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Explicit moments for a class of micro-models in non-life insurance

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Abstract

This paper considers properties of the micro-model analysed in Antonio and Plat (2014). The main results are analytical expressions for the moments of the outstanding claims payments subdivided into IBNR claims and individual RBNS claims. These moments are possible to compute explicitly using the discretisation scheme for estimation and simulation used in Antonio and Plat (2014) since the expressions then do not involve any integrals that, typically, would require numerical solutions. Other aspects of the model that are investigated are properties of the maximum likelihood estimators of the model parameters, such as bias and consistency, and a way of computing prediction uncertainty in terms of the mean squared error of prediction that does not require simulations. Moreover, a brief discussion is given on how to compute moments or risk-measures of the claims development result (CDR) using simulations, which based on the results of the present paper can be done without any nested simulations. Based on this it is straightforward to compute the one-year Solvency Capital Requirement, which corresponds to the 99.5% Value-at-Risk of the one-year CDR. Finally, a brief numerical illustration is used to show the theoretical performance of the maximum likelihood estimators of the parameters in the claims development process under this model using a realistic set-up based on the case-study of Antonio and Plat (2014).

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Keywords: Stochastic claims reserving; risk; solvency; loss reserving; Poisson process.

1 Introduction

In the present paper, we consider properties of the model analysed in Antonio and Plat (2014). In that paper, the authors perform an extensive case study of a model that falls under the general class of models introduced in Norberg (1993), which is a class of models for individual claims in non-life insurance. These types of models are usually referred to as *micro-models*. They carry out full likelihood estimation within this framework and simulate the reserve together with the full reserve loss distribution. An observation regarding the reserve part of their work is that there is no need to simulate to obtain the reserve. Our main results in the present paper are analytical expressions for the moments of the outstanding claims payments under this particular model, which is valuable in computing,

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