DCC Garch Model

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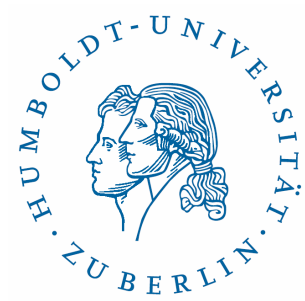
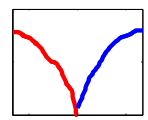


Background

- Volatility varies over time and tends to cluster in periods - heteroscedatisity.
- Volatility has shown to be autocorrelated.

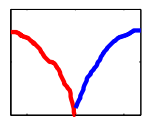


What is DCC Garch Model

- The dynamic conditional correlations proposed by Engle and Tse and Tsui(2002).
- It can be estimated in two steps to make the model relatively easy to use in practice.

The two steps:

1. The conditional variance is estimated via unvariate GARCH model for respectively asset.
2. The parameters for the conditional correlation given the parameters from the first step are estimated.

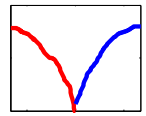


GARCH Model Estimation

- The simplest and popular GARCH model is the GARCH(1,1)

$$h_t = \omega + \delta \eta_{t-1}^2 + \gamma h_{t-1}$$

where $\omega >= 0, \delta >= 0, \gamma >= 0$

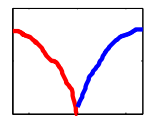


DCC Model Estimation

- In the DCC model, the covariance matrix is decomposed into

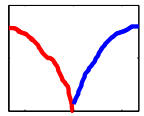
$$H_t = D_t R_t D_t$$

Remarks:
D_t is a diagonal matrix of time varying standard variation from univariate GARCH - processes.
R_t is the conditional correlation matrix of the standardized disturbances ε_t.



The DCC-model in Practice

- Portfolio: four stocks consisting Apple, Google, Nike and Microsoft obtained from Yahoo Finance.
- Time Period: From 2009-12-14 to 2012-12-12 daily data, 755 observations.
- The initial value is 10000 US-Dollar.
- The estimation window is 734, and The rolling window is 20 days.
- The log return was assumed to be normally distributed.



Not Normally Distributed

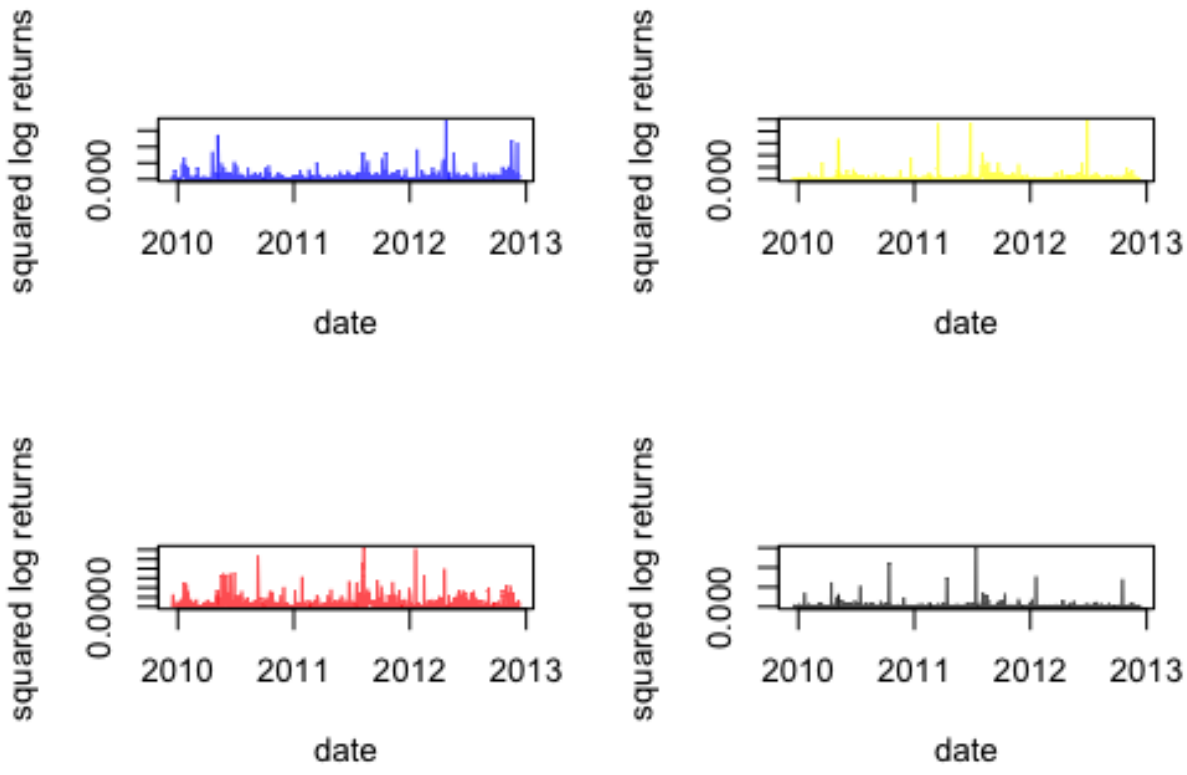
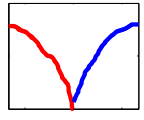


