

Impact of the Dependence Between Lines of Business on the Estimation of Reserves

(From the French « Effets de la dépendance entre les différentes branches sur le calcul des provisions »)

By Antonin Gillet and Benjamin Sierra

Summary for the CAS International Research Committee by Thomas M. Cordier

Gillet and Sierra show how dependence between lines of business impacts the variability of an insurance portfolio.

Using a parametric approach in an incremental payment triangle, the authors model each calendar year (CY) incremental payment for each accident year (AY) with a Gamma distribution, for auto liability and auto physical damage. In order to make the fit, they use a large amount of data and break it down using comparable measures of exposure.

They then fit a copula that will model the relationship between elements in the two triangles for all AY-CY combinations (fit only one copula for the whole triangle). Once the model is calibrated they run simulations and compare the portfolio variance when the lines are dependent to the case where they are independent. They also use the results to compare the probability of ruin in each case.

To refine the model, they fit a copula for each year of development to model the relationship between the two triangles (as opposed to same copula for all CYs). This accounts for the fact that auto liability and auto physical damage do not mature at the same speed. The variance of the portfolio is higher with this model than with the first one.

In order to account for the fact that incremental payments depend on the AY, they introduce a model in which each AY has a variable intensity factor with a mean of 1. There is a different factor for each triangle, for the same AY. Thus, each gamma function that represents future payments depends on a parameter inherited from its own AY. The initial copula model is then applied (one copula for the whole triangle, as in the first model) and simulations are run. The impact on the variability of the portfolio is comparable to the other two models.

To conclude, Gillet and Sierra suggest that in the future a liability for “dependence between lines of business” be required.

Link to the original article:

http://www.astin2003.de/img/papers/gillet_serra.pdf

*CAS Taxonomy category: **II B 19 Reserving - Correlation***