TMS086/MSA410: Financial Time Series – Hand in 2

Formal instructions: You work in groups of two persons or less. You may use any (and as many) statistics package(s) you like as long as you get the job done. A word-file or pdf (created with serious software) containing detailed and well motivated solutions should be sent to mattib.chalmers'at'analys.urkund.se AND to mattib'at'chalmers.se no later than 12am May 30th. Reports not sent to 'urkund' are considered NOT handed in. Reports handed in after the deadline cannot give a grade higher than 3 or G, i.e. pass. The results from this hand in will be weighted to account for one half (just like the first hand in after the cancellation of the written exam) of your total grade, however you have to get at least 25 points from this hand in to pass the course. If you do not accumulate 25 points I will let you know and return your hand in with suggestions for improvements. Maximum points per task are given below.

1. Download the Carlsberg tick data found at the course web page.

   (a) Investigate if there are any intra-day patterns (see slides for lecture 8 or Tsay ch.5) by counting the number of transactions in five minute intervals, taking the means of numbers for the intervals over the trading days and plotting the means vs. time. You may have to transform the hours, minutes and seconds, e.g. 09:00:03, given in the spreadsheet into numbers but this is easily done in Excel. (3p)

   (b) Create a two-way classification table (see slides for lecture 8 or Tsay ch.5) for the price movements of the Carlsberg stock (3p)

   (c) Fit the decomposition model, to intra-day price changes, with lagged values as explanatory variables (see, slides for lecture 8 or Tsay ch.5) to the Carlsberg data. The likelihood function is found in Tsay. Describe your procedure.(5p)

   (d) Using profile-likelihood (see slides for lecture 10), create 95% confidence intervals for the parameters of the fitted model. (3p)

2. Using 500 financial return observations of your choice, fit a Nadaraya-Watson volatility estimator (see slides for lecture 7). Present plots of the estimated volatility and the returns. Describe how you chose the bandwidth for the N-W estimator. (5p)

3. Using 500 financial return observations of your choice, try to impose stationarity on the data using variance and mean windows, i.e., for the return series $\{r_t\}$ and windows of size n, create the standardized returns

$$\tilde{r}_t = \frac{r_t - \hat{\mu}_t}{\hat{\sigma}_t},$$

   where $\hat{\mu}_t = \frac{1}{n}\sum_{i=0}^{n-1} r_{t-i}$ and $\hat{\sigma}_t^2 = \frac{1}{n-1}\sum_{i=0}^{n-1}(r_{t-i} - \hat{\mu}_t)^2$.

   (a) Plot the non-standadized data and the standardized data (1p)

(b) Investigate the normality of the standadized data, using descriptive measures (skewness and kurtosis) and PP or QQ-plots. Present your results (2p)

(c) Create 95% and 99% VaR for the (non-standardized) returns assuming normality for the standardized returns (see the last slide for lecture 9) and present your results in a plot with the to VaR series and the (non-standardized) return series (3p)

(d) Create 95% and 99% VaR for the (non-standardized) returns using Block Maxima/GEV under i.i.d. assumption for the standardized returns (see slide for lecture 9) and present your results in a plot with the to VaR series and the (non-standardized) return series. Also present a QQ and/or PP plot of the fit the GEV (5p)

(e) Create 95% and 99% VaR for the (non-standardized) returns using POT/GPD under i.i.d. assumption for the standardized returns (see slide for lecture 9) and present your results in a plot with the to VaR series and the (non-standardized) return series. Also present a QQ and/or PP plot of the fit the GPD and describe your procedure for threshold choise (7p)

(f) Create 95% and 99% VaR for the (non-standardized) returns using Block Maxima/GEV under stationarity (but not independence) assumption for the standardized returns (see slide for lecture 9) and present your results in a plot with the to VaR series and the (non-standardized) return series. Also describe your procedure for declustering and estimation of the extremal index (7p)

(g) Present a table of the performance of the different models, respresented by the violation percentages, i.e. the proportions of returns that exceed VaR and discuss the pros and cons of the models (5p).