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Title:

"Integrating Climate Variables into Chain Ladder Method: A Ridge-Regularized Generalized Linear Model Approach"

Abstract:

In recent years, Brazil has faced increasing challenges related to climate events, posing significant risks to the insurance industry. Brazilian actuaries are still learning how to address the impact of such events on reserving models. This paper explores the integration of exogenous climate variables into the traditional Chain Ladder method using a Ridge-Regularized Generalized Linear Model (GLM). By incorporating external factors such as precipitation and temperature variations, this approach aims to enhance the accuracy of reserve estimates for portfolios exposed to environmental risks. Ridge regularization improves model stability and precision, mitigating the uncertainty introduced by climate variability. A case study using real insurance data demonstrates how climate trends affect reserve calculations and the potential benefits of integrating such factors into actuarial models. The findings suggest that incorporating climate dynamics into reserving methodologies can strengthen their robustness, providing a valuable framework for actuaries adapting to the challenges of climate change in the Brazilian insurance market.

Keywords: Climate change, reserving models, Ridge regression, Chain Ladder, insurance risk