

## CATASTROPHIC RISK MANAGEMENT: STOCHASTIC MODEL TO CALCULATE THE LOSS INDEX TRIGGER FOR CATASTROPHE BONDS (CAT BONDS)

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### ABSTRACT

This paper develops a stochastic model to calculate the loss index trigger for catastrophe bonds (Cat bonds) as alternative instruments for the management of major insured risks, such as natural catastrophe risks. The underlying loss index of catastrophe bonds is the aggregate catastrophe losses reported before the end of certain period. The catastrophe severity is defined as the sum of two random variables; the reported loss amount and incurred-but-not-yet-reported loss amount, and the central hypothesis is that the latter decreases proportionally to a linearly increasing function up to a certain time and constant thereafter, called the mixed claim reporting rate. To account for randomness in the reporting process, the claim reporting rate is considered to follow a Wiener process (geometric Brownian motion). The validity of the proposed model is evaluated by estimating its parameters using machine learning techniques (specifically, evolutionary strategies, ES). ES search for the best value of mixed claim reporting rate and the volatility that minimize the error for several catastrophes. The goodness of fit is tested for a sample of floods occurring in different Spanish regions susceptible to this type of catastrophes.

The results shows that the model accurately captures the uneven behavior of the claim reporting process over time and therefore correctly describes the catastrophic claims reporting process. The model proposed in this paper allows for an easy calculation of catastrophic loss indexes, thus facilitating the pricing of loss index-triggered Cat bonds. This translates into better catastrophe risk management for both insurance and reinsurance companies, as well as for those companies that diversify their portfolios with this type of financial instruments. The relative simplicity of the presented model also facilitates parameter estimation and simulation. In this work, the application of evolutionary strategy techniques allows the optimization of the parameter values by optimizing the cumulative square error.

### KEYWORDS

Reported Claims Amount; Incurred-But-Not-Yet-Reported Claims Amount; Mixed Claims Reporting Rate; Evolutionary Strategies.

