Claims Prediction with Dependence using Copula Models

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Classical credibility models provide for predictive claims in linear form. For example, the Bühlmann and the Bühlmann-Straub credibility models express the next period’s claims as a weighted average of historical claims arising from each group's own experience and the entire portfolio's experience. The weight that is attached to the own experience reflects a credibility factor. These classical models typically assume claim independence. In this paper, we extend the notion of predicting the next period’s claims by relaxing these independence assumptions. We specify claim dependence structure using the concept of copula models. This has in recent years received considerable attention for modelling dependencies. This paper extends the models offered by Frees and Wang (2005) and Yeo and Valdez (2004) that respectively used the frameworks of copula models and common effects. Here we find that the predictive claim can be expressed as an expectation under a new probability measure (in effect, a change of measure) which reflects the ratio of the densities of the copulas relating to the historical claims. We examine this expectation for different families of copulas and in several instances, we find we are able to explicitly express the predictive claim in terms of historical claims, and as we suspect, these predictive claims are no longer linear in form.

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