with integrity.[8] The internal risk measurement model should be closely integrated in the daily risk management process and serve as a basis for reporting of risk exposures to senior officers. Institutions should have, for example, highly trained personnel who can evaluate the adequacy of the risk models and who are organizationally independent of personnel responsible for executing trades. These individuals should compare actual daily trading gains and losses with VAR figures generated by the model as part of their on-going evaluations of the modelling process. At least annually, internal auditors should assess the institution's overall process for managing and measuring trading risks.

Notwithstanding the use of VAR as a basis for a regulatory capital charge, institutions should also routinely evaluate their exposures to highly stressful events, selected to identify the circumstances to which their particular trading portfolios are most vulnerable. Such a program of stress testing supplements the capital standard and illustrates management's commitment to evaluating trading risks fully.

The stress testing process, along with other relevant internal policies, controls, and procedures, should be well documented and available for examiners to review. Examiners will need this information, as well as comparisons of VAR measures with actual daily trading results, to judge the acceptability of the institution's model on an initial and periodic basis. Under the proposal, if key management procedures are missing or weak, or if the integrity of a model is questionable, the appropriate supervisor may either disallow the model for regulatory capital purposes or require capital above the minimum specified in the proposal. The latter may be done by increasing the size of the multiplier that would be applied to an institution's VAR (discussed below under ''Capital Requirement''). Typically, the Agencies would expect to see any management or modelling shortcomings addressed and the risk measure improved, rather than seek to resolve the matter by applying a larger multiplier to a marginally satisfactory or questionable modelling or management approach.

Quantitative Standards

Whereas the qualitative standards focus on the integrity of the modelling process and incorporate standards of sound practice, the quantitative standards are designed to develop a prudential capital requirement by addressing the level of rigor in an institution's models and the consistency of model parameters among institutions. The Agencies have sought to minimize the quantitative constraints and to make those that were deemed necessary as compatible as practicable with existing procedures of institutions. The Agencies recognize, however, that some of these standards may require an institution to make certain modifications to its internal model when using it for computing regulatory capital requirements. The Agencies propose that an institution that elects to use the internal model approach be subject to the following standards for its internal model:

(1) *Value-at-risk* should be computed each business day and should be based on a 99 percent (one-tailed) *confidence level* of estimated maximum loss.

(2) The assumed *holding period* used for the VAR measure must be 10 business days, although for positions that display linear price characteristics (not options, which display nonlinear characteristics) the institution may use results based on one-day periods, increased to ten days by multiplying by the square root of time.[9]

(3) The model must measure *all material risks* incurred by the institution, although no specific type of model is prescribed.

(4) The model may utilize historical *correlations* within broad categories of risk factors (interest rates, exchange rates, and equity and commodity prices), but not among these categories. That is, the consolidated value-at-risk is the sum of the individual VARs measured for each broad category.

(5) The *non-linear price characteristics* of options must be adequately addressed, both by ensuring that the model incorporates potential non-linear price behavior and by evaluating actual minimum 10 day holding periods, rather than multiplying the results based on one-day periods by the square root of time. The volatility of the rates and prices (vega) underlying the options must also be included among the risk factors.

(6) The *historical observation period* used to estimate future price and rate changes must have a minimum length of one year. The Agencies request specific comment on whether they should also require institutions to calculate their exposures using a shorter observation period (e.g. less than 6 months), with the capital requirement based on the higher result.

(7) Data must be *updated* no less frequently than once every three months and more frequently if market conditions warrant.

(8) Each yield curve in a major currency must be modeled using at *least six risk factors,* selected to reflect the characteristics of the interest rate sensitive instruments that the institution trades. The model must also take account of spread risk.

Several of these constraints warrant a discussion of their underlying rationale:

Minimum holding period (and issues regarding options). Typically, longer holding periods lead to larger expected price changes and, consequently, to larger measures of risk. When estimating risk in trading activities for management purposes, most institutions assume only a one-day holding period, since trading decisions are made constantly, and some instruments are held for only minutes or hours. This approach may be fully satisfactory for day-to-day management purposes but seems less appropriate when designing a prudent capital standard.

In periods of market turmoil, when an institution's capital is most needed, many financial instruments could become unexpectedly illiquid, as market participants become less willing to accept market risk. One method of increasing the rigor of the risk measure and addressing an unexpectedly large price change that could result from a decline in market liquidity would be to assume a longer holding period. The proposed requirement that institutions use a 10-day holding period does not imply that the Agencies would expect them to plan for that eventuality. Indeed, some positions, such as those involving spot foreign exchange contracts, will mature and settle within that time frame and could not be held for 10 days, in any event. Therefore, in this context, the 10-day period should be viewed simply as a way of producing a more stressful market shock by assuming an *instantaneous* price movement of a size that one would normally expect to witness only over the longer period of time.

However, in order to minimize modelling costs and recognize the linear nature of price movements of many financial instruments, the Agencies would permit institutions to estimate a 10-day price or rate movement—for instruments other than options—using the risk factor changes calculated on the basis of one-day holding periods. This adjustment could be accomplished using the ''square root of time'' method

[8] With respect to the qualitative standards, the OCC is planning to provide additional guidance through supplementary banking issuances.

[9] For example, one can estimate the ten day price volatility of an instrument by multiplying the volatility calculated on one-day changes by the square root of ten.