Multivariate analysis to modelling and aggregating surrender risk under internal risk models

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Abstract

Following last years' AFIR paper (see Cerchiara et al. [2008]) on the use of GLM (see for example McCullagh and Nelder [1989]) to investigate lapse experience and dynamic policyholder behavior, the present article is aimed at the investigation of the capital charge for surrender risk[1] in the context of a life internal model.

The first part of the article will deal with the impact of a more sophisticated surrender analysis, involving the investigation of rational lapse behaviour, could have on available capital and surrender capital charges calculated according to the standard formula proposed in the Quantitative Impact Studies 4 (QIS4, see CEIOPS [2008]) under the Solvency II Project.

We will start our analysis by building on the case study presented at last year's AFIR colloquium, in which we investigated the surrender behaviour of the customers of a Continental European insurance company, by means of GLM analysis. First of all we will investigate the impact on the available capital and on the capital charge for lapse risk by switching from a univariate surrender experience analysis to the more sophisticated multivariate surrender analysis.

We will then consider possible approaches on how to use this GLM analysis to calibrate a formula modelling policyholder behaviour as a function of market rates and "moneyness" of the surrender option. Here we will investigate the impact of policyholder behaviour assumptions derived in this way on the available capital and the surrender capital charge according the standard formula.

In the second part of the article we will then broaden the discussion to the question of how to construct an internal model for lapse risk, and in particular to possible approaches to calibrate the volatility parameter for irrational lapse behaviour. Finally, we will discuss the aggregation of market and lapse risks and in particular we underline the possible use of multivariate models to calculate an aggregate capital charge for market and lapse risk.

Numerical analysis will conclude the work.

Keywords:

Generalized Linear Model, risk factors, lapse risk, life insurance, Solvency II, internal risk models

Principal References

CEIOPS (2008): QIS4 - Technical Specifications
Cerchiara R.R., Edwards M., Gambini A. (2008): Generalized Linear Models in life insurance:
Decrements and risk factor analysis under Solvency II. Proceedings of Afir Colloquium. Rome. Italy. To appear on Italian Institute of Actuaries Journal.
McCullagh P., Nelder J.A. (1989): Generalized linear models, Second edition, Chapman and Hall, New York

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[1] For lapse risk analysis in life insurance there is a wide leterature and for the one page format that AFIR committee requested for this abstract, we don't report these references, but we provided a deep list of references that we used in Cerchiara et al. [2008].