



SOCIETY OF ACTUARIES

Article from:

ARCH 2013.1 Proceedings

August 1- 4, 2012

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Micro-Level Loss Reserving Models for P&C Insurance

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Accurate loss reserve is essential for insurers to decide capital allocation, to maintain adequate capital and to efficiently price their insurance products. Loss reserving for Property & Casualty insurance is usually based on aggregated data in a run-off loss triangle and the chain-ladder technique is the most widely used approach. The key assumption of chain-ladder technique is that claims recorded to date will continue develop in a similar manner in the future. However, in many real world practice, there are significant changes in environment, such as changes in product mix, benefit level, regulation, inflation, and claim adjusting process, which could break this assumption and bias the reserve estimates generated by chain-ladder approach. Actuaries sometimes “trend” the aggregated loss data to adjust for the changing environment, but due to the inability to use micro-level data, these “trending” techniques are usually not as flexible or responsive as needed to fully capture the changes in environment. In contrast, micro-level (individual claim level) reserving models are likely to respond to environmental changes in a more flexible way. The use of policy, claim or even transaction level covariates provides a way to directly incorporate environmental changes in the reserving model and may help to generate more accurate reserve estimates.

In this study, we simulated claims data under different environmental changes and applied both chain-ladder and a micro-level model to each simulated data set. The performance of both methods was evaluated by comparing the reserve estimates, not only the point estimates, but also the entire distribution, to the realized loss data.

The environmental changes we explored here include changing product mix, changes in benefit level, changes in claims adjusting schemes, and inflation. When changes are small, chain-ladder and micromodel give similar results and both are close to the true reserve. When changes get more significant, chain-ladder generates bigger and bigger reserve errors while micro-model still gives reserve estimates with reserve errors within a reasonable range.