

**Hand in assignment: Statistical properties of financial returns and conditional volatility models**

The answers to these questions need to be submitted on moodle by the 30 October 2022 (Sunday) 11:59pm. Your work should include two files: 1) a brief report with graphs, numerical results and clear explanations (\*.pdf file) and; 2) R code.

1. Download daily prices for Tesla (tsla) stock from 01/01/13 to 30/09/22. (10 marks)
2. Check whether the daily returns are normally distributed: both graphically and with an appropriate statistical test. For the statistical test approach, what is your test statistic estimate and what do you compare it with in order to reject/not reject the null? Comment on your results. (20 marks)
3. Check for autocorrelations in squared returns: both graphically and with an appropriate statistical test. For the statistical test approach, what is your test statistic estimate and what do you compare it with in order to reject/not reject the null? (For the statistical test, you may try different lag values.) Comment on your results. (20 marks)
4. Produce in-sample volatility forecasts using the following models: EWMA, GARCH(1,1) and GJR-GARCH(1,1). Present your results graphically by comparing the realized returns with the  $\pm 1$  estimated conditional standard deviations. Comment on their differences (if any). (30 marks)
5. Compare the GARCH and GJR-GARCH with an appropriate statistical test. Explain your results. (10 marks)
6. Produce a plot of the daily returns and your three volatility estimates for the year 2016. Comment on the performance of each model in relation to the return observed on the 22/06/2016. (10 marks)