Figure 1. Squared returns on daily data from December 2009 to December 2012.



Time Series Data of Log Return

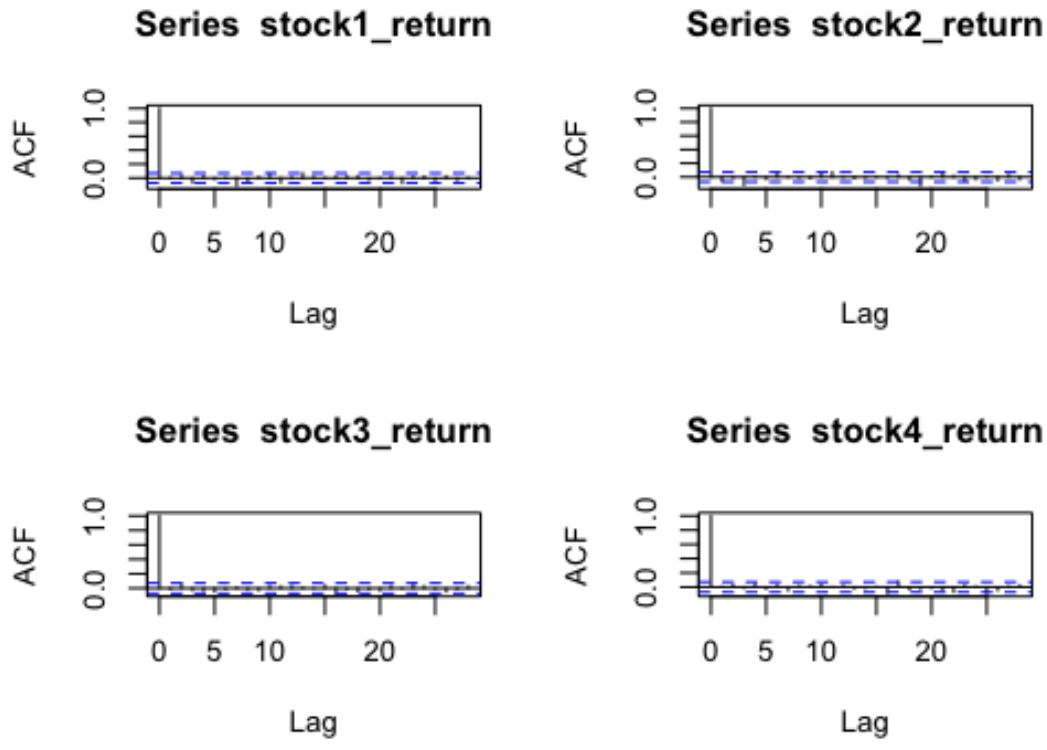
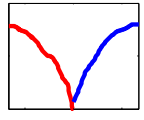


Figure 2. ACF of returns on daily data from December 2009 to December 2012.



Time Series Data of Log Return Cont.

