

## MODEL RISK: AN OVERVIEW OF THE ISSUES

“Model risk” is the risk of error due to inadequacies in financial risk measurement and valuation models. Insufficient attention to model risk can lead to financial losses. In an ever complex financial world in which esoteric pricing and risk measurement models are continually being introduced, the consequences of model risk are an apparent and increasing source of risk to financial stability.

A wide variety of different model types are used in the financial industry. The most important class of models used are “fundamental models” such as the Black-Scholes option pricing model that makes assumptions about dynamic processes and interrelationships between different variables. Another widely used group are “statistical models” that aim at capturing statistical relationships between variables, usually focusing on the correlation between variables. Both fundamental and statistical models are used routinely to take financial decisions concerning the loss limits and risk budgets of financial institutions. However, by their very nature, models are simplified structures, and are a representation of something more complex, so some degree of error is to be expected. Therefore, it is important to understand when and how models can go wrong.

Model risk can arise from a variety of sources. An important one is incorrect model specification which could come in the form of missing risk factors, misspecifying stochastic processes underlying the model or ignoring important variables. Incorrect model application is often a source of model risk. It can arise from using the wrong model for the problem at hand or using a model that is no longer best practice. Implementation risk is another source of model risk which typically manifests itself in the context of a complex environment when a partially knowledgeable user tries to mechanically implement a model as a deterministic black box. A

related implementation risk is incorrect calibration of model parameters, programming errors or problems with data when up-to-date model input information is not available.

Model risk can be mitigated in different ways. Different layers in a financial organisation should be involved in such risk mitigating efforts: from the individual practitioner building and using the models, to the senior manager who oversees the introduction, implementation and roll-out of models. Even at a higher level, at the institutional level, checks and controls can be implemented through an adequate organisational set-up to minimize such risks. The following methods and practices provide a non-exhaustive battery of tools and recommendations to manage model risk:

- Model risk exists: awareness of the issue includes understanding the strengths and weaknesses of different models and how to use them correctly.
- Evaluate and check key assumptions: models should be re-calibrated and estimated regularly and methods should be kept up to date.
- Use the simplest reasonable model and escape from unnecessary complexity: if a more complex model is used instead of a simpler one, a clear justification for such a decision needs to be given.
- Back-testing and stress-testing should be performed regularly to evaluate model adequacy.
- Small problems that are unexplained by the model should not be ignored: they often serve as important warning signals that the model may not be sufficiently robust.
- Whenever possible, model risk should be quantified through, for example, scenario or simulation methods, keeping in mind that this process is subject to model risk itself.
- Senior managers should have a clear understanding of model assumptions, scope of application and model weaknesses.
- Encourage a multidisciplinary approach to model building in which a variety of staff with different profiles (e.g. finance experts, mathematicians, computer experts, traders, economists, etc.) interact in a climate of constructive criticism.
- At a firm level, an independent risk oversight function with responsibility for monitoring risk (including model risk) independently of other business units is necessary. Risk managers should have access to the complete specification (i.e. documentation) of the models, enabling checks on model soundness, and develop benchmark tests to check the performance of the models.

Model risk is often treated as if it was a minor consideration, and sometimes it is even ignored altogether. However, model risk could cast a shadow on the risk management area if ignored. Constant financial innovation continuously pushes the boundaries of theoretical and practical finance, creating the need for new models or for adjusting old ones. Prudence suggests that the possible outcomes if model assumptions fail to hold should be continuously assessed. Ignoring this basic principle could undermine appropriate risk management at the firm level and cause dislocations in broader financial markets as evidenced by events related to the latest market turmoil.