STA457H1/STA2202HF L5101 – Time Series Analysis

Assignment 3 due by 11:59pm Thursday November 28, 2019

Consider the data set of IBM price shares in the time series observed from January 1st, 2015 to December 31st, 2018:

1. (4 points) Read in the data set for the specified time period. Identify the length of your data and display the first month of the time series data (roughly 30 data points don't go wild).
2. (8 points) Plot ACF and PACF of IBM stock price and change in IBM stock price up to lag 40. Based on auto correlations and the partial auto correlations, if you want to fit an AR(p) model, what order p would you pick ?
3. (6 points) Perform a simultaneous test for $\phi(1) = \phi(2) = \cdots = \phi(K)$ where $K = 5$ for IBM stock price. Comment on the results.
4. (12 points) Fit an AR(1) model. Perform diagnostic test on this model (does the model fit well?) and comment. Write down the AR(1) model with the estimated parameters.
5. (10 point) Is the data set stationary? Support your claim with appropriate test.
6. (6 points) Is the noise ϵ_i in the AR(1) model Gaussian ?
7. (8 points) Based on AIC what is the best ARIMA model? Write down the model with the fitted parameters.
8. (10 points) Fit a t-distribution to the noise ϵ_t for the ARIMA model.
9. (10 points) Evaluate how well the fitted t-distribution by comparing empirical density with fitted t-density functions (in the same plot and label properly) and a quantile plot.
10. (16 points) Based on the previous results, use Model-based resampling to simulate a 95% confidence band forecasting the month of January 2019. Write down a detailed description for each step and plot the confidence band.
11. (10 points) Instead of Price use the log return of the data set to plot ACF and PACF and empirical density. Comment on why log returns are widely used in the financial time series analyses over raw asset prices analysis.

Recommended format for the submission of Assignment 3:

1. One PDF file to be uploaded onto Quercus
2. Structure your report in the following way for each question:
   a. Question number;
   b. R code, comprehensively commented;
   c. Plots, graphs and outputs from R;
   d. Your comments, analysis and conclusions.
3. Please make sure that your submission could be easily read and marked by TAs on the computer screen.