Modeling Risks: "A Sample Approach to Model Validation"

By Todd Sauer

As regulators enter into the era of ORSA reporting, it will become increasingly important to understand the risks associated with modeling.

Model validation touches many types of risks including but not limited to credit risk, operational risk, market risk, insurance risk and economic capital risk. Model effectiveness (or ineffectiveness) has a major impact on the ability of insurance companies to manage prospective risk embedded in their product offerings and investment strategy. Good corporate governance requires strong oversight of critical models and regulators need to better understand and assess this risk area. Understanding the model functionality is the first step in analyzing the associated risk and how one might test or validate such a model. The process of model validation commonly involves a defined scope of objectives that review the mathematical and theoretical soundness of functionality and use. Typically, the model validation team within an organization works with its various business units to establish policies that govern the development and associated documentation.

A closer look at model validation:

1) Review of Assumptions and Inputs

An organization must ensure that certain model assumptions are based on analysis that is reflective of current market conditions and activity. Determining the source of inputs and assumptions is critical. Do they include all major assumptions? (the AIG CDS model did not address collateral call risk). Do they come from a reliable source? Does the process of updating and vetting the assumptions occur within a controlled environment? Do the inputs come from an internal model or an external source? What are the controls surrounding this source? Inputs will vary by model. For example: A credit risk model will use financial ratios while a default model might use macroeconomic inputs.

Risks associated with assumptions and inputs can be evaluated by:

- Researching appropriate benchmarks applicable to the model assumptions
- Creating a historical trend analysis of assumptions and inputs,

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- Determining appropriate calibration of certain assumptions; have the inputs been properly calibrated to observable market data? and
- Determining the sensitivity of certain assumption changes. Which inputs create more variability? ORSA will require key assumptions be predicted based on normal and stressed assumptions. This is also prudent business management as key assumptions like market liquidity and consumer behavior will vary dramatically in stressed scenarios.

2) Theory — is the logic accepted and can it be supported?

The creation of the model is based upon the theory of a particular financial product. Does the developer of the financial model have the proper background? Risks associated with model logic can be evaluated by:

- Understanding the financial theory of related products.
- Verifying the theoretical soundness (as reflected in recent financial literature and evidence) of the pricing /risk relationship of various products.
- Assuring that all key risks are considered in the model.
- A comparison to historical experience, particularly performance during high stress periods.

3) Testing of the code — does the math work?

The testing of the code and mathematics behind the financial theory often requires detailed line-by line procedures. For many spreadsheet models this occurs by a replication of calculations and formulas given the same set of assumptions. Spreadsheet models should always be tested using a full replication of the workbook calculations due to the lack of security and key stroke errors which are often un-detected. Many debt-like features of certain bonds have detailed pay-down logic or waterfall rules which can be easily replicated within a spreadsheet environment.

Risks associated with model coding can be evaluated by:

- Independent recalculation of financial product amortization and expected cash flows including performance measurement statistics such as yield, duration and weighted average life.
- Testing option pricing models and applying Value at Risk assumptions.

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4) Reporting and model output

The analysis of model reporting is critical to the decisions made by senior management. Robust reporting functions allow users to back-test and benchmark more efficiently and accurately. The reports should also be used for clearly outlining the assumptions and associated results given a set of inputs. Many companies also use reporting to provide outside parties with a trail of evidence and support for audit related activities.

Risks associated with reporting and model output can be evaluated by:

- Thoroughly reviewing the reporting mechanism and associated accuracy of disclosed items,
- Back-testing the model and evaluating predicted outcomes vs. actual outcomes, and
- Generating scenarios which would potentially cause the reporting functionality to be stressed.

Reviewing models and the associated risks embedded in these models should be considered when performing risk focused exams. Ideally the corporate governance assessment and priority rating of the company will be impacted by the insurer's ability to effectively use models to mitigate prospective risk. New solvency tools like ORSA will be directly impacted by a company's ability to model key risk in a stressed environment. Inputs and assumptions vary based upon the type of model or system used to perform various tasks. The evolution of insurance products throughout the years has created a complex system of models. Each insurance company has specific models in place to predict financial markets, product pricing, consumer behavior and overall economic forecasts.

An area of risk often overlooked is the aggregation of risk at a holding company level. Recently we have seen that insurance companies are starting to pay more attention to modeling at the enterprise-wide level, ensuring that aggregations of risk are not created, and ensuring that consistent assumptions are used for models across the organization.

The impact of potential model errors can cause significant financial damage and create uncertainty in the operations of a company. Multiple risks identified within the exam process can be tied back to the use of models and the overall model design. Understanding what may cause a "break in the model" is critical when examining certain model related controls. Often times, specialists (IT, actuarial, investment and reinsurance) are needed for the deep understanding of specific products that may have unique assumptions or modeling approaches. For example: Certain models which are used by actuaries to predict optionality in products such as Equity Indexed Annuities may

have significant investment assumptions embedded in the models. Both an Investment Specialist and an Actuary should collaborate on the model risk and the associated controls covering this activity.

In conclusion, risks associated with financial models could pose significant impact to many aspects of an insurance company. As regulators, understanding how to assess and review these models is critical to conducting effective and thorough examinations. The upcoming ORSA requirements facing many insurers will require significant expertise in model reviews for certain key activities.

About the Author

Todd Sauer is a Director at Risk & Regulatory Consulting LLC, where he works as an Investment Specialist. He has 13 years of experience in providing investment services. Todd performs investment and risk management consulting services for state insurance departments. Areas of expertise include the valuation of structured products, review of asset-liability risks and associated hedging programs, portfolio surveillance, assessment of financial models, cash flow modeling of structured transactions and various other corporate finance consulting assignments. Todd has assessed the reasonableness of assumptions and techniques used in the determination of security impairment, write-down and overall portfolio credit quality while participating on numerous risk focused exams. Prior to joining Risk & Regulatory Consulting, Todd worked in the financial risk and modeling practice of a "Big 4" accounting and consulting firm. Prior to that, Todd was in the consulting division of a Fortune 500 company. Todd holds a Masters of Business Administration from Loyola University in Maryland and graduated with Bachelor of Science degree in Economics from Mount Saint Mary's University. Todd can be contacted at todd.sauer@riskreg.com.