Model Risk Management for stress testing in financial institutions

Banks are using stress testing results more and more to make strategic and business decisions. Understanding the capabilities of stress testing models, their limitations and the impact of model uncertainty on banks’ stress testing results are critical.

An increasing reliance on models, regulatory challenges, and resource scarcity will drive banks toward a Model Risk Management organization that is both more effective and value-centric and this framework should include stress testing models.
A new type of Risk
Model Risk Management is a new type of risk, currently involving significant organizational and process changes in risk management departments.

Model Risk can be defined as the potential loss an institution may incur, as a consequence of decisions made on the output of the models, due to errors in the development, implementation or use of such models. Model risk could be particularly high, especially under stressed conditions or combined with other interrelated trigger events.

A clearly defined Model Risk Management (MRM) framework with a strong management insight in the monitoring of the models allow institutions to strengthen their decision making processes and improve their profitability. For example, a better decision made using a credit score to grant a consumer loan, could enable the financial institution to reduce the number of future defaults by 5 to 10% and therefore the Cost of Risk of the portfolio.

In the banking industry, regulators have paid a particular attention to Model Risk since the early 2000s with the first definition of models and model risk.

US regulation opened the way for Model Risk Management practices in 2011 with the first Supervisory Guidance issued by OCC-FED. European regulation is now following the trend, with various publications from the EBA, the Bank of Spain, Bank IT, the Polish Financial Supervisory Authority and the PRA.

A changing environment for modelling practices
Since the financial crisis, internal expectations regarding modelling practices have also evolved, as now modelers have to use modelling approaches designed and validated by centralized modelling functions.

A recent push by the European Central Bank on Model Risk Management related topics is speeding up the institutions to focus on model governance and Model Risk Management.

Banks recognize the importance of complying with European and US regulations, as well as the importance of continuing to align to the internal view of model risk. They however express a degree of consensus that MRM is a second-line activity, albeit with levels of maturity ranging from early stage formation to large teams already up-and-running.

Most of the banks in Europe are now organizing their MRM departments, hiring model risk analysts and managers in order to design and maintain their Model Risk Management framework including:
- Model inventories, to allow a holistic understanding of model application and usage,
- Model attestation process,
- Model lifecycle management process,
- A review of model validation policies,
- Model risk reporting,
- And the quantification of model risk using a rating approach.

The ECB launched the TRIM exercise in 2017 with the objective of focusing on model governance and validation of internal models. These set of guidelines are aligned with the US Supervisory Guidance on Model Risk Management, called SR 11-7, published by the FED in 2011. This is a first step towards MRM in Europe and these guidelines will certainly be applicable to a wider scope of models.

The scope of which models are falling into the foundation of an effective MRM framework is considered as part of the MRM strategy or roadmap that the bank must implement. The priority is not only on internal models but also on stress testing models, as well as on business decision models. Model risk goes beyond IRB capital models, pre-payment for credit, pricing and credit scoring models; valuation models are also on the radar as well as ALM and Compliance models (ex. Anti-Money Laundering).

Stress testing models and MRM
Stress testing models are used for regulatory exercises and for internal risk analysis such as budgetary stress testing, risk strategy, limit settings, risk appetite framework, and the IFRS9 forward-looking component for ECL calculations for credit risk. Banks are using stress testing results more and more to make strategic and business decisions.

Good quality stress testing models are becoming a priority since they underpin bank’s stress tests results. Understanding the capabilities of stress testing models, their limitations and the impact of model uncertainty on banks’ stress testing results are critical.

Figure 1: Main regulatory references on Model Risk Management
The BoE Prudential Regulation Authority has recently written to the Head of Stress Testing in the banks to request their feedback regarding a set of four key stress testing model management principles.

The PRA four principles cover the MRM core expectations described in the US guidelines SR 11-7.

Firstly, in principle one, the definition of a stress testing model has to be considered. Various types of mechanisms are used for stress testing purposes, often requiring some qualitative judgement, for example adjustments made to address known model limitations.

All stress testing calculations components should be considered: stress scenario design mechanism, stressed results (impairment or stressed income models), stressed parameters (probability of default or loss given default models, expected loss under stress calculations...).

Stress testing frameworks can be very sensitive to model risk or model error. There are various types of approaches: sensitivity analysis, scenario analysis based on satellite models, expert judgement or reverse stress tests. These models can be linked to other models such as IRBA models for credit risk or AMA models for operational risk. They also rely on external constraints such as macroeconomic variables which can also be built with interrelated systems of models or expert scenarios.

The statistical performance of these models, even at the building stage, can sometimes be fairly low as we try to explain risk behaviours with external factors over long periods of data history. However, if we use the example of probability of default satellite models, other factors than macroeconomic and financials should be considered to explain default rates variation. Internal or regulatory factors would also have a significant impact.

Macroeconomic scenarios are also a key source of variability in terms of stress testing results. A range of scenarios are generally used, from central to adverse and very adverse degree of severity. However these scenarios, albeit they could be derived from a system of models, are highly dependent on expert judgement. Different economists can produce different scenarios as they have different visions of the economic outlook. Looking at the consensus forecast database, we can easily see the degree of variance between the different views of the economists, even for the central scenario. For example, for the US GDP, the gap between forecast and observation is above one standard deviation for 30% of the time, notably during economic expansion or downturn periods.

The IFRS9 Forward-looking component strongly relies on stress testing models. Its implementation and usage of multiple scenarios is a significant challenge but this is one way to tackle the impact on scenario volatility. Some questions remain without clear answers such as the assumed non-linearity of Forward-looking scenarios which implies the need of multiple scenarios for Expected Credit Losses calculation. However, different approaches can be used to incorporate Forward-looking scenarios: Baseline scenarios extended by a scalar adjustment, Probability-weighted ECL based on a multiplicity of scenarios, Monte Carlo simulation. When assessing the weight of a scenario, the associated probability (either expert based or estimated with a systematic approach) are expected to change over time. This is also another source of variation in the stress testing framework.

Stress testing model validation is also under scrutiny in principle four, as a stress testing model lifecycle can be particularly short, indeed these models need regular adjustments and therefore re-validation. It is becoming obvious that Banks should focus on stress testing model risk management, and notably stress testing model validation, as part of their MRM program.

Historically, model validation was perceived as a ‘tick the box’ function to partially confirm that stress testing models were...
Model risk has risen up the agenda in banks due to high profile losses and high P&L volatility. Over-reliance on models for decisions creates a false sense of certainty. Independent model reviews lead to better models and more confidence in their outputs.

An increasing reliance on models, regulatory challenges, and resource scarcity will drive banks toward a Model Risk Management organization that is both more effective and value-centric and this framework should include stress testing models.

We believe that these challenges leave opportunities to improve upon existing practices.

Validating stress testing models can reduce associated model risk and hence reduce likelihood of a capital add-on. It also ensures that the bank is ahead of the regulatory curve. We believe that banks should use stress testing models to inform business decisions and robustly challenge model outputs. And in a very uncertain world, stress testing can improve profitability.

Banks should ensure stress testing model validation with a range of tailored quantitative and qualitative tests. For a standard stress testing framework, the main components to be considered are the scenario design, the macroeconomic translation, the loss creation or the gain opportunity. Regarding the scenario design, which is a key source of model output variations, key considerations should be whether scenarios are severe but plausible and distinct, the consideration of a business change, and the application of expert judgement.

About the Author

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Accurate and conceptually reasonable. Model Risk Management goes beyond this land focuses on other key aspects such as data quality, model use, quantification of the impact of model limitations, deeper understanding of the model as it relates to business. These dimensions are important in assessing Model Risk.

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