

Title: *Q*-Credibility for Compound Losses Under Dependent Risk Profiles for Frequency and Severity

Abstract:

We generalise the credibility estimator to incorporate the full claim information regarding frequency and severity by expressing the premium in terms of the observed claim numbers and individual loss amounts. Policyholders are characterised by separate risk factors for frequency and severity, assumed to be drawn from a bivariate prior distribution, thus allowing these components to be dependent. This is advantageous over traditional approaches, which model the aggregate loss over a period, as we differentiate between cases of frequent small claims and fewer large claims. Given that credibility is inherently determined by the frequency of claims, our methodology can properly account for this factor. Additionally, we incorporate up to quadratic terms in claim number and size to capture nonlinearities in the premium and this includes an interaction between frequency and severity. Our method involves extending the classical structural parameters, and we derive the credibility factors for frequency and severity that minimise the mean squared error to the pure premium. Like classical credibility, the resulting estimator can be expressed as a weighted average of the collective and individual claim history, and solutions are found for parametric and non-parametric cases. Numerical examples confirm the improved performance over aggregate modelling methods, even when the distributions of frequency and severity are independent.