reverse repurchase agreement;
4. Maintain an unused line of credit with a wholesale corporate or a commercial bank;
5. Emphasize securities that are similar to products trading in dealer markets (e.g., MBS or public agencies); or
6. Sell and lease back the corporate's office building.

Liquidity management allows a corporate to respond to anticipated or unanticipated cash flow deficiencies. Liquidity management must consider the entire asset/liability structure.

Liabilities and Liquidity

Measurement

Member - initiated sources and uses of funds provide the foundation for liquidity risk management. When loan demand exceeds normal share growth, management must rely on access to borrowed money or the sale of securities to raise needed cash. Similarly, corporates may reduce reliance on borrowed money and increase temporary investments when the reverse occurs.

A corporate has several alternatives to raise cash through liability management.

Like assets, maturity is a key to relative liquidity. However, reliance on short-term liabilities requires more liquidity than reliance on long-term liabilities. Members have the legal right to withdraw funds or force repayment at maturity. Liquidity risk is increased when management relies on three-month certificates rather than three-year certificates. Liquidity risk is also increased when management relies on short-term borrowing as opposed to longer term advances. Shorter-term liabilities increase liquidity risk. Such liabilities also tend to cost less since they should be priced off the short-term end of the yield curve.

Some share accounts may be withdrawn immediately, or on demand, yet do not necessarily cause an increase in liquidity risk. Although a specific member may withdraw funds immediately, another member may reinvest a like amount of funds. A corporate does not have to respond to the specific needs of each member; it must respond to net aggregate shifts in shares. Clearing accounts may provide a corporate with a very long-term source of funds because members must maintain constant balances to cover daily settlement activities. The account may be considered a core share. Core shares are extremely important when measuring liquidity risk. Core shares are placed by members for reasons principally related to the financial services and the convenience offered by the corporate, rather than simply the interest rate paid. A corporate will lose core shares over time if services or dividend rates become non-competitive. In addition to clearing accounts, membership capital shares and paid-in capital, a portion of regular overnight shares, and share certificates may be considered core shares if supported by proper analysis. The use of early prepayment penalties also helps enhance liquidity as certificate holders will not be as quick to withdraw the funds when it requires foregoing income.

By contrast, other shares require more liquidity because investors have selected a specific account and a specific corporate for one reason, it offers the highest rate of interest. When management posts a lower rate, volatile, or wholesale funds disappear. Volatile liabilities increase liquidity risk. However, a corporate temporarily may meet liquidity needs by posting high interest rates. Management and examiners should distinguish core shares from volatile shares.

Many core share accounts carry high average operating expenses and low share balances. Corporates may more quickly raise desired

amounts of funds through the wholesale share market or by borrowing money.

Each corporate must determine for itself whether the advantages of borrowed money exceed the attendant costs. One of the constraints that limits the advantage of borrowing funds is the minimum capital ratio (borrowed funds grow the balance sheet and increase the assets relative to capital). Examiners should review the corporate's related calculations.

Although most corporates choose not to borrow funds, borrowing can be an attractive funding alternative to regular shares. Therefore, a corporate should establish multiple borrowing sources to ensure a source is available when needed. Even when the borrowed money carries higher interest rates than shares, the interest expense is limited to the incremental funds raised, not total funds. An arithmetic example illustrates the difference. Assume a corporate needs to quickly increase cash by 10 percent. In order to acquire the new funds, the corporate believes it must post higher interest rates for all of its share products by $1/8$ of 1 percent. For each \$10 million of total shares, interest expense thereby increases \$12,500 annually. The incremental interest incurred amounts to 1.25 percent for the desired \$1 million (10 percent of the \$10 million shares). The desired growth could have been more cheaply obtained by borrowed money if its cost was no more expensive than 1.25 percent above the current share rate. Table 9, illustrates various combinations of incremental interest rates needed to attract share funds and targeted growth. The indicated values show how much extra a corporate could pay for borrowed money than shares and break even.

