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Abstract

Since the summer 2007 as the Subprime crisis began to unravel, the financial markets in the United States and in a number of other industrialized countries have been under considerable strain. The turmoil has affected the prospects of the broader economy, principally through its effects on the availability and terms of credit to households and businesses. Financial market conditions, in turn, have been sensitive to the evolving economic outlook, as investors have tried to assess the implications of incoming economic information for future earnings and asset values.

The aim of the thesis is to present different approaches in estimating volatilities and covariance matrices. In addition, the thesis addresses some of the shortcomings of the simpler models and aims to develop more sophisticated models which would in turn reflect more accurately the observed behavior of volatilities and covariances. The aim of the thesis is also to analyze the performance and stability of the Orthogonal GARCH approach in forecasting volatility and estimating large covariance matrices during the Sub-prime crisis of 2007.

Several statistical approaches are used to analyze the validity of different covariance estimation models. Firstly, root mean squared error (RMSE) was adopted. In addition, an asymmetric extension of RMSE was used as a statistical measurement to evaluate the forecasting ability of volatility and covariance models. Secondly, backtesting under Value-at-Risk framework was adopted to measure the validity of various covariance models solely.

It can be concluded that in terms of forecasting future volatilities, the O-GARCH performs rather poorly. In fact, a simple MA100 model seems to outperform all the other models in the symmetric root mean squared error test as well as in the asymmetric extension of RMSE where over-predictions are penalized more than under-predictions. However, the O-GARCH model dominates the other models when an asymmetric extension of the root mean squared error is used, which penalized under-predictions more than over-predictions. Reason for the performance of the O-GARCH model can be accredited to the time period used to estimate the O-GARCH model.

Covariance Value-at-Risk with the assumption of normal distribution was adopted as the Value-at-Risk methodology. The EWMA model was found to outperform all the other models MA20 close behind. The O-GARCH performed third best, the O-EWMA fourth best and the MA100 was the worst performer.

Further studies on the performance of O-GARCH are needed since till now, the studies have been focusing on time-periods where market volatility has been exceptionally high. Therefore, a study under normal market conditions is much needed.

Key words	Orthogonal GARCH, volatility, covariance, correlation
Further information	