

Portfolio Value-at-Risk Estimation with a Time-varying Copula Approach: An Illustration of Model Risk

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Abstract

The traditional portfolio value-at-risk (PVaR) estimation method commonly used in current practice exhibits considerable biases due to model specification errors. This paper attempts to improve PVaR estimation by relaxing the conventional assumption of normal joint distribution and developing an empirical model of time-varying PVaR conditional on time-varying dependences among portfolio components. Specifically, single-parameter conditional copulas and copula mixture models are used to form a joint distribution. Using a sample period covering 1 January 2004 to 29 October 2007 which includes the period of the outbreak of U.S. subprime market collapse from August to October 2007, the PVaR estimates for optimal hedged portfolios are computed using the various copula models. Backtesting diagnostics indicate that the copula-based PVaR outperforms the traditional PVaR estimator at the 99% (rather than 95%) confidence level. To reduce the model risk, our results indicate that using a smaller nominal coverage probability (say, 95% instead of 99%) is preferable.

Keyword : Copula; Value-at-risk; Hedge ratios; Backtests; Subprime market crash