Development of an exposure-based pricing approach for personal accident per risk

Summary of the masterthesis prepared in Cooperation with SCOR Reinsurance Germany and the University Ulm.

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Motivation and Objective

As the primary insurer enlarged the cover of the private accident insurance policies in Germany within the last ten years according to the German Insurance Association (GDV), the pricing models for reinsurance contracts have to be adjusted. In this context, the topic about developing an exposure-based pricing approach, in cooperation with SCOR Reinsurance Germany, arose. Additionally, SCORs' internal clients evaluations showed that the primary insurer try to attract more clients by offering higher disability benefits and widening their scope of cover. Furthermore, a rising trend of the claim exposure for re-/insurer is noticeable. From the modelling perspective, the actuaries face several issues with pricing private accident reinsurance contracts. So far, only an experience model is adopted that relies on the loss history of the cedents. As many primary insurers did not have to face many large losses, the current pricing does not reflect the risk appropriately. Moreover, the private accident insurance is a sum insurance with claims of the same loss amount, which makes it difficult to fit a distribution to the empirical observations. Therefore, an additional pricing approach, which also takes the exposure of the cedents into account, would lead to a more adequate assessment of the underlying risk.

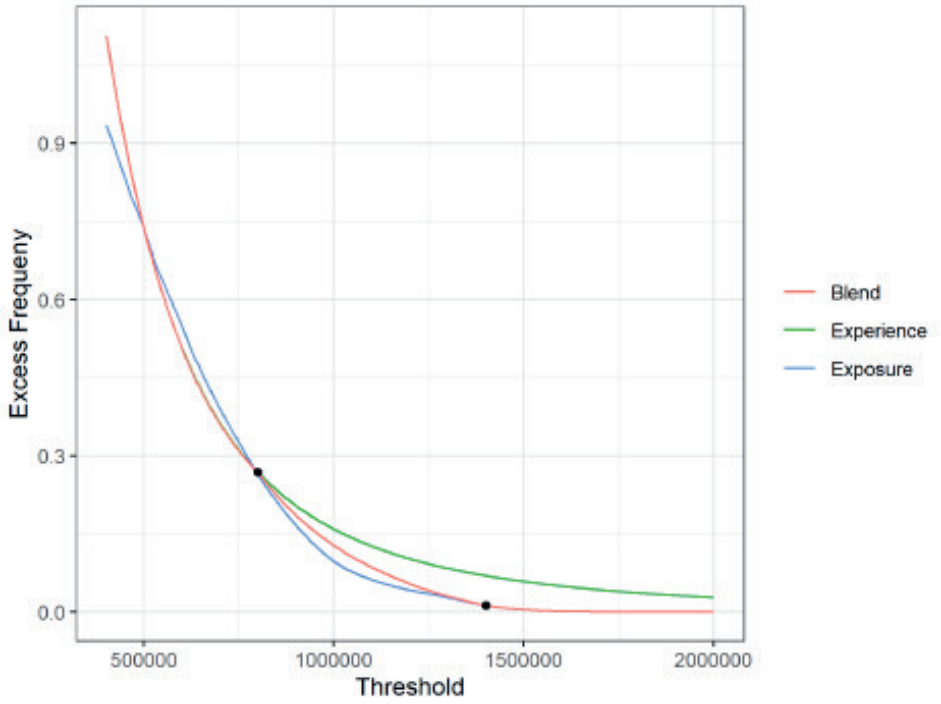
Modell Approach

This sections presents the idea of the exposure-based pricing approach developed for the PA insurance. As for some cedents, only the risk profiles are available, the aim is to find a general exposure curve parameter which is applicable to every primary insurer. Therefore, the individual data is taken to compute the parameter and further used as a test set to verify the results. Additionally, for the cedents which provide individual data, the model is adapted to compute the severity and frequency distribution for the reinsurer.
The basic idea is to calculate the expected loss above a series of thresholds for the whole portfolio of the primary insurer and conclude from that the premium share between the primary insurer and the reinsurer. The expected loss is calculated by multiplying the benefit amounts with the occurrence probability of corresponding disability degree. The considered compensations of the reinsurer consists of the present value of the pension annuity (PVP) and the disability benefit, which results from the basic sum insured and the progression model. Hence, there are three possibilities in which the reinsurer has to compensate the primary insurer.

1. The present value of the pension annuity is above the threshold
2. The disability benefit is above the threshold at a disability degree below 50%
3. The sum of the present value of the pension annuity and the disability benefit is above the threshold at a minimum disability degree of 50%

Results

The next evaluation provides a good example why an additional exposure model leads to a more adequate pricing of a PA portfolio. Therefore, the insurer 4 is going to be analysed. The portfolio contains around 36.000 risks and hence only 224 losses are reported. The model threshold is set at AC 200.000 and 59 re-evaluated loses exceed that amount. As the highest loss is at € 1,2 million, it is more difficult to build an accurate experience pricing model. Nevertheless, a Poisson distribution with parameter $\lambda = 2, 19$ is obtained and for the severity, again the Log Gamma distribution with $\alpha = 3, 19$ and $\gamma = 2, 57$ provides the best model badness. For the transition points, € 800.000 and € 1,4 million are selected. The results of the excess frequency are presented in the figure below.



Comparison Excess of Loss Frequency Insurer 4

The summary of the risk premium allocation in the table, shows the advantages for blending the experience and the exposure model. The excess frequency of the experience model is always above the exposure model from the first transition point. As there is no loss experience above € 1,2 million, it is very insecure to model the non-working area up to € 2 million. Examining the risk premium for the whole contract, there is a difference of around almost € 60.000 between both models. This can be mostly led back to the risk allocation for the non-working area. As it can be observed in the second row of the table, that the charged risk premium for the area of losses between € 1,2 million and € 2 million, is almost € 40.000 lower for the exposure model. As a result, blending both excess frequency functions brings in the advantages of both models.

Priority	Limit	Experience	Exposure	Blended
400.000	1.600.000	337.230	280.228	289.724
1.200.000	800.000	43.773	6.884	7.782

Risk Premium Distribution per Model for Insurer 4