Estimating and Evaluating the Archimedean-Copula-Based Models in Financial Risk Management

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To my family

Abstract

Copula is used to model multivariate data, as it accounts for the dependence structure and provides a flexible representation of the multivariate distribution. Recently a large number of Archimedean copulas have been proposed to deal with various dependence aspects in financial risk management, which invokes several new questions in some important yet under-researched areas. These questions, therefore, need further investigation.

This dissertation comprises three essays and probes into three untouched questions all involving the Archimedean-copula-based models. The first essay studies whether the Archimedean-copula-based portfolio value-at-risk (PVaR) model outperforms the Gaussian-copula-based PVaR model in out-of-sample forecasting. My empirical findings in this essay show that the Archimedean-copula-based PVaR model, especially the Clayton copula-based model, has better forecasting performance than the Gaussian-copula-based PVaR model in most cases in both the in-sample and out-of-sample periods. In addition, the data snooping problem (i.e., model risk) associated with the copula-based PVaR model is also explored.

The second essay examines the question of how to evaluate the non-Gaussian multivariate density forecasts. In this essay, I propose a test procedure, by using the likelihood ratio test based on the Kullback-Leibler information criterion, to evaluate the Archimedean-copula-based multivariate density forecasts, and apply the procedure to foreign exchange markets. The test procedure is not only conducive to fully ranking competing sophisticated models with the non-Gaussian-distributed multivariate densities, but also allows for model misspecification in both marginal and copula functions under the null and the alternative hypothesis.

The third essay focuses on this question: Will the PVaR estimation be improved if the Archimedean copula model takes into account conditional asymmetric tail dependence and time-varying investors' heterogeneous beliefs? I use the conditional skewed-t distribution (as the marginal function) to represent time-varying investors' heterogeneous beliefs, and employ three two-parameter Archimedean copulas to investigate dynamic asymmetric tail dependence between two of three Asian developed futures markets. My results provide strong evidence that such conditional copula models can improve the PVaR estimation and so a greater amount of diversification benefits can be reaped at a higher confidence level.

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However, none of the above individuals hold responsibility for the opinions expressed, or for any remaining errors and omissions, which are my own.

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