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The collective reserving model

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Abstract

This paper sets out a model for analysing claims development data, which we call the collective reserving model (CRM). The model is defined on the individual claim level and it produces separate IBNR and RBNS reserve estimators at the collective level *without* using any approximations. The CRM is based on ideas from a paper by Verrall, Nielsen and Jessen (VNJ) from 2010 in which a model is proposed that relies on a claim giving rise to a single payment. This is generalised by the CRM to the case of multiple payments per claim. All predictors of outstanding claims payments for the VNJ model are shown to hold for this new model. Moreover, the quasi-Poisson GLM estimation framework will be applicable as well. Furthermore, analytical expressions for the variance of the total outstanding claims payments are given, with a subdivision on IBNR and RBNS claims. To quantify the effect of allowing only one payment per claim, the model is related and compared to the VNJ model, in particular by looking at variance inequalities. The double chain ladder (DCL) method is discussed as an estimation method for this new model and it is shown that both the GLM- and DCL-based estimators are consistent in terms of an exposure measure. Lastly, both of these methods are shown to asymptotically reproduce the regular chain ladder reserve estimator, motivating the chain ladder technique as a large-exposure approximation of this model.

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Keywords: Stochastic claims reserving; risk; solvency; chain ladder.

1 Introduction

There has been much research carried out in the area of triangle-based reserving methods, with one of the most famous methods being the chain ladder technique. The chain ladder technique is a simple algorithm used to predict outstanding claims payments based on historical payment patterns. Initially it was not based on any stochastic model, and for this reason, considerable effort has been made trying to motivate its use. Models that produce the same estimators as the chain ladder technique can be found in, for instance, Mack (1991) and Renshaw and Verrall (1998). In Mack (1991), the maximum likelihood estimators of a multiplicative Poisson model and the estimators from the chain ladder technique were shown to coincide. In Renshaw and Verrall (1998), another prominent triangle-based model, the over-dispersed Poisson model, was introduced and also shown to have estimators which

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