



***Federal Housing Finance Board
Office of Supervision***

Date: September 29, 2004

To: Federal Home Loan Bank Chairs, Presidents, Chief Financial Officers, Risk Management Officers, and Directors of Internal Audit

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Subject: Interest Rate Risk Management

Overview

This Advisory Bulletin provides guidance on interest rate risk management. To carry out its responsibilities with respect to the oversight of interest rate risk, the board of directors of a Federal Home Loan Bank (Bank) should approve major strategies and policies with respect to interest rate risk and ensure that Bank management is effectively identifying, measuring, monitoring, and controlling the Bank's exposure to interest rate risk. This Bulletin describes the policies, procedures, and internal controls that a Bank should have in place to manage its exposure to interest rate risk. The Bulletin also discusses the risk measurement, monitoring, and reporting systems that a Bank should have and outlines the Finance Board's expectations with respect to stress testing, model validation, model documentation, and backtesting.

This Bulletin places particular emphasis on the importance of establishing and adhering to prudent interest rate risk limits. One of the board's primary responsibilities is to understand and approve its Bank's aggregate interest rate risk limits. The board should establish its tolerance for interest rate risk and should assess periodically whether the Bank is adequately compensated for the risk taken. A Bank's risk limits should be consistent with its mission, risk and return objectives, and risk management capabilities.

This Bulletin also highlights the importance of maintaining an independent risk management function. The process of measuring, reporting, and controlling interest rate risk should be managed independently from those who take interest rate risk positions.

This guidance supplements and does not replace the market-risk related requirements of the Finance Board's regulations.¹

¹ Section 917.3 of the Finance Board's regulation requires each Bank to have a written policy that addresses its exposure to market risk. This regulation also requires each Bank's board of directors to establish a risk management policy that sets forth tolerance levels for market risk and the standards for the methods and models used to measure and monitor market risk. In addition, the regulation requires each Bank to establish and maintain internal controls to ensure the effective management and control of market risk and to ensure compliance with the Bank's market risk tolerance limits.



Background

What is interest rate risk?

Interest rate risk is the risk that changes in interest rates may adversely affect an institution's financial condition and performance. More specifically, interest rate risk is the sensitivity of an institution's cash flows, reported earnings, and economic value to changes in interest rates.

What are the objectives of interest rate risk management?

The primary objectives of interest rate risk management are to achieve a target level of return while maintaining the institution's interest rate risk exposures within prudent bounds. In pursuing these objectives, management should ensure that the risk to the institution's earnings and to its economic value is within prudent bounds over a range of plausible interest rate environments. The objective is not to eliminate interest rate risk, but rather to maintain risk exposures at levels that are prudent and acceptable to the institution's board of directors.

The risk and return objectives of a Bank should be consistent with the housing finance and community investment mission and consistent with the safety and soundness objectives of remaining adequately capitalized, liquid, and able to raise funds in the capital markets.

What are the most common target accounts for managing interest rate risk?

At financial institutions, interest rate risk is generally managed with respect to an institution's earnings or economic capital, or both. With respect to earnings, **net interest income** is the most common target account (*i.e.*, the focal point of management) for measuring, managing, and controlling interest rate risk.² With respect to capital, the two most common targets are **net portfolio value**³ and the **economic capital ratio**.⁴

When net interest income is the target account, the risk management objective is to maintain net interest earnings within an acceptable range over a specified time horizon. The time horizon over which interest rate

² No institution can concurrently eliminate or minimize the risk to both earnings and net portfolio value. Specifically, a reduction in the volatility of net interest income will result in an increase in the volatility of net portfolio value and *vice versa*. An institution's net cash flows can be modified to become less sensitive to interest rates or more sensitive to interest rates. If the pattern of net cash flows is modified so as to become more stable, its market value of equity will behave more like a fixed rate bond, that is, when interest rates rise the value of the bond will fall and vice versa. On the other hand, if the pattern of net cash flows (*i.e.*, earnings) is modified so as to move in lockstep with changes in interest rates its market value of equity will behave more like an adjustable rate bond, that is, when interest rates rise or fall the value of the bond will remain at or close to par.