Table 9
Borrowed Money Break-Even Analysis

| Incremental Share Rate Increase to Obtain Growth | Funding Growth | | |
|---|----------------|-------|------|
| | 5% | 10% | 15% |
| $1/8$ of 1% | 2.5% | 1.25% | .83% |
| $1/4$ of 1% | 5.00 | 2.50 | 1.67 |
| $1/2$ of 1% | 10.00 | 5.00 | 3.33 |

The interest rate differential that can be paid and still break even for borrowed money increases when the corporate otherwise needs to post a higher rate for all savings, or the amount of incremental growth is relatively small. Borrowed money is best viewed as a source of incremental funds to meet liquidity needs.

Management Considerations

Corporates may generate cash flow and manage liquidity through shares and borrowed money. The corporate system's ability to attract shares is also affected by factors external to the actions of a specific corporate. These include:

1. Economic growth and regional booms (loan growth uses up excess liquidity);
2. Decline in personal savings ratios for members of natural person credit unions;
3. Perceived strengths and weaknesses of the corporate credit union system; and
4. Competition from other financial institutions, including other corporate credit unions.

If management has a specific need for funds, a corporate may need to borrow money to obtain cash.

There are a wide variety of specific liabilities corporates may use. Rather than describe each one, the following listing categorizes types of financings that may be used to generate cash:

1. Repurchase Agreements/Dollar Rolls: by selling securities through a reverse repurchase agreement or a dollar roll, the corporate sells a security and simultaneously agrees to purchase the same or a similar security at the end of the agreement (e.g., a week or month).
2. Commercial paper: by issuing commercial paper, the corporate raises non-insured funds from investors, typically with a maximum maturity of 270 days. Some corporates keep a constant amount of commercial paper issued to maintain a market presence.
3. Medium-Term Notes (MTN): by issuing an MTN in the marketplace, the corporate raises funds from investors for several years.

More specialized securities provide for specific cash flows to appeal to certain investors. However, more specific cash flows limit the subsequent marketability of an issue unless information is easily available about the cash flows and the issue is similar to others. A corporate should be concerned with the secondary market of its liabilities because more marketable securities carry less risk to investors and thereby reduce the interest cost. For this reason, a \$100 million liability issue may carry a five basis point lower cost than a \$50 million issue. Management should have a plan for accessing borrowed money over time. Examiners should review the plans to ensure there is adequate liquidity, and other risks involved with procuring sufficient liquidity are addressed and do not negatively impact the asset/liability structure. Liquidity management is also affected by the existence of commitments and hedging instruments.

Commitments and Liquidity

Corporates often own assets and acquire shares with options that complicate cash flow planning. Table 10 illustrates the cash flow consequence of a change in interest rates for these accounts.

Rising interest rates affect assets and liabilities. Therefore, the corporate may have to search for more sources of cash when it is least desirable. (i.e., during a period of high rates). Options made available to members greatly complicate cash flow planning.

Hedging may partially offset IRR and some liquidity risk. Hedging does effect the cash flows of a corporate. Hedging may increase the perceived liquidity of an asset because the transaction reduces the corporate's reluctance to sell an asset at a loss. The hedge should provide an approximate offsetting gain.

Table 10

| Cash Flow and Interest Rate Change* | | | | |
|--|------------------|---------------------------|--------------|----------------------------|
| Account | Option | Effect of Rising Rates | | Effect of Falling Rates |
| Corporate Bond | Call Feature | No Call | Call (+) | |
| Term Share | Early Withdrawal | | Withdrawn(-) | No Change |
| *(+) Cash Inflow; (-) Cash Outflow | | | | |

Asset/Liability Structure and Cash Flow

Cash Budgeting

Corporates should develop pro forma cash budgets to ensure cash and liquidity will be available in the future. The uncertainty created by MBS prepayments, fixed-rate commitments and share withdrawals reduce the confidence of a cash budget being realized. Therefore, examiners should determine how management anticipates cash flows in the future.