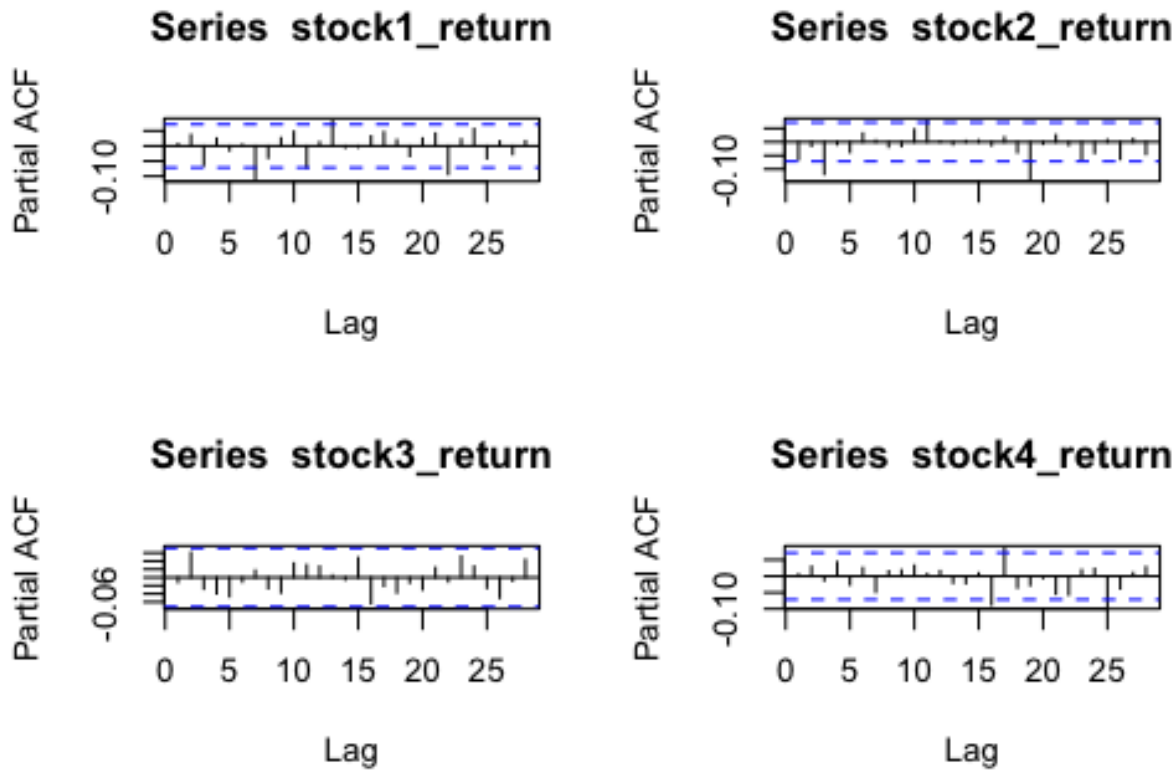
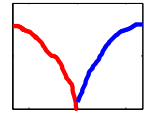
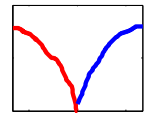


Figure 3. PACF of returns on daily data from December 2009 to December 2012.



Estimation Model

- Arma(1,0), Normally distributed, DCC (1,1)
- Arma(1,0), Student t distributed, DCC (1,1)
- Arma(1,0), Student t distributed, DCC (2,1)



