



THE UNIVERSITY OF  
CHICAGO

Department of Statistics

## MASTER'S THESIS PRESENTATION

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### Portfolio Value-at-Risk Estimation: a Multivariate Copula-based Volatility Model

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Jones 304, 5747 S. Ellis Avenue

#### ABSTRACT

Traditional value-at-risk (VaR) estimation methods rely on normality assumptions of asset returns, which are often violated in practice. In this thesis, we present a method which uses dynamic conditional correlation (DCC) multivariate GARCH as the underlying volatility model, and Archimedean or elliptical copulas as a tool for modeling dependence structures between asset returns. This combination allows the conditional correlation to be time-varying, guarantees the volatility matrix to be positive definite, and also accounts for tail dependence to deal with large market movements. Our model is then tested on stock returns of banks from five European countries over a twelve-year period. Back-testing results based on standard normal hypothesis test and Kupiec's POF test show that using a 500-day observation period, the model estimates the VaR accurately regardless of the copula family used, while only slightly overestimating the risk for the UK and France at 90% confidence level.

Keywords: Value-at-risk (VaR), GARCH, Dynamic conditional correlation, Copula, Back-testing