Section 704.8 (ALM): Interpretation and Examples

Prudent risk managers view regulatory requirements as a *minimum* standard. Examiners should expect corporates' risk managers to manage to best practices, not the regulation, as long as those practices do not contradict or ignore regulatory requirements. Where appropriate, a corporate will need to develop additional tests, methodologies, and procedures to manage its risk (additional means beyond the minimum requirements of regulation). Corporate management may fail its basic fiduciary responsibilities if it limits its risk management to only regulatory compliance.

ALM policies may be integrated with the investment policies (or vice versa). In addition, it is acceptable to have all financial risk policies combined into one source so long as the unique considerations of each area are addressed and the respective procedures are in place.

Section 704.8(a) addresses the ALM policy requirements for corporates. Note that it uses the term "at a minimum" in describing policy stipulations.

1. The purpose and objectives of the policy should be consistent with the risk tolerance and risk management philosophy of the organization. The examination review will need to consider if management's actions and performance are consistent with this statement.
2. The policy must address the tests that will be used to evaluate investments prior to purchase. This requirement is integral with the investment policy (prudent portfolio

selection criteria would automatically require this discipline). Corporates have an obligation to develop appropriate criteria for investments. Testing can estimate the impact of a credit migration or default. Analysis of creditworthiness includes probability of default in various scenarios. Testing may also measure the relative liquidity for a type of transaction (depth of market and price risk). Additionally, the effect of a purchase on overall liquidity measurement limits should be addressed. The type of tests required will be a function of an investment's complexity, structure, and/or acceptance in the general marketplace. Before a corporate can buy/sell a new investment type (new in the market or new to the corporate), it must develop appropriate analyses and test parameters and modify its ALM policy *before* engaging in the activity. The type of investments will determine the types of tests that are appropriate. For example, a shock test would not be expected for an overnight Fed Funds transaction although the credit analysis of the counterparty would be expected. Interest rate stress tests would be required for instruments such as structured share certificates or mortgage-backed securities.

3. The policy must address the maximum allowable percentage decline in NEV, compared to base case NEV. A simple example of how this information can be communicated is provided in Table 11.

Table 11

| Change in Interest Rates (in basis points) | Maximum Permissible Change in: | |
|---|-------------------------------------|------------------------------------|
| | Net Economic Value (Board Limit) | Net Economic Value (Regulation) |
| +300 | -13.0% | -15% |
| +200 | -10.0% | -15% |
| +100 | -5.0% | -15% |
| 0 | - | - |
| -100 | -5.0% | -15% |
| -200 | -10.0% | -15% |
| -300 | -13.0% | -15% |

almtbl01

4. The policy is required to include the minimum allowable NEV ratio. Corporates are required by Section 704.8(d)(1) to limit risk exposure to: (1) levels that do not result in a base case NEV ratio or any NEV ratio resulting from the tests...below 2 percent; and (2) levels that do not result in a decline in NEV of more than 15 percent.. The board is expected to prescribe the corporate's NEV policy limit within the regulatory limit. An example of how this information might be presented is included in Table 12.

The effect on NEV of an adverse change in market rates (measured with rate shocks) is measured relative to the size of the estimated present value of the corporate's assets. Thus, the NEV ratio is defined as NEV divided by the fair value of assets, or:

$$\text{NEV Ratio} = \frac{\text{NEV}}{\text{FV}_{\text{ASSETS}}}$$

Table 12
Interest Rate Scenario

| | - 300 BP Change | Base Case | + 300 BP Change |
|-------------------------------------|-----------------|-----------|-----------------|
| Present Value of Assets | \$104 | \$100 | \$80 |
| Present Value of Liabilities | -99 | -97 | -78 |
| NEV | 5 | 3 | 2 |
| NEV Ratio | 4.8% | 3.0% | 2.5% |
| Minimum NEV Ratio Policy Minimum | 2.0% | 2.0% | 2.0% |

5. The policy must address limits and specific test parameters for the IRR simulation tests set forth in Section 704.8(d) which deals with rate shock analysis relating to NEV and the NEV ratio.

