Risk-Neutral Calibration Process Overview

by William Pauling, CFA

Every month, Conning develops updated risk-neutral calibrations for the US and Canada. In this note, we provide some insight into the calibration process.

Step 1: Gather Current Market Data

Conning uses two sources for market data; S&P Global provides market data for the swap curve, swaption volatility, equity option implied volatility, and corporate bond yield curves are obtained from Bloomberg.

Swap and Swaption Data: S&P Global

	US SOFR	Canada CORRA
Swap Curve	**Tenors:** 3m, 6m, 1y, 2y, 3y, 4y, 5y, 6y, 7y, 8y, 9y, 10y, 12y, 15y, 20y, 25y, 30y, 40y, 50y	**Tenors:** 3m, 6m, 1y, 2y, 3y, 4y, 5y, 6y, 7y, 8y, 9y, 10y, 12y, 15y, 20y, 25y, 30y, 40y
Swaption ATM Volatilities	**Tenors:** 1y, 5y, 10y, 20y, 30y **Expiries:** 1y, 2y, 3y, 4y, 5y, 6y, 7y, 8y, 9y, 10y, 15y, 20y, 25y, 30y	**Tenors:** 1y, 5y, 10y, 30y **Expiries:** 1y, 2y, 3y, 4y, 5y, 7y, 10y

Equity Option Data: S&P Global

US SPX, MID, RTY, NDX	Canada TSX60
Moneyness: 80%, 90%, 100%, 110% **Expiries:** 1m, 2m, 3m, 6m, 9m, 1y, 1.5y, 2y, 2.5y, 4y, 5y, 10y	**Moneyness:** 80%, 90%, 100%, 110% **Expiries:** 1m, 2m, 3m, 6m, 9m, 1y, 1.5y, 2y, 2.5y, 4y, 5y, 10y

Option-implied volatilities are provided by S&P Global and translated into call and put prices using the Black-Scholes model. The model is calibrated to the option prices.

Corporate Bond Yield Curves: Bloomberg

US	Canada
Maturities: 3m, 1y, 2y, 3y, 4y, 5y, 7y, 8y, 9y 10y, 15y, 20y **Qualities:** A, BBB, BB	**Maturities:** 3m, 1y, 2y, 3y, 4y, 5y, 7y, 8y, 9y 10y, 15y, 20y **Qualities:** AA, A, BBB

Any missing data is filled out by interpolation. For example, the Canadian AAA curve is interpolated using the swap and AA curves.

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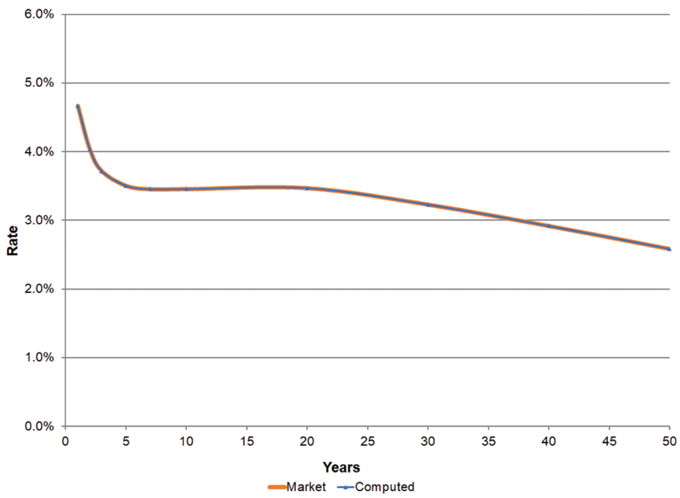
Step 2: Calibrate Model

Conning has developed a risk-neutral calibration tool to calibrate the GEMS® Economic Scenario Generator ("GEMS®"). The tool uses the current market data gathered in the previous step. It pairs GEMS® closed-form and semi-closed-form solutions for bond and option prices with advanced optimization techniques to match the observed data as closely as possible. Once complete, the tool displays information related to the goodness-of-fit against the market data.

