



A probabilistic strategy for parametric catastrophe insurance

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Economic losses due to natural hazards have shown an upward trend since 1980, which is expected to continue. Recent years have seen a growing worldwide commitment towards the reduction of disaster losses. This requires effective management of disaster risk at all levels, a part of which involves reducing financial vulnerability to disasters *ex-ante*, ensuring that necessary resources will be available following such events. One way to achieve this is through risk transfer instruments. These can be based on different types of triggers, which determine the conditions under which payouts are made after an event.

This study focuses on parametric triggers, where payouts are determined by the occurrence of an event exceeding specified physical parameters at a given location, or at multiple locations, or over a region. This type of product offers a number of important advantages, and its adoption is increasing. The main drawback of parametric triggers is their susceptibility to basis risk, which arises when there is a mismatch between triggered payouts and the occurrence of loss events. This is unavoidable in said programmes, as their calibration is based on models containing a number of different sources of uncertainty. Thus, a deterministic definition of the loss event triggering parameters appears flawed. However, often for simplicity, this is the way in which most parametric models tend to be developed. This study therefore presents an innovative probabilistic strategy for parametric catastrophe insurance. It is advantageous as it recognizes uncertainties and minimizes basis risk while maintaining a simple and transparent procedure.

A logistic regression model is constructed here to represent the occurrence of loss events based on certain loss index variables, obtained through the transformation of input environmental variables. Flood-related losses due to rainfall are studied. The resulting model is able, for any given day, to issue probabilities of occurrence of loss events. Due to the nature of parametric programmes, it is still necessary to clearly define when a payout is due or not, and so a decision threshold probability above which a loss event is considered to occur must be set, effectively converting the issued probabilities into deterministic binary outcomes. Model skill and value are evaluated over the range of possible threshold probabilities, with the objective of defining the optimal one. The predictive ability of the model is assessed. In terms of value assessment, a decision model is proposed, allowing users to quantify monetarily their expected expenses when different combinations of model event triggering and actual event occurrence take place, directly tackling the problem of basis risk.