³ Net portfolio value represents the underlying net economic value (or net present value) of an institution's portfolio of assets and liabilities, including any off-balance sheet items. Net portfolio value is defined as the present value of assets **less** the present value of liabilities **plus** the net present value of any off-balance sheet contracts. In contrast to the GAAP-based shareholders' equity account, net portfolio value represents the shareholders' equity account expressed in present value terms.

⁴ The economic capital ratio is simply the economic value of an institution's equity base (net portfolio value) divided by the economic value of assets (market value of assets). Market value of assets includes the net market value of off-balance sheet contracts.



risk is managed is typically relatively short -- usually three to 12 months. For example, the management objective may be to ensure that net interest income will remain within certain parameters -- or not fall below pre-specified levels -- during the next three months over a range of hypothetical interest rate scenarios.

When net portfolio value is the focus, a common objective is to keep the institution's net portfolio value from falling below pre-specified limits over a range of interest rate scenarios. For example, the objective may be to ensure that net portfolio value does not fall by more than 5 percent over a range of scenarios.

From a safety and soundness perspective, however, a more relevant objective is to ensure that the institution's economic capital ratio does not fall below a pre-specified level over a range of pre-determined interest rate scenarios. The advantages of using the economic capital ratio to limit interest rate risk are: (1) it is an unambiguous means of communicating an institution's tolerance for risk; (2) it represents a "floor" that does not have to be linked to a specific time horizon; and (3) it addresses the loss to economic value from all key risk factors -- parallel rate shocks, non-parallel rate shock, prepayment risk, and so forth. Moreover, the focus on economic capital is consistent with the goal of maximizing risk-adjusted returns to shareholders over the long run. By focusing on economic value and the economic capital ratio, management is less likely to inadvertently sacrifice long-term economic earnings in pursuit of short-term gains.

What other targets or limits are used to manage interest rate risk?

Duration of equity limits. Duration is a measure of the sensitivity of a financial instrument's value, or the value of a portfolio of instruments, to small, parallel shifts in interest rates. Duration of equity is a measure of the interest rate sensitivity of the net portfolio value of an institution. While useful, the limitations of duration as a risk metric are well known. It assumes instantaneous, small, parallel rate shocks. In reality, sizable yield shifts tend to occur over time, and parallel rate shocks are not likely. Moreover, duration does not describe an institution's exposure to other key risk factors such as changes in the shape of the yield curve and changes in spreads.

Duration gap limits. Duration gap is simply the duration of an institution's assets less the duration of its liabilities. A portfolio with a longer (wider) duration gap will experience a greater relative change in value for a given change in interest rates because its cash flows reprice more slowly to the new rate structure than a portfolio with a shorter (narrower) gap. Unlike duration of equity, duration gap does not take into account the effects of financial leverage on risk exposure. An increase in leverage will magnify the impact of a given duration gap on the institution's duration of equity, and thus on the sensitivity of net portfolio value to changes in interest rates.

Maturity gap limits. A maturity gap is the difference between the dollar volume of assets and the dollar volume of liabilities that mature or reprice within a specified time horizon. Some institutions use maturity gap limits to control the risk to earnings from changes in interest rates for specific time periods or time bands. Limits generally specify the maximum allowable maturity gap for each time band in the institution's planning horizon.



Table 1
Net Interest Income Versus Market Value Capital Measures
As Target Accounts for Managing Interest Rate Risks⁵

Net Interest Income	Market Value Measures
Strengths:	Strengths:
<ul style="list-style-type: none"> • Ties in with reported earnings 	<ul style="list-style-type: none"> • Consistent with goal of maximizing shareholder value
<ul style="list-style-type: none"> • Managerial compensation is often linked to reported earnings 	<ul style="list-style-type: none"> • Takes account of the present value of all future earnings related to the institution’s existing balance sheet
<ul style="list-style-type: none"> • Allows institution to take account of and simulate the impact of new business over the forecast horizon 	<ul style="list-style-type: none"> • Managing economic value reduces long-term volatility of earnings and net worth
<ul style="list-style-type: none"> • Pinpoints the timing of interest rate risk over the forecast horizon 	<ul style="list-style-type: none"> • Facilitates scenario analysis over a wide range of scenarios
<ul style="list-style-type: none"> • Facilitates the management of earnings over the forecast horizon 	<ul style="list-style-type: none"> • Summarizes risk in a single set of numbers
Weaknesses:	<ul style="list-style-type: none"> • Captures risk over the entire horizon of future cash flows from existing balance sheet accounts
<ul style="list-style-type: none"> • Ignores “long-tailed” risk that exists beyond the forecast horizon 	<ul style="list-style-type: none"> • Identifies options risk and opportunities for hedging risk in different scenarios
<ul style="list-style-type: none"> • Inadequately captures risk of options embedded in balance sheet 	Weakness:
<ul style="list-style-type: none"> • Maximizing short-term accounting earnings may be inconsistent with maximizing shareholder value (or the market value of portfolio equity) 	<ul style="list-style-type: none"> • Does not pinpoint when future earnings problems may occur
<ul style="list-style-type: none"> • Difficult to simulate earnings over a wide range of scenarios 	

