

About the Justification of Experience Rating: Bonus Malus System and a new Poisson Mixture Model

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Abstract

The claim experience of the past is a very important information to calculate the fair price of an insurance contract. In a lot of European countries for instance the prices for motor car insurance depend on the number of claims the driver has reported to the insurance company during the last years. Classically these prices are calculated on the basis of a mixed Poisson model with a gamma mixing distribution. The mixing distribution models the car drivers' qualities across the insured portfolio. This is just one example for experience rating. In the classical context the price is equal to the expectation of the Bayesian posterior distribution.

In some lines of business (especially third party liability and lines with exposure to extreme weather events) we find that the real world data cannot be described well enough by the classical Poisson – gamma model. Therefore we investigate the influence of the mixing distribution on the posterior distribution conditional on the experienced number of claims. This enables the application of other – more risk adequate premium principles than the expectation principle. We introduce the inverse – gamma distribution as a new mixing distribution to model claim numbers and compare it to the classical gamma distribution. In both cases a closed analytic representation of the mixed distribution can be found: In the classic case the well known negative binomial distribution, in our new one a representation using the Bessel functions. Additionally we present numerical results about the tail behaviour of the mixed Poisson – inverse – gamma distribution.

Finally we introduce the concept of resolution. It enables us to decide if the classification of risk groups via the number of experienced claims is a risk adequate procedure.

Keywords:

Bonus Malus System, mixed Poisson distribution, inverse gamma distribution, premium principle, fat tail.