VaR estimation Results

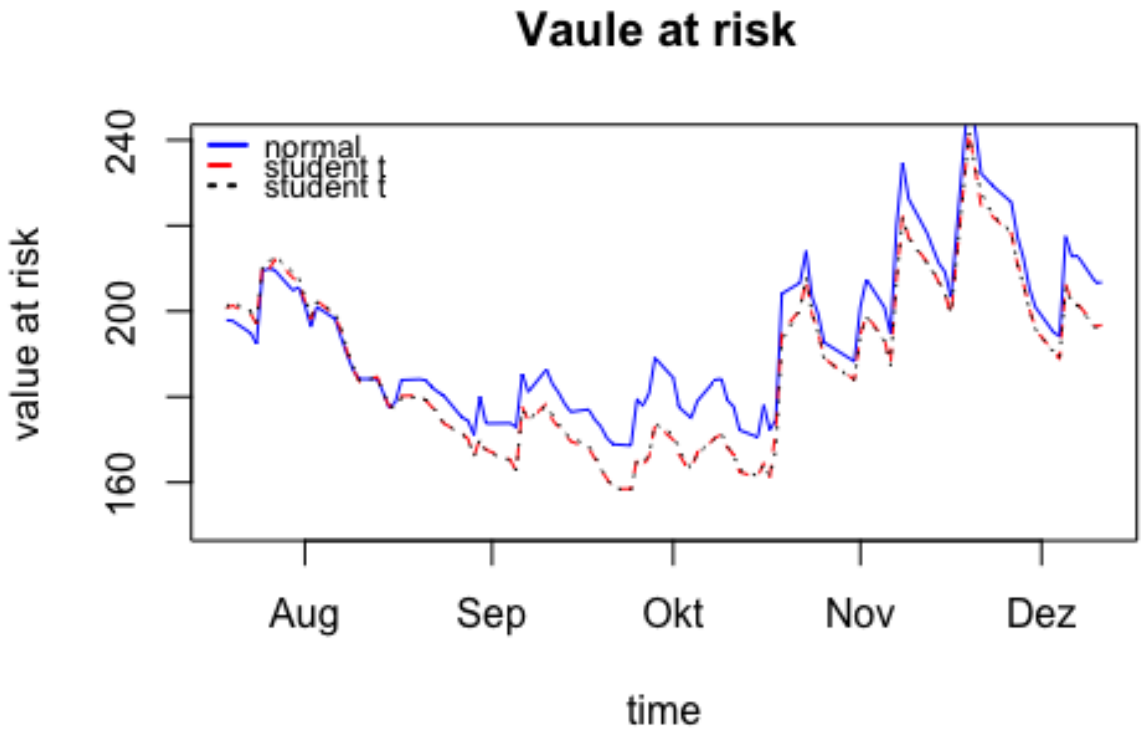
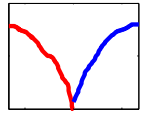


Figure 4. 100 days Value at Risk estimation.



Value at Risk 95% for 20 days forecasting

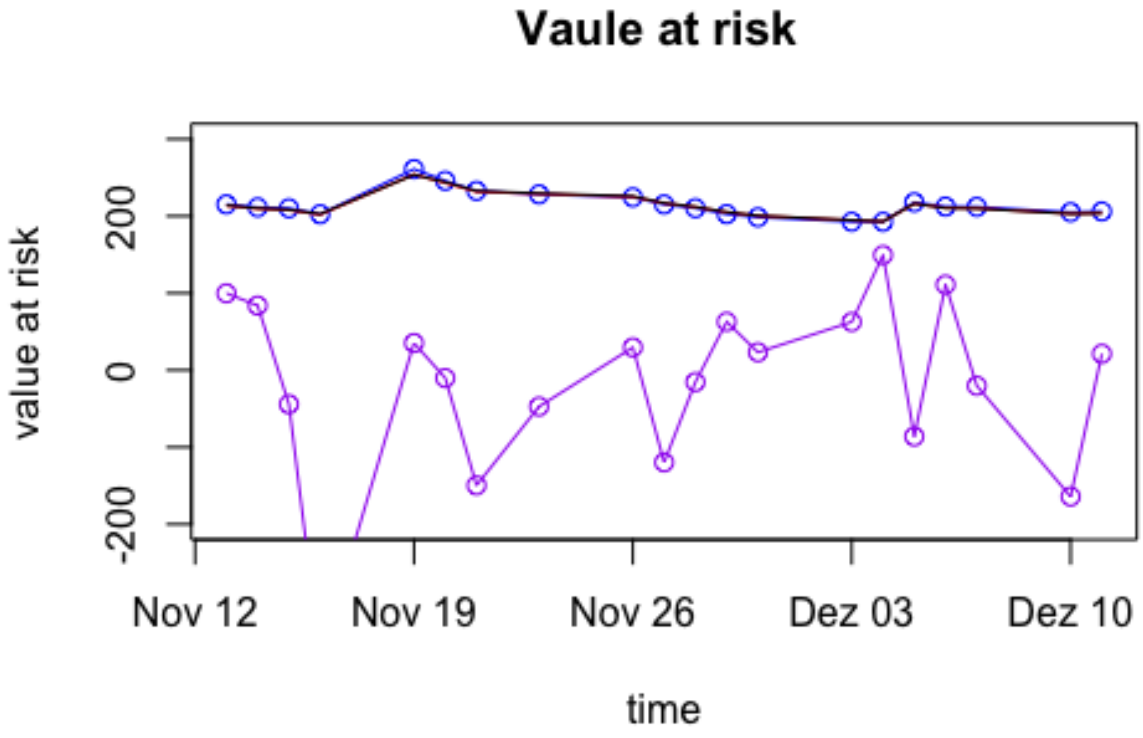
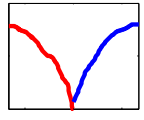