⁵ Source: Adapted from Anthony G. Cornyn, *Managing Interest Rate Risk*, Special Management Bulletin, S-373, America’s Community Bankers, October, 2002.



Market value of equity to book value of equity (MVE/BVE). This ratio measures the market value of equity, or net portfolio value, of an institution relative to book value of equity. In general, an excess of market value of equity over the book value of equity is a positive sign. Hence, an institution might structure its portfolio in such a way that the market value of equity does not fall below some threshold, say 90 percent, over a range of scenarios.

Retained earnings limits. Given the importance of retained earnings to the financial stability of an institution, it is appropriate to set risk limits in terms of retained earnings. For example, a Bank might limit the maximum dollar or percentage loss in retained earnings resulting from a +/-200 basis point interest rate shock or from adverse movements in other risk factors.

Value-at-Risk (VaR) limits. VaR is a statistical measure of potential portfolio losses over a given horizon at a given confidence level under “normal” market conditions. It does not provide a measure of worst loss. VaR answers the question: “What is the maximum loss over a given period of time, for example one month, such that there is a low probability, say a one percent probability, that the actual loss over that time period will be larger?” In principle, VaR can be used to measure market, credit, and operational risk. Hence it is a useful summary measure of risk for institutions that are exposed to multiple sources of risk. It can also be used to set risk limits for traders, business units, or the firm as a whole.⁶

What is the appropriate role for stress testing and scenario analysis?

Stress testing and scenario analysis should play an important role in a Bank’s interest rate risk management strategy. As a matter of sound practice, management should not plan its asset/liability strategy around a single “most likely” forecast of interest rates, but rather should structure its portfolio so that the Bank performs acceptably across a range of plausible interest rate scenarios. The power of scenario analysis is that it prompts decision-makers to think about and plan for alternative future environments, including those environments they might otherwise choose to ignore. Scenario analysis is useful because we do not know how the future will unfold.

Scenario analysis usually begins with “what if” questions. For example, the CFO might ask: What would happen to earnings and net portfolio value if interest rates were to rise or fall by 50, 100, or 200 basis points? What would happen if the yield curve flattens or steepens? What would happen if mortgage prepayments double from current levels or slow dramatically? Once the scenarios are selected, the next step is to perform simulation analyses to determine what would likely happen to earnings, net portfolio value, and the economic capital ratio under the selected scenarios. If the analysis shows that performance would be unacceptable under one or more scenarios, then management would consider ways to modify, rebalance, or hedge the portfolio so that performance would be acceptable under the identified scenarios. Done properly, scenario analysis not only prompts management to consider the risks inherent in maintaining its current portfolio mix, but also leads to an exploration of strategic alternatives for improving performance. The end result of scenario analysis should be better decision making and improved risk management.

⁶ VaR approaches for determining capital adequacy are consistent with provisions of the Gramm-Leach-Bliley Financial Modernization Act of 1999 pertaining to the FHLBank System.



Guidance

The ultimate responsibility for interest rate risk management rests with the Bank's board of directors. Functional responsibility for interest rate risk management should rest with a chief risk officer or an equivalent, independent officer of the Bank. The board and senior management must ensure that the Bank has in place appropriate policies, procedures, and internal controls for managing and controlling the Bank's exposure to interest rate risk. The board and senior management must also ensure the Bank's risk measurement, monitoring, and reporting systems are reliable and effective. Senior management should also strive to keep pace with best practices with respect to stress testing, model validation, model documentation, backtesting, and other aspects of risk management. A Bank should periodically consult with independent, outside advisors regarding the adequacy of its interest rate risk management systems and controls.

