Robust Regression Credibility Models for Heavy-Tailed Claims

Harald Dornheim[1]

University of Wisconsin-Milwaukee

Vytaras Brazauskas

University of Wisconsin-Milwaukee

Abstract

In actuarial practice, regression models serve as a popular statistical tool for analyzing insurance data and tariff ratemaking. In this paper, we consider classical credibility models that can be embedded within the framework of mixed linear models. For inference about fixed effects and variance components, likelihood-based methods such as (restricted) maximum likelihood estimators are commonly pursued. However, it is well-known that these standard and fully efficient estimators are extremely sensitive to small deviations from hypothesized normality of random components as well as to the occurrence of outliers. To obtain better estimators for premium calculation and prediction of future claims, various robust methods have been successfully adopted to credibility theory in the actuarial literature. The objective of this work is to develop robust and efficient methods for credibility when heavy-tailed claims are approximately log-location-scale distributed. To accomplish that, we first show how to express additive credibility models such as Bühlmann-Straub and Hachemeister as mixed linear models with symmetric or asymmetric errors. Then, we adjust *adaptively truncated likelihood* methods and compute highly robust credibility estimates for the ordinary but heavy-tailed claims part. Finally, we treat the identified excess claims separately and find robust-efficient credibility premiums. Practical performance of this approach is examined —via simulations— under several contaminating scenarios. A widely studied real-data set is used to illustrate functional capabilities of the new robust credibility estimators.

Key words and phrases: Adaptive robust-efficient estimation; Asymmetric heavy-tailed residuals; Credibility ratemaking; Mixed linear model; Treatment of excess claims.

[1]PRESENTER. Harald Dornheim is Ph.D. Candidate, Department of Mathematical Sciences, University of Wisconsin-Milwaukee, P.O. Box 413, Milwaukee, Wisconsin 53201, USA. E-mail: dornheim@uwm.edu