

Actuarial Applications of Multivariate Two-Part Regression Models

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Abstract

This paper synthesizes and extends the literature on multivariate two-part regression modeling, with an emphasis on actuarial applications.

To illustrate the modeling, the paper considers a detailed study of health expenditures. We use data from the US Medical Expenditure Panel Survey to explore expenditures that come in two parts. In the first part, zero expenditures correspond to no payments for health care services during a year. For the second part, a positive expenditure corresponds to the payment amount, a measure of utilization. Expenditures are multivariate, the five components being (i) office-based, (ii) hospital outpatient, (iii) emergency room, (iv) hospital inpatient, and (v) home health expenditures. For each individual in the survey, we base our predictions on age, gender and many more covariates that have been explored extensively in the healthcare literature. To assess whether there is a payment for each type, we use multivariate binary regression models. For the payment amounts, we use generalized linear models for marginal distributions and elliptical copulas for the association among types.