Figure 5. 20 day forecasting of value at risk and real loss.



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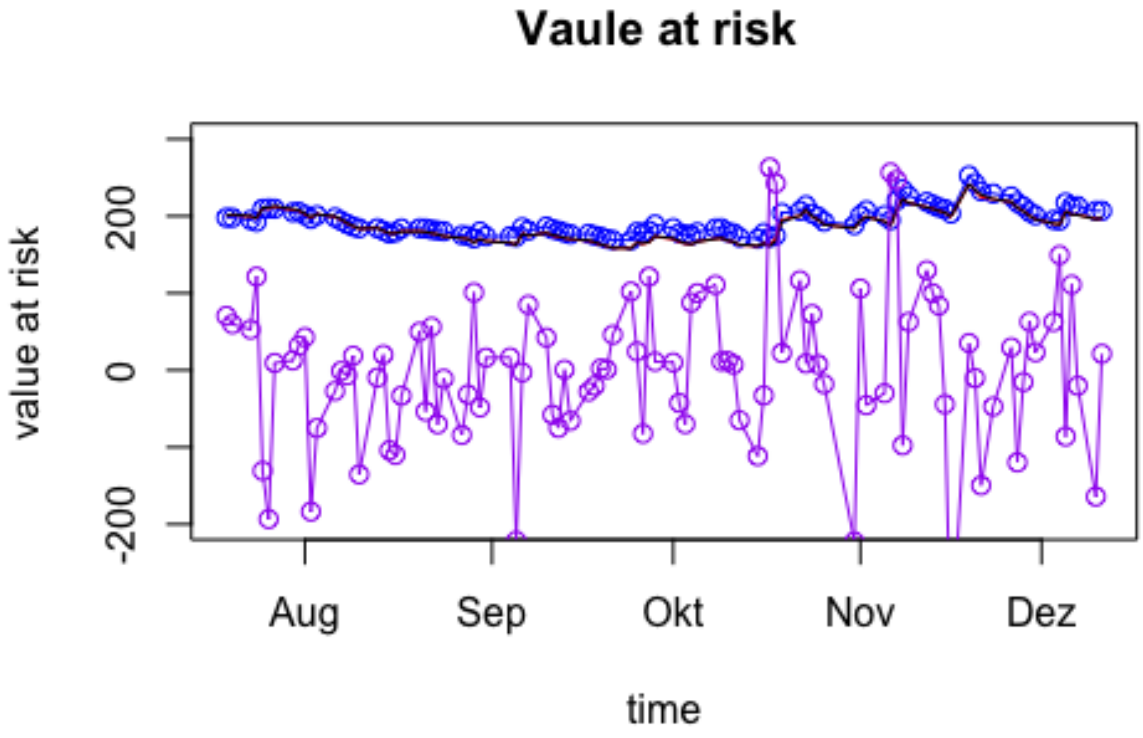
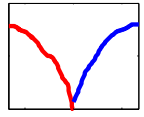


Figure 6. 100 day forecasting of value at risk and real loss.



Summary

- The DCC-model with suitably specified univariate GARCH-models is an appropriate model to use when forcasting the covariance matrix in the short run.