Estimation of extreme risk regions under multivariate regular variation

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Abstract

When considering d possibly dependent random variables one is often interested in extreme risk regions, with very small probability p. We consider risk regions of the form $\{\mathbf{z} \in \mathbb{R}^d : f(\mathbf{z}) \leq \beta\}$, where f is the joint density and β a small number. Estimation of such an extreme risk region is difficult since it contains hardly any or no data. Using extreme value theory, we construct a natural estimator of an extreme risk region and prove a refined form of consistency, given a random sample of multivariate regularly varying random vectors. In a detailed simulation and comparison study the good performance of the procedure is demonstrated. We also apply our estimator to financial data.

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