Premium risk in Solvency II with reinurance

Prerequisite: STK4540.

Cooperation and evaluation The project may cooperate with its twin project and perhaps share computer programs, but each of the students must hand in **an independently written** report which will be evaluated separately.

The problem We are considering property insurance where premium risk signifies new claims during the coming year which come from both existing contracts and new contracts. Solvency II handles the capital requirement by subtracting the expected net expenses from the actual expenses and then defining the 99.5% percentile of the difference as the solvency capital. The project will compare the approximate way Solvency II does this with a more nuanced simulation-based approach. Reinsurance is included and its impact a main point of the project. Common factors in the underlying model are not taken into account.

Mathematical formulation Suppose there are J_1 policies at the start of the year with J_2 additional ones expected. They are all identical risks and contribute each an annual premium π considered net of expenses which means that the latter are subtracted out. A suitable expression for the expected premium income next year might be $J_2\pi$ whereas such income last year from the existing contracts would then be $J_1\pi$. The latter has already been booked and added the assets of the company. If $(\mathcal{X}_1 + \mathcal{X}_2)^{\text{net}}$ are total claims from the old and the new contracts with reinsurance compensations subtracted we seek the $1-\epsilon$ percentile q_ϵ of $(\mathcal{X}_1 + \mathcal{X}_2)^{\text{net}} - E\{(\mathcal{X}_1 + \mathcal{X}_2)^{\text{net}}\}$ with $\epsilon = 0.5\%$. Note that this is the same as the net expenses with mean expenses subtracted, the $1-\epsilon$ percentile of which being what the Solvency II capital requirement SCR is meant to estimate.

Details Solvency II specifies SCR= $3V^{\text{net}}\sigma^{\text{net}}$ where V^{net} (abbreviation for volume) is the maximum of the premia last year and that (expected) next year with reinsurance premia subtracted. The other quantity σ^{net} is a standard deviation factor which is listed for various branches of insurance on pp 255-256 in EIOPA (2014) and corrected for reinsurance there. This simplistic approach is to be compared with accurate simulation-based computations where the project must build realistic models and try to calibrate them to the Solvency II assumption regarding σ (the standard deviation factor when there is no reinsurance). This calibration requires some thinking and should be done in cooperation with the project advisor. Various reinsurance contracts must be introduced into the analysis.

Reference EIOPA (2014). Technical specifications for the preparatory phase. Part I. Available as https://eiopa.europa.eu/Publications/Standards/A_-_Technical_Specification_for_the_Preparatory_Phase__Part_I_.pdf.