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COPULA INFERENCE FOR INCURRED BUT NOT REPORTED (IBNR) CLAIMS

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Abstract.

Building reserves for outstanding claim liabilities is an important issue of a general insurance company. This project examines the problem of selecting and validating archimedean and elliptical copulas that provide suitable representation of the dependence structure between two variates X_1 (development factors) and X_2 (claim sizes) in the light of a random sample $(X_{11}, X_{21}), \dots, (X_{1n}, X_{2n})$. To this end, the purpose was to estimate the dependence structure, copula parameters and fit appropriate copula classes for the given IBNR claims data and finally to simulate and estimate IBNR claim reserves using the appropriately fitted copulas. The claims data was taken from the Institute of Actuaries website and consisted of 36 realizations aggregated over eight years.

The results indicate that the Frank and Gumbel Copulas provided the best fit for the data and as a result, IBNR claim reserves were simulated and estimated using the two Archimedean Copula models. The results are illustrated by graphs and tables. The findings and consequently the conclusion is that IBNR claim reserves calculated via best fitting Archimedean Copula models are statistically equivalent and are therefore reliable. Elliptical Copulas did not provide any better fit statistically as compared to the Archimedean copulas.

Although the presentation is restricted to problems involving a random sample from a bivariate distribution, extensions to multivariate or censored cases could be envisioned. A case in point and therefore an open problem for further research would be to model IBNR claim reserves and take cognisance of such multivariate variates as claim sizes, development time, claim numbers and expenses allocated to each claim.

Keywords: General Insurance; Copula fitting, simulation, estimation and hypotheses; Archimedean Copulas- Clayton, Frank and Gumbel; Elliptical Copulas- Gaussian and t-copulas; IBNR Claim Reserves