

# Multivariate zero-modified hurdle models in insurance

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## Abstract

In non-life insurance literature, zero-truncated and zero-inflated counting distributions are of great use when the patterns of zero counts in the data display corresponding features. There has been lots of work on the univariate zero-truncation and zero-inflation in the literature, but little has been done in the multivariate context. Different from the univariate models, multivariate zero count abnormalities are more complicated. For instance, there are three cases of zero truncation in the multivariate setting: only records with straight zeros are missing (Type I), zero counts for one or some dimensions are missing, or zeros are completely missing for all dimensions. It is similar for the multivariate zero-inflation: all dimensions are zero-inflated, or only some dimensions are zero-inflated. In this talk, we shall focus on Type I multivariate zero truncation and the first case of multivariate zero inflation.

To enhance the flexibility in marginal distribution selection, in this talk, we employ the multivariate hurdle model to study the aforementioned multivariate zero modification phenomena. After discussing the model inference, some simulation studies are conducted. Finally, the usefulness of our proposed multivariate zero-modified hurdle models is illustrated using two real-life insurance data sets.

**Keywords:** Type I multivariate zero-truncation; multivariate zero-inflation; hurdle model; EM algorithm