These factors have already been addressed by 3 and 4 above. However, corporates are also required by Section 704.8(d)(2) to assess annually if it should conduct periodic additional tests to address market factors that may materially impact the corporate credit union's NEV. The factors should include, but are not limited to the following:

1. Changes in the shape of the Treasury yield curve;
2. Adjustments to prepayment projections used for amortizing securities to consider the impact of significantly faster/slower prepayment speeds;
3. Adjustments to the market spread assumptions for non Treasury instruments to consider the impact of widening spreads;
4. Adjustments to volatility assumptions to consider the impact that changing volatilities have on embedded option values.; and
5. Changes in market spreads.

The regulation does not establish specific targets or ranges for these extra tests. It is the responsibility of the board to: (1) decide how these tests should be conducted; (2) determine the frequency of the additional tests; and (3) place appropriate parameters and limits upon exposures to these particular market risks. Parallel, instantaneous and

sustained shocks in the yield curve address a majority, but not all, potential market risks. Rate shocks do not capture the full spectrum of market risks and additional tests are intended to provide a more rigorous assessment. For example, a change in market volatility is not captured in a rate shock and significant value changes in options could therefore be missed.

The examination review of this area must consider the relevance and appropriate frequency of the additional tests and determine if the limits appear consistent with the overall board philosophy on risk. For example, if a corporate portfolio has no prepayment optionality to speak of, tests for prepayment changes would be meaningless. If, on the other hand, a corporate portfolio is heavily weighted in asset-backed securities (or some other non-Treasury “spread” product), the test for changes in market spreads will be essential.

Certain market indices (e.g., LIBOR, PRIME, COFI and CMT) serve as references for computing periodic interest payments on structured share certificates and securities. When buying instruments that contain interest coupon payment formulas tied to market indices, the corporate needs to obtain reasonable projections for future index levels. This is necessary to compute NEV for the various interest rate tests. Corporates are expected to place greater attention on projections of those indices which are not market determined rates (such as PRIME and COFI). Correlation analyses, which demonstrate the relationship between the non-market indices and market rates, is a major component of most index forecasts.

ALM

The objectives of the ALM review are to:

Examination Objectives

1. Determine if policies, procedures, and strategic plans regarding cash flow and liquidity management adequately address safety and soundness, earnings, and compliance with laws and regulations.
2. Determine if the corporate has complied with the regulatory liquidity measurement and monitoring requirements of Part 704. Determine liquidity management evaluates: the potential liquidity needs of members; regularly monitors sources of internal and external liquidity; and sets accounting classification of securities consistent with potential liquidity demands.
3. Determine if the contingency funding plan adequately addresses alternative funding strategies in successively deteriorating liquidity scenarios, and assumptions utilized are reasonable and supportable.
4. Determine if reasonable parameters have been established for the corporate's NEV position, the corporate is operating within established parameters, and the parameters are reasonable.
5. Identify weaknesses in the IRR measurement systems, internal management reporting, or internal controls.

6. Evaluate plans for reducing excessive IRR, if applicable.
7. Evaluate management of the corporate's assets and liabilities.
8. Determine if internal management reports provide the necessary information for informed funds management decisions and for monitoring the results of those decisions.
9. Initiate corrective action when ALM policies, procedures, practices, and internal controls are deficient.

**ALM
Examination
Procedures**

See Corporate Examination Procedures - Asset/Liability Management (OCCU 202P and OCCU 202.1P).

**Corporate Examination
Questionnaire**

See Corporate Examination Questionnaire - Asset/Liability Management (OCCU 202Q and OCCU 202.1Q).

References

1. NCUA Rules and Regulations (Section 704.8)
2. Regulatory Handbook, Thrift Activities (OTC) Volume II
3. Comptrollers Handbook, Interest Rate, Funds Management
<http://www.occ.gov/handbook/FundsMgt1.pdf>
4. Comptrollers Handbook, Liquidity
<http://www.occ.gov/handbook/liquidity.pdf>