

One-year and ultimate reserve risk in Mack Chain Ladder model

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Abstract

We investigate the relation between one-year reserve risk and ultimate reserve risk in Mack Chain Ladder model in a simulation study. The first goal is to validate the so-called linear emergence pattern formula, which maps the ultimate loss to the one-year loss, in case when we measure the risks with Value-at-Risk. The second goal is to estimate the true emergence pattern of the ultimate loss, i.e. the conditional distribution of the one-year loss given the ultimate loss, from which we can properly derive a risk measure for the one-year horizon from the simulations of ultimate losses. Finally, our third goal is to test if classical actuarial distributions can be used for modelling of the outstanding loss from the ultimate and the one-year perspective. In our simulation study we investigate several synthetic loss triangles with various duration of the claims development process, volatility, skewness and distributional assumptions of the individual development factors. We quantify the reserve risks without and with the estimation error of the claims development factors.

We have demonstrated that the linear emergence pattern formula may misestimate the one-year risk and actuaries should apply emergence patterns with care when scaling the ultimate risk to the one-year risk. At the same time, the misestimation errors identified in our study seem not to be critical for loss triangles most often observed in actuarial practice. In a model without the estimation error, we have derived the true emergence pattern of the ultimate loss in a Mack Chain Ladder model and presented that it may differ from the linear emergence pattern formula. Finally, we have found that two-parameter loss distributions commonly used by actuaries, in particular the most commonly used lognormal distribution, may not be sufficient to model the outstanding loss from the ultimate and the one-year perspective and goodness-of-fit can be improved by fitting shifted versions of classical loss distributions.

Keywords: One-year risk, ultimate risk, reserve risk, emergence pattern, Mack Chain Ladder.

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