

Home Assignment 3

Submission deadline: **30 June 2022** (before 23:59 CEST). Individual solutions to be submitted as an .R code file with comments to wischnewsy@uni-trier.de. Use the following label: <YourLastName>.R.

1. (10 points) **GARCH Models**

1. Load the multivariate dataset `data3.xlsx`. Then, select the closing price of the *OMXS30 Index* and plot it.¹
2. Describe the continuous returns of the index with the help of a histogram, kurtosis, and skewness measures.
3. Calculate the degrees of freedom appropriate for the Student's t-distributional shape and plot it against the actual histogram.²
4. Compute the 30-day historical volatility.³
5. Start your analysis with an ARIMA(p,d,q) model. Comment on the results.
6. Find an adequate ARMA-GARCH specification for the log-returns. Consider normal as well as t-distributed residuals.
7. Use a GJR-GARCH(p,q) model to check whether the leverage effect is present.
8. Compare your results to an exponential GARCH(p,q) model. What can be inferred?
9. Transform the variable into monthly frequency.
10. Estimate an ARIMA(p,d,q) model using the monthly time series. Test for heteroskedasticity in the squared residuals. What changes in the case of a quarterly time series?

Useful functions: `rugarch::ugarchspec()`, `rugarch::ugarchfit()`

¹OMX Stockholm 30 is the Stockholm Stock Exchange's leading share index consisting of the 30 most actively traded stocks and structured products.

² $kurtosis = 3 + 6/(df - 4)$.

³Annualized and expressed as a percentage.

2. (2 points) **Bonus: Alternative Diagnosis of ARCH Effects**

Manually set up the Lagrange Multiplier Test. Check if autoregressive conditional heteroskedasticity is present in the continuous index returns. Do you get the same results when using one of the existing preset commands?