Exam 4: Introduction to Catastrophe Risk Management
Learning Objective No. 26
Study Note

Learning Objective 26: Understand the major steps in the cat modelling process, and the important considerations at each step.

Describe the major steps in the cat modelling process along with important considerations. The process will look different at every company. Not all steps may be completed, additional steps may be added, or the steps may happen in a different order.

This document contains content from the following documents, along with original content:
Natural Catastrophe Risk Management and Modelling: A Practitioner's Guide: 1 Fundamentals; 2 Applications of Catastrophe Modeling; 4.2 Introduction to Building Catastrophe Models; 5.2 Introduction to Developing a View of Risk

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In the insurance and reinsurance industry, managing catastrophe risks is the ongoing process of:
1) Identifying the risk, given the context of the organization or community
   - This includes evaluating both underlying hazard (the danger from a potential cause of loss or damage such as earthquake or windstorm) and exposure (underlying objects subject to the hazard). Catastrophe modelers will need to work closely with research group and underwriting teams on identifying risks for the underlying organization or community.
2) Quantifying the risk
   - Most industry participants use catastrophe models to quantify and estimate the potential loss from the extreme and wide-impact events. Like all models, catastrophe models are abstractions of real-world process, and have appropriateness and limitations of their use and interpretation. The models will usually include 5 components:
     a. Hazard: reflects the extent and intensity of a peril as defined by a specific hazard metric (see 1.8.1 of Natural Catastrophe Risk Management and Modelling: A Practitioner's Guide)
     b. Exposure: for specific objects being modelled and as a representation of industry exposure for the region covered by the model (see 1.8.3 of Natural Catastrophe Risk Management and Modelling: A Practitioner's Guide)
     c. Vulnerability: is the interface between hazard, exposure and loss, and provides a means to estimate the relative damage to the asset, given a certain level of hazard (see 1.8.2 of Natural Catastrophe Risk Management and Modelling: A Practitioner's Guide)
     d. Loss and financial perspectives: The output from the vulnerability module of a catastrophe model is the total losses. For the output to be useful to the insurer or reinsurer, the model needs to perform several further functions (see 1.8.4 of Natural Catastrophe Risk Management and Modelling: A Practitioner's Guide).
        ➢ Use the data describing insurance financial structures to share the ground up loss between the various parties involved in the risk transfer.
        ➢ Aggregate or combine the loss statistics at different output resolutions.
        ➢ Back allocate the impact of the structures applied further up in the hierarchy down to the more detailed level, if different financial structures applied at different resolutions.

          e. Platform
3) Deciding what to do, given the level of risk and the risk appetite
- Combined with loss estimates and various financial perspectives, deciding strategies with given level of risk and risk appetite, will form the main discussion on catastrophe modeling applications. Common questions that catastrophe model output is used to address include the following. See the corresponding sections in *Natural Catastrophe Risk Management and Modelling: A Practitioner's Guide* for further information. High level understanding of major steps in each section will be sufficient for this learning objective.
  - How much should we charge for a (re)insurance policy? (2.6 Underwriting and pricing)
  - Which new business should we add? (2.8 Portfolio management and optimization)
  - How profitable is it likely to be? (2.6 Underwriting and pricing; 2.8 Portfolio management and optimization)
  - How much could we typically lose and with what likelihood? (2.7 Accumulation, roll-up and capacity monitoring)
  - What might a specific event cost us? (2.9 Event response and integration with claims team)
  - What are the potential causes of loss, considering our business model? (2.10 Capital modelling, management and dynamic financial analysis)
  - How can we best mitigate these? (2.12 through 2.15 give some case studies and references, from both private and public sectors.)
  - Do we have enough money set aside for specific eventualities? (2.10 Capital modelling, management and dynamic financial analysis)
  - Are we operating within the constraints set by our board, our regulators and supervisory agents? (2.10 Capital modelling, management and dynamic financial analysis; 2.11 Regulation and best practice in catastrophe modeling)

During the process of quantifying the risk, from a dataflow perspective, catastrophe analysis usually include:
1) Model input (see 1.9 of Natural Catastrophe Risk Management and Modelling: A Practitioner's Guide)
- Exposure details: include location information, exposure values, exposure characteristics and user-defined information for classification and reporting purposes.
- Financial structure information: such as deductibles, limits and reinsurance
- Information about how the locations are grouped or categorized into policies
- Additional analysis settings: Common settings and options in stochastic modeling are:
  - Demand surge
  - Secondary perils
  - Secondary uncertainty
  - Stochastic event set
  - Number of Samples to use for simulation

2) Model output (see 1.10 of Natural Catastrophe Risk Management and Modelling: A Practitioner's Guide). High level understanding will be sufficient for this learning objective. Understanding modeled output will be discussed in other learning objectives of this exam.

In addition to the ongoing process from above, catastrophe management also includes the following processes, mostly on a project basis. They may look different at every company, given various level of resources, operation environment and business prospects. Section 2) and 3) will be discussed more in advanced exam sittings.

1) Building catastrophe models (See 4.2 Introduction to building catastrophe models)
2) Developing a view of risks (See 5.2 Introduction of developing a view of risk)