A multivariate extension of Value-at-Risk and Conditional-Tail-Expectation

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Abstract

In this paper, we introduce a multivariate extension of the classical univariate Value-at-Risk (VaR). This extension may be useful to understand how solvency capital requirement computed for a given financial institution may be affected by the presence of additional risks. We also generalize the bivariate Conditional-Tail–Expectation (CTE), previously introduced by Di Bernardino et al. (2011), in a multivariate setting and we study its behavior. Several properties have been derived. In particular, we show that these two risk measures both satisfy the positive homogeneity and the translation invariance property. Comparison between univariate risk measures and components of multivariate VaR and CTE are provided. We also analyze how they are impacted by a change in marginal distributions, by a change in dependence structure and by a change in risk level. Interestingly, these results turn to be consistent with existing properties on univariate risk measures. Illustrations are given in the class of Archimedean copulas.