Investigating the Effect of Climate-Related Hazards on Claim Frequency Prediction in Motor Insurance with Incomplete Data

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Abstract

This study addresses the challenge of predicting motor insurance claim frequencies resulting from climate-related hazards, using an incomplete dataset provided by a Greek insurance company. The dataset only includes storm events that result in at least one claim, yielding a triangular support for the joint distribution of storm counts and claims. To overcome this limitation, we propose a new class of compound frequency models that jointly estimate the actual number of storm events and per-storm claim frequencies. These models incorporate geospatial covariates and use a finite mixture approach to flexibly capture intrinsic dependence structures and overdispersion in the data. A tailored Expectation-Conditional Maximization (ECM) algorithm is developed for parameter estimation. Application of the methodology reveals a significant negative dependence between the number of storms and the average number of claims per storm, suggesting a diversification effect that could benefit insurers facing increased climate risks. Our findings offer a robust framework for modeling insurance data under partial observability, with applications in pricing and risk management.

Keywords

Climate change; compound frequency models; incomplete data; ECM algorithm; dependence modelling; geospatial covariates; motor insurance; natural phenomena coverage.