Historical Value At Risk Analytics

Market risk is the risk of a decrease in value of a portfolio of investments, trades, and positions due to changes in the market factors which determine the market value of the portfolio.

Under the regulatory guidelines, the trading book requires capital underpinning of exposure to both general and specific market risk. General market risk arises from exposure to losses that result from an adverse change in the general level of market rates.

Specific risk arises from exposure to an adverse movement in the price of an individual security owing to factors related to the individual issuers including widening of credit spreads, credit migration and default. In measuring market risk in the trading book, banks may choose the standardized methodology or the internal models methodology.

The standardized methodology uses a “building block” approach that groups underlying risks into broad categories and limits the benefits of diversification across business and product lines. While the standardized approach to the measurement of market risk was set out by the regulators, it was deemed not appropriate for major institutions with large scale trading operations. OSFI has indicated that the standardized approach was to be used on a temporary basis and it expects major Canadian banks to adopt an internal models approach as soon as possible.

The internal models methodology provides a more granular breakdown of the underlying risks and recognizes the benefits of diversification. In addition to providing more accurate measures of risk, the internal models methodology provides significant regulatory capital relief because it measures risk more efficiently. It is generally acknowledged that the models approach will require about half the regulatory capital of the standardized approach. Implementation of the

models based approach requires regulatory approval and is subject to satisfying a number of qualitative and quantitative standards that are recognized as industry best practices.

Market risk is typically measured using a Value at Risk methodology. Market risk can also be contrasted with Specific risk, which measures the risk of a decrease in ones investment due to a change in a specific industry or sector, as opposed to a market-wide move.

Historical VaR for a particular time horizon is derived from a distribution of portfolio values generated from scenarios created by applying historical changes to the current market rates.

Historical simulation approach is used to measure value at risk (VAR) due to general market moves. The VAR measure uses historical daily rate changes for the last 500 days to evaluate the possible negative impact of each transaction.

This generates a profit and loss (P&L) vector representing the daily correlated aggregate P/L that would result if the changes in market values over the last 500 days were to be repeated. Transactions are grouped into portfolios and a single P&L vector is derived for each portfolio by adding the P&L results of all transactions for each scenario. The sum of these vectors will be an estimate of the enterprise-wide VAR.

Obtain two-year historical value time series of all market factors, such as a stock price time series is $\bar{x}_1 \quad \cdots \quad \bar{x}_{500}$

Assuming today's value is x_0, generate 500 historical scenarios. The i-th is $x_i = ({}^{\bar{x}_i}/_{\bar{x}_{i-1}} - 1)x_0$. First, compute base PV at today t as $P(x_o)$. Then compute 500 scenario PVs: $P(x_i)$. Next, compute 500 scenario P&L: $P(x_i) - P(x_0)$. Finally sort 250 scenario P&L. The VaR is 5th lowest (negative) numbers

The 99th percentile worst case scenario will be deemed the VAR for a 10-day horizon. It can then be scaled back by sqrt(10) to estimate the 1-day risk.

Back-testing is the process required to prove that the daily VAR estimation meets the stated confidence level of 99%.

There are three issues that must be addressed for back-testing:

1. The back-test time horizon,
2. The risk factors to be back-tested,
3. The frequency of back-testing.

We have chosen to perform a 1-day back-test since this is consistent with our P&L reporting. Furthermore, back-testing the 10-day model presents significant operational and tracking issues which do not justify any added benefit.