Examiners will base their conclusions regarding the quality of a Bank's market risk management on an assessment of all significant facets of a Bank's interest risk management process including the extent to which a Bank's interest rate risk management process comports with the guidance set forth below.⁷

I. Board and senior management oversight of interest rate risk

A. Responsibilities of the board of directors

1. The board of directors has ultimate responsibility for understanding the nature and level of the Bank's interest rate risk exposures.
2. The board should approve all major strategies and policies relating to the management of interest rate risk and should review such strategies and policies at least annually and more frequently if market conditions change or if the Bank incurs significant deviations from expectations.
3. The board should establish the Bank's tolerance for interest rate risk, approve aggregate interest rate risk limits, and provide management with clear guidance regarding the level of acceptable interest rate risk. The risk limits should be consistent with the Bank's risk and return objectives and consistent with liquidity and capital needs.
4. The board of directors should review policies and institution-wide risk limits at least annually, and more frequently in the event of significant changes in market or financial conditions. The review should address the appropriateness of the Bank's risk limits in light of the board's tolerance for risk, the strength of the Bank's capital, the adequacy of retained earnings, and the overall quality of risk management, measurement, and reporting systems. The review should also include an assessment of management's compliance with the risk limits.

⁷ See Examiner Guidance Bulletin 04-03, *Interest Rate Risk Limits*.



5. The board or a committee of the board should ensure that senior management has taken the steps necessary to identify, measure, manage, control, and report on the Bank's interest rate risk exposures and should ensure that the Bank's system of internal controls is functioning effectively.
6. The board or a committee of the board should ensure that the Bank's interest rate risk policies establish lines of authority and responsibility for managing interest rate risk.
7. The board should be satisfied that there is an adequate separation of duties in the risk management process to avoid potential conflicts of interest.
8. The board should be satisfied that the risk management, monitoring, and control functions of the Bank are sufficiently independent of the position-taking functions. Ideally, the Bank should establish an independent risk management unit responsible for the design and administration of the Bank's risk measurement, monitoring, and control functions. In general, the unit should be headed by an officer with responsibility for developing an effective risk management infrastructure which includes: (1) a capable risk management staff; (2) risk management policies, procedures, and controls; (3) review and approval of risk models; (4) risk measurement and monitoring; (5) monitoring and enforcement of risk limits; and (6) communication of risk management results to senior management and the board of directors.
9. The board or a specific committee of the board should be informed routinely of the Bank's interest rate risk exposures and should, on a regular basis, discuss and evaluate the Bank's risk exposures in light of current market conditions, established risk limits, operating performance, and other relevant factors.
10. The board or a specific committee of the board should understand and assess the performance of senior management with respect to the implementation of board-approved strategies and policies governing interest rate risk and compliance with interest rate risk limits.
11. The board should ensure that appropriate corrective measures (e.g., improved reporting systems, intensified board oversight, disciplinary action) are taken when interest rate risk limit violations occur.



B. Responsibilities of senior management

1. Senior management is responsible for implementing board-approved strategies and policies relating to the management of interest rate risk.
2. Senior management should ensure that effective and appropriate interest rate risk management policies, procedures, and controls are clearly written, sufficiently detailed, formally documented, and followed.
3. Senior management should ensure that the Bank has adequate systems and resources available to measure, monitor, manage, and control the Bank's interest rate risk. Management should ensure that knowledgeable, competent, and experienced staff conduct analyses and risk management activities relating to interest rate risk.
4. Senior management should ensure that policies and procedures assign responsibility for managing the Bank's interest rate limits.
5. Senior management should ensure that the lines of authority and responsibility for managing interest rate risk and monitoring interest rate risk limits are clearly identified.
6. Senior management should ensure that policies and procedures identify the reporting and remedial actions to be taken by management when interest rate risk limit violations occur.
7. Senior management should periodically review and discuss with the board information regarding the Bank's interest rate exposures that is sufficient in detail and timeliness to permit the board to understand and assess the performance of management with respect to the management and control of the Bank's interest rate risk exposures.

