

7. Academics For The Trading Book

7.1 Value at Risk (VaR) Implementation

There is no consensus regarding the proper time horizon for risk measurement. The appropriate time horizon depends on the risk measurement purpose (e.g., setting capital limits) as well as portfolio liquidity. Time-varying volatility results from volatility fluctuation over time. It is important to recognize time-varying volatility in VaR measures since ignoring it will likely lead to an underestimation of risk. In addition to volatility fluctuations, risk managers should also account for time-varying correlations when making VaR calculations.

To simplify VaR estimation, the financial industry has a tendency to use short time horizons. However, a 10-day VaR time horizon, as suggested by the Basel Committee on Banking Supervision, is not always optimal. When computing VaR over long time horizons, a risk manager needs to account for the variation in a portfolio's composition over time (dynamic portfolio). Thus, a longer than 10-day time horizon may be necessary for economic capital purposes, for instance, structured product like exotic options which takes longer time for settlement.

Historically, VaR backtesting has been used to validate VaR models. However, backtesting is not effective when the number of VaR exceptions are small. In addition, backtesting is less effective over longer time horizons due to portfolio instability. VaR models tend to be more realistic if time-varying volatility is incorporated.

7.2 Integrating Liquidity Risk into VaR Models

Exogenous liquidity is handled through the calculation of a liquidity-adjusted VaR (LVaR) measure, and represents market specific and average transaction costs. The LVaR measure incorporates a bid / ask spread by adding liquidity costs to the initial estimate of VaR.

Endogenous liquidity is an adjustment for the price effect of liquidating positions and is calculated by the elasticity of prices to trading volumes. It depends on trade sizes and is applicable when market orders are large enough to move prices (the "block deal").

Poor market conditions can cause a "flight to quality", which decreases a trader's ability to unwind positions in thinly traded assets. Thus, endogenous liquidity risk is most applicable to exotic, complex trading positions and very relevant in high-stress market conditions, however endogenous liquidity costs will be present in all market conditions.

7.3 Spectral Risk Measures

VaR is a useful measure of risk since it is easy to compute and readily applicable. However, it does not consider losses beyond the VaR confidence level (i.e., the threshold level). In other words, VaR does not consider the severity of losses in the tail of the returns distribution. An additional disadvantage of VaR is it is not subadditive, meaning that the VaR of a combined portfolio can be greater than the sum of the VaRs of each asset within the portfolio.

Spectral risk measures generalize expected shortfall and consider an investment manager's aversion to risk. Just as expected shortfall, these measures have selected advantages over expected shortfall by including better smoothness properties when weighting observations as well as the ability to modify a risk measure to reflect an investor's specific risk aversion. In short, spectral risk measures have satisfied the subadditivity and incorporated the measurement of magnitude ('the tail risk'), various weighting schemes, and risk aversion functions.

7.4 Integrated Risk Measurement

VaR mapping is the method for risk aggregation. Unified and compartmentalized risk measurement methods aggregate risks for banks. A unified approach considers all risk categories simultaneously. This approach can capture possible compounding effects that are not considered when looking at individual risk measures in isolation. For example, unified approaches may consider market, credit, and operational risks all together.

When calculating capital requirements, banks use a compartmentalized approach, whereby capital requirements are calculated for individual risk types, such as market risk and credit risk. Pillar 1 risk categories include market, credit, and operational risks. Pillar 2 risk categories incorporate concentration risks, stress tests, and other risks, such as liquidity, residual, and business risks. The Basel regulatory framework uses a "building block" approach, whereby a bank's regulatory capital requirement is the sum of the capital requirements for various risk categories. Thus, the overall Basel approach to calculating capital requirements is a non-integrated approach to risk measurement.

The top-down approach to risk aggregation assumes that a bank's portfolio can be cleanly subdivided according to market, credit and operational risk measures. In other words, if risk definitions are possible, the top-down approach (the "macro" approach) is appropriate and the ratio of unified capital to compartmentalized capital (i.e., the ratio of integrated risks to separate risks) are calculated to be less than one, which suggests the risk diversification is present and ignored by the separate approach.

In contrast, a bottom-up approach attempts to account for interactions among various risk factors. If it is not possible to completely separate risks, the compartmentalized approach or the bottom-up approach (or the "micro" approach) will not be conservative enough, the risk diversification should be questioned, which could lead to underestimation of risk. In this case, bank managers and regulators should conclude that the bank's overall capital level should be higher than the sum of capital calculations derived from risks individually.

7.5 Balance Sheet Management

When a balance sheet is actively managed, the amount of leverage on the balance sheet becomes procyclical. Thus, capital requirements tend to amplify boom and bust cycles (i.e., magnify financial and economic fluctuations). Leverage (measured as total assets to equity) is inversely related to the market value of total assets. When net worth rises, leverage decreases, and when net worth declines, leverage increases. This results in a cyclical feedback loop: asset purchases increase when asset prices are rising, and assets are sold when asset prices are declining. For example, an economic boom will relax this VaR constraint since a bank's level of equity is expanding. Thus, this expansion allows financial institutions to take on more risk and further increase debt by leveraging up.

7.6 Stressed VaR Approach

It is important to incorporate stress testing into risk models by selecting various stress scenarios, three primary applications of stress testing exercises are: 1. Historical scenarios, which examine previous market data, 2. Predefined scenarios, which attempt to assess the impact on profit/loss of adverse changes in a predetermined set of risk factors, 3. Mechanical-search stress tests, which use automated routines like Monte-Carlo to cover possible changes in risk factors.

In stress testing, it is important to “stress” the correlation matrix, often referred to as comrelation or correlation breakdown. A stressed VaR approach, which attempts to account for a significantly financial stressed period, has not been thoroughly tested or analyzed. Thus, VaR could lead to inaccurate risk assessment under market stresses.