Semi-parametric Estimation of Multivariate Extreme Expectiles

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Abstract

This paper focuses on semi-parametric estimation of multivariate expectiles for extreme levels of risk. Multivariate expectiles and their extremes have been the focus of plentiful research in recent years. In particular, it has been noted that due to the difficulty in estimating these values for elevated levels of risk, an alternative formulation of the underlying optimization problem would be necessary. However, in such a scenario, estimators have only been provided for the limiting cases of tail dependence: independence and comonotonicity. In this paper, we extend the estimation of multivariate extreme expectiles (MEEs) by providing a consistent estimation scheme for random vectors with any arbitrary dependence structure. Specifically, we show that if the upper tail dependence function, tail index, and tail ratio can be consistently estimated, then one would be able to accurately estimate MEEs. The finite-sample performance of this methodology is illustrated using both simulated and real data.

Keywords: Dependence, Extreme value theory, Multivariate risk measures, Optimization, Semi, parametric estimation

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