obstacles to the repatriation of profits from a foreign subsidiary or where management structure does not allow timely management of risk on a consolidated basis).

2. All transactions, including forward sales and purchases, should be included in the calculation of market risk capital requirements from the date on which they were entered into. Although banks subject to the capital requirements for market risk will continue to report their capital on a quarterly basis, the FDIC expects banks to meet their capital requirements for market risk on a continuous basis (that is, at a minimum, at the close of each business day).

3. The risk-based capital ratios adjusted for market risk are minimum supervisory ratios. The FDIC expects banks to operate with capital positions well above the minimum ratios. In all cases, banks should hold capital commensurate with the level and nature of the risks to which they are exposed.

III. The Internal Models Approach

A. Use of Models

1. With prior approval of the FDIC, a bank may use its internal risk measurement model(s) for measuring value-at-risk to be used as the measure for market risk.

a. Requests for approval should include, at a minimum, a complete description of the bank's internal modeling and risk management systems and how these systems conform to the criteria set forth in this section III, an explanation of the policies and procedures established by the bank to ensure continued compliance with such criteria, a discussion of internal and external validation procedures, and a description of other relevant policies and procedures consistent with sound practices.

b. The FDIC will approve an internal model for regulatory capital purposes only after determining that the bank's internal model and risk management systems meet the criteria in this section III. Such a determination may require on-site examinations of the systems. The FDIC may require modification to an internal model as deemed necessary to ensure compliance, on a continuing basis, with the provisions of this appendix C. A bank's internal model will be subject to continuing review, both on- and off-site, by the FDIC.[12]

2. A bank should ensure that the level of sophistication of its internal model is commensurate with the nature and volume of the bank's trading activity in the risk factor categories covered by this appendix C and measures market risk as accurately as possible. In addition, the model should be adjusted to reflect changing portfolio composition and changing market conditions.

B. Qualitative Criteria

1. A bank using the internal models approach should have market risk management systems that are conceptually sound and implemented with integrity. Internal risk measurement models must be closely integrated into the day-to-day risk management process of the bank. For example, the risk measurement model must be used in conjunction with internal trading and exposure limits.

2. A bank must meet the following minimum qualitative criteria before using its internal model as the measure for market risk:[13]

a. A bank must have a risk control unit that is independent from business trading units and reports directly to senior management of the bank. The unit must be responsible for designing and implementing the bank's risk management system and analyzing daily reports on the output of the bank's risk measurement model in the context of trading limits. The unit must conduct regular back-testing.[14]

b. Senior management must be actively involved in the risk control process. The daily reports produced by the risk management unit must be reviewed by a level of management with sufficient authority to enforce both reductions in positions taken by individual traders, as well as in the bank's overall risk exposure.

c. The bank must have a routine and rigorous program of stress-testing to identify the effect of low-probability events on the bank's trading portfolio. Bank stress-testing should cover a range of factors that can create extraordinary losses or gains in trading portfolios or make the control of risk in those portfolios difficult. These factors include low-probability events of all types, including the various components of market, credit, and operational risks. Senior management must routinely review the results of stress-testing in the context of the potential effect of the events on bank capital and the appropriate procedures the bank should take to minimize losses. The policies of the bank set by management and the bank's board of directors should identify appropriate stress-tests and the procedures to follow in response to the test results.

d. The bank must have established procedures for ensuring compliance with a documented set of internal policies and controls, as well as for monitoring the overall operation of the risk measurement system.

e. Not less than once a year, the bank must conduct, as part of its regular internal audit process, an independent review of the risk measurement system. This review must include both the activities of the business trading units and of the independent risk control unit of the bank.

f. Not less than once a year, the bank must conduct a review of its overall risk management process. The review must consider:

i. The adequacy of the documentation of the risk management system and process, and the organization of the risk control unit;

ii. The integration of market risk measures into daily risk management and the integrity of the management information system;

iii. The process the bank employs for approving risk pricing models and valuation systems that are used by front- and back-office personnel;

iv. The scope of market risks captured by the risk measurement model and the validation of any significant changes in the risk measurement process;

v. The accuracy and completeness of position data, the accuracy and appropriateness of volatility and correlation assumptions, and the accuracy of valuation and risk sensitivity calculations;

vi. The verification process the bank employs to evaluate the consistency, timeliness, and reliability of data sources used to run internal models, including the independence of such data sources; and

vii. The verification process the bank uses to evaluate back-testing that is conducted to assess the model's accuracy.

C. Market Risk Factors

1. *Generally*. For regulatory capital purposes, a bank's internal risk measurement system must use sufficient risk factors to capture the risks inherent in the bank's portfolio of on- and off-balance-sheet trading positions and must, subject to the following guidelines, cover interest rates, equity prices, exchange rates, commodity prices, and volatilities related to options positions in each risk factor category. The level of sophistication of the bank's risk factors must be commensurate with the nature and scope of the risks taken by the bank.

2. *Interest Rates*. a. A bank must use a set of market risk factors corresponding to interest rates in each currency in which it has material interest rate-sensitive on- or off-balance-sheet positions. The risk measurement system must model the yield curve [15] using one of a number of generally accepted approaches, for example, by estimating forward rates of zero coupon yields. The yield curve must be divided into various maturity segments in order to capture variation in the volatility of rates along the yield curve; there will typically be one risk factor corresponding to each maturity segment.

b. For significant exposures to interest rate movements in the major currencies and markets, a bank must model the yield curve using a minimum of six risk factors. However, the number of risk factors used should ultimately be driven by the nature of the bank's trading strategies.[16] The risk measurement system must incorporate separate risk factors to capture spread risk.[17]

[12] Banks that need to modify their existing modeling procedures to accommodate the requirements of this appendix C should, nonetheless, continue to use the internal models they consider most appropriate in evaluating risks for other purposes.

[13] If the FDIC is not satisfied with the extent to which a bank meets these criteria, the FDIC may adjust the multiplication factor used in section II.B.2.a.ii. of this appendix C to determine the total measure for market risk or otherwise increase capital requirements.

[14] Back-testing includes *ex post* comparisions of the risk measures generated by the model against the actual daily changes in portfolio value.

[15] Generally, a yield curve is a graph showing the term structure of interest rates by plotting the yields of all instruments of the same quality by maturities ranging from the shortest to the longest available. The resulting curve shows whether short-term interest rates are higher or lower than long-term interest rates.

[16] For example, a bank that has a portfolio of various types of securities across many points of the yield curve and that engages in complex arbitrage strategies would require a greater number of risk factors to accurately capture interest rate risk.

[17] For these purposes, spread risk refers to the potential changes in value of an instrument or