II. Risk management policies, procedures, and internal controls

A. General

1. A Bank should have clearly defined policies and procedures for managing and controlling interest rate risk exposures.
2. Policies and procedures should delineate lines of responsibility and accountability over interest rate risk decisions.
3. Policies and procedures should delineate authorized hedging instruments and hedging strategies.
4. Management should identify the interest rate risks inherent in new products and in business activities, including hedging activities, and ensure that they are subject to appropriate policies, procedures and controls before being introduced or undertaken. Major initiatives should be reviewed and approved by the board or a specific committee of the board.



B. Interest rate risk limits

1. The board of directors should establish risk limits to safeguard earnings and economic capital against adverse movements in interest rates and other risk factors. Risk limits should reflect the risk and return objectives of the board of directors. A Bank should adopt a comprehensive set of interest rate risk limits.
2. A Bank should consider setting risk limits that are defined in terms of the Bank's economic capital ratio. Limits based on the economic capital ratio should define the lowest economic capital ratio that the board is willing to tolerate under selected interest rate scenarios (e.g., parallel and nonparallel interest rate shocks as well as changes in other key risk factors such as prepayments, interest rate volatility, and interest rate spreads).
3. A Bank should also consider setting limits on the maximum allowable decline (or variation) in net interest income (or net income) that its board of directors is willing to tolerate for a specified time horizon under specified interest rate scenarios. Limits based on other risk metrics such as VaR, duration of equity, duration gap, and the MVE/BVE ratio, should be considered.
4. Limits should not be set so far above actual risk exposures, or target levels of exposure, that they are meaningless or have no effect on risk-taking behavior. Target levels for risk exposure should generally be below a Bank's risk limits.
5. A Bank's limits should be commensurate with the strength of its capital position, the level of its retained earnings, and the quality of its management and reporting systems.
6. The establishment of, or change in, a Bank's aggregate risk limits should be approved by the board and documented in the board's minutes.
7. A Bank should have a formal system to monitor interest rate risk exposures against established limits. Staff that is independent of those who are authorized to take positions should perform the monitoring.
8. Senior management should also ensure that appropriate and prompt follow-up action is taken when limit violations occur and when policies and procedures are not followed. The Bank should also maintain a record of all limit violations.
9. Recurrent changes in interest rate risk limits for the purpose of accommodating instances in which the limits have been, or are about to be, breached may be indicative of poor or inadequate risk management or faulty risk measurement systems.



C. Internal controls

1. A Bank should have an adequate system of internal controls over its interest rate risk management process.
2. With respect to interest rate risk management, internal control is a *process* carried out by the board, management, and others to provide reasonable assurance that the established goals and objectives for managing interest rate risk are being achieved.
3. The internal control process should promote:
 - a. Effective and efficient management of interest rate risk;
 - b. Reliable measurement of interest rate risk;
 - c. Reliable reporting and communication of interest rate risk;
 - d. Compliance with applicable statutes, regulations, and policies governing interest rate risk;
 - e. Periodic reviews and evaluations of interest rate risk positions, policies, and procedures; and
 - f. Periodic reviews and evaluations of the accuracy and reliability of risk measurement systems.
4. Management should ensure that appropriate, prompt, and effective corrective action is taken when violations of policies and procedures are detected or when internal control weaknesses are identified.
5. Management should have a strong model validation program and model documentation program in place.

III. Risk measurement, monitoring, and reporting

A. Risk measurement systems

1. A Bank should have an interest rate risk measurement system (a model or models) that capture(s) all material sources of interest rate risk and provide(s) meaningful measures of the Bank's interest rate risk exposures.
2. The risk measurement system should be capable of estimating the effect of changes in interest rates and other key risk factors on the Bank's earnings and net portfolio value over a range of scenarios.
3. The measurement system should address all material sources of interest rate risk including repricing risk, yield curve risk, basis risk, and options risk. The sophistication of the risk



measurement system should be commensurate with the complexity of the financial instruments held by the Bank.

