Catastrophe risk management and Solvency II: Raising the bar

Solvency II is about a holistic framework for managing risk. Catastrophe risk models are at the heart of this process but they are not the only part of it

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In a perfect modelling world, catastrophe risk models are abundant and reliable for every peril/region combination globally. Long data records that meet every reasonable quality standard underlie their calibrations. The exposure information used as input for these models is accurate, appropriate and complete.

Insurers and reinsurers use them appropriately and consistently for setting their economic capital, purchasing their reinsurance programme, pricing insurance contracts for their clients and for managing their cat risk appetite. The models are widely embedded and well understood within the firms, including their limitations. All material models are frequently validated in detail by internal experts and by independent third parties. Possible alternatives are considered when choosing the most appropriate cat model for the business. All processes are thoroughly documented.

Internal models

Firms applying to use an internal model under Solvency II – the new directive for insurance and reinsurance undertakings in Europe – will certainly recognise some of the topics referred to above. The Solvency II requirements apply to internal models; using an external model (ie, vendors' models such as cat models) "shall not be considered to be a justification for exemption from any of the requirements for the internal model [art 126, Solvency II Directive]". Where catastrophe risk is material, tests and standards for internal models apply to catastrophe models as well.

Complicated proprietary tools

Catastrophe models were traditionally thought to be – and to a certain extent still are – complicated proprietary tools only a few were courageous enough to claim to understand in detail. In this regard, some feel Solvency II is "asking for the impossible": to undo the black-box mentality. This has in turn led to opinions being expressed that Solvency II is inapplicable in the context of cat models and no firm will be able to meet the tests and standards for internal models. Some appear to be investing more time in arguing against the requirements rather than seeking to understand and work towards meeting them.

Solvency II does indeed raise the bar but it is far from being an idealistic, inapplicable framework for catastrophe risk. However important the requirements involving external models may be, Solvency II is not only about models. With the main objective of policyholder protection and in line with recent developments in risk management, it is about a holistic framework for managing risk. Catastrophe models are at the

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Risk modelling versus risk management

Risk modelling has become the standard approach for estimating cat losses. While cat models produce a lot of numbers, they can be problematic for risk-management decision-making, particularly when the numbers vary significantly from model to model and update to update

Karen Clark, president and chief executive
Karen Clark & Company

Risk models provide a lot of valuable information, but they are not highly effective risk-management tools.

More stable and transparent risk metrics enable insurance companies to better measure and manage risk over time. Much of the volatility in the model-generated loss estimates is driven by "noise" or uncertainty arising from the lack of data supporting many of the model assumptions. The opaqueness of the models makes it difficult for the modellers and the model users to decipher the true drivers of changes in the modelled loss estimates and recent model updates have clearly demonstrated this issue. As the models have become more detailed and complex, the model loss estimates have become more volatile and prone to error.

Characteristic events (CEs) are stable, transparent and operational risk metrics a growing number of companies are using to better understand and manage their large loss potential. CEs are defined-probability events created for specific peril regions. CEs are developed for the return periods of most interest to insurers, such as one-in-100-year and one-in-250-year returns. Unlike the model-generated events, CEs remain consistent from year to year, so effective risk-management strategies can be implemented and monitored over time.

Maps: 100-year hurricane characteristic event footprints for various regions of the US

Source: Karen Clark & Company

Graph: Hypothetical losses for north-east US-based company arising from category-three landfalling hurricane characteristic event

Source: Karen Clark & Company

Hurricane Irene: had the storm stayed at category-three strength and tracked along the north-east US coast, it could have inflicted $100bn-plus losses

How CEs work

Using the same scientific data underlying catastrophe models, the CE intensity "footprints" are created to represent the type of event that is characteristic of the selected return period in each region. The fully transparent footprints are superimposed on a company's book of property exposures and damage functions by occupancy and construction are applied to estimate the losses. The maps (*left*) show the 100-year US hurricane CEs for different coastal regions.

Continuing the hurricane example, for each coastal region the CE footprints are "floated" along the coastline to make sure all exposed properties are covered and the resulting patterns of risk are smooth and logical, particularly at high resolution. The losses are tabulated for each landfall location, so companies can see clearly where they are exposed to large losses. The graph (*above*) shows a CE analysis for a hypothetical north-east company along with the company's one-in-100-year probable maximum loss (PML), the primary model output used to monitor and manage risk.

For the sample company, a category-three hurricane with a landfall point near Long Beach, New York would cause losses far exceeding the company's PML and the top of its reinsurance programme. While this is a hypothetical company, if hurricane Irene had maintained category-three intensity and taken the same path hugging the New Jersey coast and making landfall across western Long Island, the industry losses would have been more than $100bn. Individual company losses would have been higher than the model-generated PMLs and would have gone over the top of reinsurance programmes. This would have been a surprise to many companies even though a category-three hurricane is not an unrealistic storm in the north-east.

By focusing on PMLs to manage risk, insurers are frequently surprised by actual events that cause losses greater than their PML estimates. While this may be because of "model miss", the more significant problem is model-generated PMLs mask the significant loss potential from 100-year events making landfall in specific locations. While the PML is a useful number, it can give a false sense of security with respect to large loss potential.

Rather than trying to pinpoint a PML, CEs help a company answer other important risk-management questions, such as:

- Where am I exposed to the largest 100-year event losses?
- Where can my 100-year event losses exceed my reinsurance protection?
- What are my expected 100-year event losses by region?

The CE analyses highlight clearly where companies have exposure concentrations that could result in solvency-impairing losses from events with not insignificant chances of occurring. By floating 100-year CEs across a company's book of business, exposure concentrations that may be missed by a model are clearly identified and the spikes in large loss potential are highlighted.

Using CEs to manage the risk

CEs are very valuable for risk-management purposes and provide the right balance between fully probabilistic and deterministic approaches to catastrophe loss estimation. Many companies, realising the shortcomings in the probabilistic models, have turned to scenario-based deterministic approaches that are more concrete but do not give a complete picture of catastrophe loss potential. CEs are defined-probability events and they provide a complete analysis of the loss potential for representative return periods.

CEs help companies better understand and manage catastrophe risk. Because the CEs are fully transparent to the user, insurers know exactly the types of events to which they are managing their business. CEs make the events and loss potential more vivid and real to senior executives and boards of directors.

Because the CE loss estimates are generated by a set of specific events, CEs are operational risk metrics that can be applied to individual policies and locations. It is straightforward for a company to determine which policies are driving CE losses above their risk tolerance. Companies can test different strategies for non-renewing policies in peak areas and growing in areas where losses are relatively low. In contrast, PMLs are not operational risk metrics.

Because the CEs remain constant from year to year, risk-management strategies designed to reduce the peak exposure concentrations can be monitored over time. By focusing on where major events are likely to cause very large losses, a company can make sure they are not over-exposed to events that will tax their claims handling ability and potentially impair their solvency.

While the CE approach is a more effective risk-management tool, it is a complement to and not a replacement for the catastrophe models. Because CEs are based on the same scientific information as the models, CEs provide the transparent, stable and operational risk metrics companies can use to manage risk while still tracking the model-generated PMLs. CEs provide a consistent yardstick so companies do not have to change pricing and underwriting strategies every time a model is updated, as long as the CEs and PMLs continue to track. ■