Fit to Market Data: US Swap Curve



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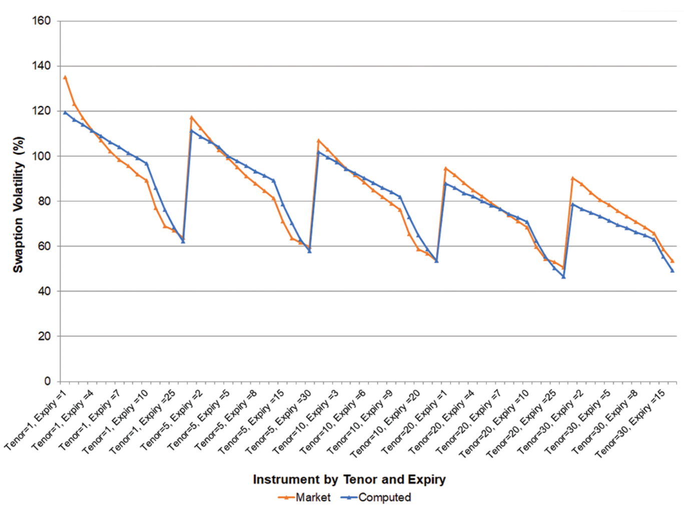
Fit to Market Data: US Swaption Volatility



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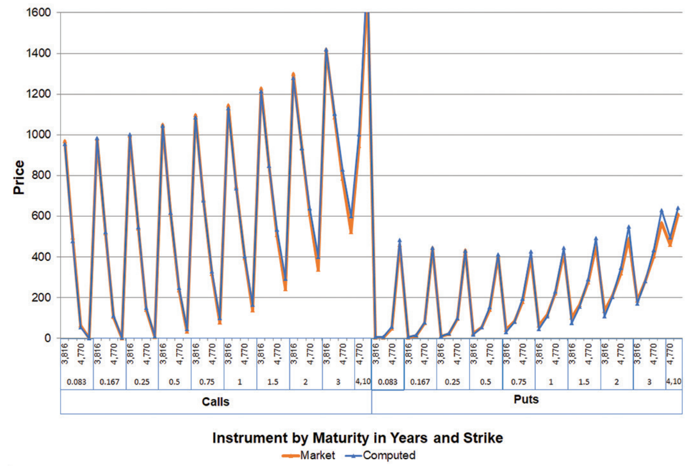
Fit to Call and Put US Large Cap Option Prices: SPX



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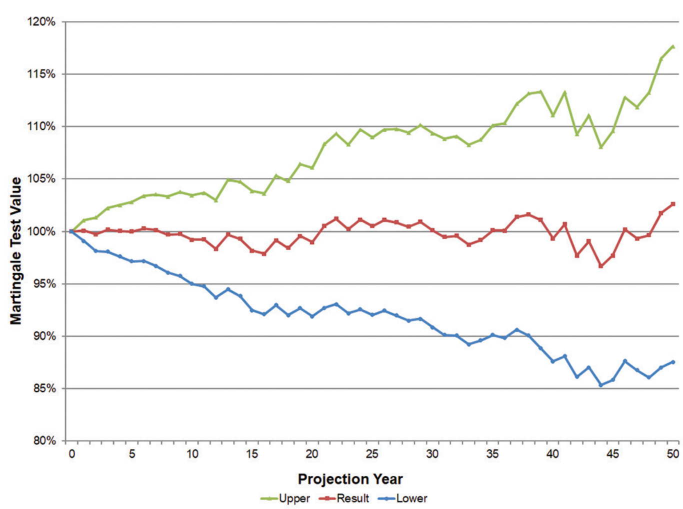
Step 3: Validate Calibration

Once the calibration is complete, the next step is to run a simulation. Our validation is based on a monthly simulation for 50 years (600 periods) and 1,000 scenarios. This simulation is the basis for the risk-neutral validation report that we publish alongside the updated template. Both the report and template are published to our Software Documentation Library each quarter.

The first section of the validation report compares the fit of the model against the observed data and includes the graphs from the prior step. The next section displays Martingale test results for each of our standard asset classes.

Martingale Test: US Large Cap SPX



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Bill Pauling, CFA, is a Director at Conning where he helps clients use Conning's software tools to make better-informed risk and capital management decisions. Prior to joining Conning in 2021, Mr. Pauling worked at The Hartford where he held a variety of roles related to ERM, ALM and investment risk management. In his most recent role, he was responsible for developing the economic scenarios used in the enterprise economic capital model. Mr. Pauling is a graduate of Drexel University with a BS in Finance. He is a CFA charterholder and a member of the Hartford CFA Society.

About Conning

Conning (www.conning.com) is a leading investment management firm with a long history of serving the insurance industry. Conning supports institutional investors, including insurers and pension plans, with investment solutions, risk modeling software, and industry research. Conning's risk management software platform provides deeper insights for decision making, regulatory and rating agency compliance, strategic asset allocation, and capital management. Founded in 1912, Conning has investment centers in Asia, Europe and North America.