4. The system should be capable of valuing all financial assets and liabilities in the Bank's portfolio. Instances where a Bank holds instruments that cannot be reliably valued by its risk model should promptly be brought to the attention of senior management and to the attention of the examiner-in-charge.
5. The measurement system used to estimate interest rate risk should use an option adjusted spread (OAS) methodology to value mortgages and other instruments with embedded options.⁸
6. The OAS methodology should employ a robust Monte Carlo or lattice technique. The number of interest rate paths used for valuing mortgages and mortgage-related securities should be commensurate with the complexity of the instrument.
7. The measurement system should use generally accepted financial concepts, valuation methodologies, and risk measurement techniques.
8. Where feasible, the measurement system's estimates of market values for assets, liabilities, and off-balance sheet contracts should be based directly or indirectly on observed market prices.
9. Management should ensure the integrity and timeliness of the data inputs used to measure the Bank's interest rate risk exposures, and should ensure that assumptions and parameters are reasonable and properly documented.
10. The system's methodologies, assumptions, and parameters should be thoroughly documented, understood by management, and reviewed on a regular basis.
11. A Bank's interest rate risk model should be upgraded periodically to incorporate advances in risk modeling technology.
12. A Bank should have a documented approval process for model changes that requires model changes to be authorized by a party independent of the party making the change.

B. Stress testing

1. A Bank should conduct stress tests that identify potential losses under extreme market conditions.⁹

⁸ The OAS methodology is a cash flow simulation technique that is used to determine, or estimate the "fair price" of financial instruments with embedded options. OAS is an estimate of the return provided by a financial instrument above some reference rate, such as LIBOR, taking into account embedded optionality

⁹ See Advisory Bulletin 03-10, *Guidance on Value-at-Risk Modeling* and Advisory Bulletin 03-8, *Capital Management and Retained Earnings*.



2. Stress testing should be designed to provide information on the kinds of conditions under which the Bank's strategies and positions would be most vulnerable.
3. A Bank's stress testing should include instantaneous parallel shifts of the yield curve of +/- 50, 100, 150, and 200 basis points. In low interest rate environments, a Bank should use the largest parallel down shock that produces post-shock Treasury rates no lower than 35 basis points.¹⁰
4. Additional stress scenarios should include changes in the relationships among key market interest rates, changes in the slope of the yield curve, changes in interest rate volatilities, changes in prepayment rates, and changes in spreads. The scenarios should include optimistic, pessimistic, and most likely forecasts.
5. Special consideration should be given to ensuring that complex financial instruments, including instruments with exotic option features, are properly valued under stress scenarios and that the risks associated with options exposures are properly understood.
6. Special consideration should be given to financial instruments or markets where the Bank has significant concentrations, particularly when the Bank has positions that may be difficult to liquidate.
7. Management should ensure that the Bank's board or specified board committee considers the results of stress tests when establishing and reviewing its strategies, policies, and limits for managing and controlling interest rate risk.
8. The board of directors and senior management should review periodically the design of stress tests to ensure that they encompass the kinds of market conditions under which the Bank's positions and strategies would be most vulnerable.

C. Monitoring and reporting

1. A Bank should have an adequate management information system for reporting interest rate risk exposures.
2. The board of directors, senior management, and the appropriate line managers should be provided with regular, accurate, informative, and timely interest rate risk reports.
3. The Bank's interest rate risk reports should:

¹⁰ See Advisory Bulletin 03-09, *Calculation of Duration of Equity (DOE) and DOE Limits in Low Interest Rate Environments and Related Reporting Requirements*, for further discussion of parallel rate shocks in low interest rate environments



- a. Show the market value (or mark-to-model value) of the Bank's assets, liabilities, and off-balance sheet contracts under a range of scenarios including parallel rate shock scenarios.
- b. Show trends in key measures of interest rate risk.
- c. Show compliance with interest rate risk policies and limits and any exceptions or violations of limits and policies. The reports should identify and explain limit violations.
- d. Compare past interest rate forecasts or risk estimates with actual results, *i.e.*, backtesting reports.
- e. Show results of key stress tests and scenarios.
- f. Summarize internal and external reviews of the Bank's interest rate risk policies, procedures, and risk measurement systems.
- g. Identify changes to risk models and model assumptions describe the rationale for the changes, and analyze their impact on risk measures and risk limits.

D. Model validation, documentation, and backtesting

1. Management should ensure that a qualified independent party, such as an internal or external auditor or risk modeling consultant, validates the Bank's model on a regular basis.¹¹ The party conducting the review should understand, test, and document the Bank's risk measurement process, evaluate the system's accuracy, and recommend solutions to identified weaknesses. The results of such reviews should be reported to the board of directors and senior management and should be made available to examiners and other appropriate Finance Board staff. The party performing the model validation should be independent of personnel responsible for constructing or operating the model. The independent party should determine whether:
 - a. The Bank has a sound model validation policy. The procedures for model validation and approval should be formalized in a written document.

