A Bayesian approach for assessing catastrophic risks

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Catastrophes are low-frequency events that cause very large losses, often highly correlated across a portfolio or a geographic area. These characteristics make catastrophic risks difficult to quantify. Furthermore, catastrophes are characterized by large transient peaks in the intensity process, causing a large number of claim arrivals in a small interval of time and, in many practical cases, claim arrival intensity is not directly observable or is only imperfectly known. This adds an extra difficulty to model calibration, and makes the Bayesian approach a natural candidate to address this challenge.

We propose a Bayesian framework for calibrating catastrophic risk models. This approach enables the estimation of the probability law of the surplus process and can be applied in near real time as new data becomes available. By selecting suitable priors, it internalizes model risk, which can thus be incorporated into risk assessments. We consider the classical compound Poisson process and their generalization through Cox processes, popular for catastrophic risks. Numerical examples illustrate the approach.