Calendar Effect and Continuous Chain Ladder

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Abstract

Recently Martínez-Miranda et al. (2013) and Mammen et al. (2015) have shown that claims reserving can be approached as a multivariate density estimation problem and that the classical chain ladder technique is a structured histogram version of this density estimator. A natural improvement of the classical chain ladder methodology consists of smoothing via kernel smoothers or some other optimal smoothers. Martínez-Miranda et al. (2013) introduce these ideas and call the approach "continuous chain ladder". The continuous chain ladder model assumes the multiplicative density model $f(x, y) = f_1(x)f_2(y)$, where f_1 is the density in the underwriting direction and f_2 is the density in development direction. There are many situations where the reserve is affected by diagonal effects such the so called economic inflation (related to claim payments following a relevant price index that follows the calendar time) and claim inflation (concerning to legal issues, changes in the way claims are handled etc.) Evidently, the two-dimensional model that is behind the (continuous) chain ladder is unable to capture any diagonal effect. In this paper we propose an extension of the model that is able to handle such types of inflation. The extended model assumes that the density can be written as $f(x, y) = f_1(x)f_2(y)f_3(x + y)$, where f_3 is a third smooth function describing the calendar time effect. While the underwriting and development effects can be estimated inside the data, the diagonal effects move out of the data becoming an extrapolation estimation problem. Under a discrete time framework, using the histogram approach involved in classical chain ladder, Kuang et al. (2008, 2011) have described how such extended model can be estimated and extrapolated using time series. We take advantages of these previous works and describe a continuous generalization using structured kernel smoothing. Identification of the model, estimation of the time effects and forecasting are fully described under a continuous time framework. Our proposal is illustrated using several real datasets.

References:

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