¹¹ Part 932.5(c) of the Finance Board's regulations requires each Bank to conduct, at least annually, an independent validation of its internal market risk model. The independent validation may be carried out by a qualified outside party, or by Bank staff not reporting to the business line responsible for conducting business transactions for the Bank. Pursuant to Advisory Bulletin 03-7, *Internal Market Risk Model Validation*, each Bank shall be expected to meet the market risk model validation requirements beginning in 2004, and annually thereafter except that any Bank that implements its capital plan in 2004 shall be expected to meet the annual market risk model validation requirements beginning in 2005.



- b. New models or modifications to existing models are reviewed, tested and approved by the appropriate management before they enter production. The validation tests and the test results should be documented. Model modifications or changes should be subject to strict control procedures to ensure that changes are made only by authorized personnel and that all changes are approved by the appropriate level of management.
 - c. The model is sufficient to capture all material sources of the Bank's interest rate risk exposures over a range of scenarios.
 - d. There is a rigorous process for ensuring and validating the quality of data used as input for the model.
 - e. The assumptions used in the model are reasonable and periodically compared to actual portfolio behaviors;
 - f. The mathematical and logical operations of the model are reasonable and supported by theory or market convention.
 - g. The model output reports are accurate, informative, and understandable.
 - h. The Bank has adequate staffing to conduct a sound interest rate risk modeling.
 - i. The Bank's management is provided with a clear and informative description of the model that describes the model's strengths and limitations including its sensitivity to changes in key assumptions.
 - j. There are complex financial instruments held by the Bank that cannot be valued properly by the Bank's model.
2. Management should ensure that the model's documentation is thorough, up-to-date, and is maintained in a secure location. To provide protection against the loss of key personnel, the documentation should be sufficient to allow an independent party to understand, operate, and replicate the model. Model inputs, assumptions, mathematical and logical operations, and validation procedures should be documented. As a matter of sound practice, a historical record of documentation changes should be maintained. Copies of documentation and model code should be maintained in another location to facilitate disaster recovery.
 3. A Bank should routinely compare, or "backtest," market risk exposure measures against actual profits and losses, *e.g.*, daily or weekly market value gains and losses, to gauge the quality and accuracy of their risk measures and risk measurement systems. For example,



there are a number of statistical tests that can be used to test the quality of a model's VaR estimates.¹² Although a Bank's VaR capital measures are calculated at the 99th percentile for a 120-business day holding period, backtesting should be conducted at a lower confidence level for a shorter time horizon in order to provide more observations for comparison. For example, a Bank might compare daily market value gains and losses against its VaR measures for one-day VaR holding periods at the 95 percentile. Over 100 business days, one would expect VaR estimates to be exceeded on average about five times, e.g., five exceptions. If the actual number of exceptions over the 100 day period were significantly greater than five, then the model may be underestimating the Bank's true risk exposure.

Conclusion

The ultimate responsibility for interest rate risk management rests with the board of directors. The board and senior management must ensure that the Bank has in place appropriate policies, procedures, and internal controls for managing and controlling the Bank's exposure to interest rate risk. The board and senior management must also ensure the Bank's risk measurement, monitoring, and reporting systems are reliable and effective. Senior management should strive to keep pace with best practices with respect to stress testing, model validation, model documentation, backtesting, and other aspects of risk management.

An Advisory Bulletin is a staff document through which the Office of Supervision provides guidance to the Federal Home Loan Banks regarding particular supervisory issues. Although an Advisory Bulletin does not have the force of a regulation or an order, it does reflect the position of the Office of Supervision on the particular issue and as such will be followed by examinations staff. If non-compliance with an Advisory Bulletin is cited as the basis for a supervisory determination, any such determination will be subject to review by the Board of Directors pursuant to the procedures of 12 CFR 907.9.

Advisory Bulletins are effective upon issuance. The Office of Supervision may amend an Advisory Bulletin, either on its own initiative or in response to comments or suggestions from the Banks or other interested parties.

¹² See *Supervisory Framework for the Use of Backtesting in Conjunction with the Internal Models Approach to Market Risk Capital Requirements*, Basle Committee on Banking Supervision, January 1996.