Financial Econometrics I: Homework 2

March 24, 2023

Instructions:

- The contact person for all agenda regarding this homework is Josef Kurka, e-mail: josef.kurka@fsv.cuni.cz
- Please form groups of two students. If you have trouble finding a colleague, use the shared table that was created for this purpose.
- Submit one file for the whole homework per group, the file needs to contain names of both students. Submit by SIS in the module "Study group roster" (Studijní mezivýsledky) - Financial Econometrics I - Lecture - HW2.
- Deadline for submissions is **Thursday, April 6, 2023, 23:59.** Any late submissions will be awarded zero points.
- Your solution should have a form of Jupyter Notebook with R source-code. Code should be properly commented, interpretations of results as well as theoretical derivations should be written in markdown cells. This is the only file you need to send. If you prefer not to write formulas in LaTeX, you can send PDF with your derivations and interpretations in additional file and R code in Jupyter Notebook.
- In this homework, especially your comments and interpretation of the obtained results will be evaluated. Solutions with no comments will not be awarded any points, and only solutions with sufficient reasoning of all the steps will be awarded the full amount of points. Please, be concise though.

Problem 1:
(6 points)

Select 100 random symbols from the symbols.csv file, i.e. using a function in R generate 100 random integers from interval {1,..., 377}, use set.seed('your SIS number') to generate these numbers (e.g. set.seed(26830192)). Then select the Tickers from rows with indices equal to the numbers you generated, and download the prices of stocks denoted by these Tickers for the period 07/2019 - 07/2022. Please restrict the period immediately when downloading the data, it should get downloaded more quickly then. Ignore the stocks that are not available in the quantmod package.

1. Compute the logarithmic returns for the time-series of each stock in your dataset.
2. For each stocks, estimate the parameters of a GARCH(1, 1) model.
3. You will end up with 100 sets of estimated coefficients. Plot the histogram of the 100 α_1 coefficients, and repeat with β_1, and $\alpha_1 + \beta_1$. Comment on the cross-sectional variation of the α_1, β_1 and $\alpha_1 + \beta_1$ and on the consequences that the values of these coefficients have on the behaviour of the estimated volatility.
4. Find the minimum and maximum values of α_1, β_1 and $\alpha_1 + \beta_1$. Comment briefly.
5. Use the GARCH volatility of the cross-section of 100 stocks for every day to obtain median "market" volatility and its quantiles (95% and 5%). Create a figure plotting the cross-section of median, the 95% quantile, and the 5% quantile "market" volatility that you have obtained. Please, comment.

Problem 2:
(6 points)

Use the dataset of logarithmic returns from the first problem. Compute the mean logarithmic return for each date. Estimate a suitable ARMA family model for this series. Consider at least three different ARMA orders that you can pinpoint as candidate models by observing the ACF and PACF. Remember to include all the necessary steps including model diagnostics.
Discuss the results in detail.