Algorithmic Trading, COMP0051, 2023/24

Coursework 1. Cohort 2023/24. This assignment is worth 40% of the overall mark.

Standard and non-standard calculators are permitted

Time series [10 Points]

1. Download two ETF time series using an API. The length of the time series T, with $T = 300$ and a daily resolution.
2. Plot the price time series

Moving averages [20 Points]

3. Define mathematically the moving average of the price time series with an arbitrary time-window τ
4. Compute three moving averages of the price time series, with time-windows $\tau = 5, 20, 60$
5. Plot the moving averages against the price time series
6. Compute the linear and log-return of the price time series
7. Plot the linear return against the log-return time series

Time Series Analysis [20 Points]

8. Define the auto-correlation function (for a stationary time-series)
9. Compute the auto-correlation functions (ACF) of the price time series
10. Plot the price ACFs
11. Compute the partial auto-correlation functions (PACF) of the price time series
12. Plot the price PACFs
13. Compute the auto-correlation function (ACF) of the return time series

14. Plot the return ACFs
15. Compute the partial auto-correlation functions (PACF) of the return time series
16. Plot the return PACFs

Gaussianity and Stationarity test [20 Points]

17. Introduce mathematically a Gaussianity test
18. Perform a Gaussianity test of the return time series
19. Introduce mathematically a stationarity test
20. Perform a stationarity test of the return time series

Conintegration [30 Points]

21. Define mathematically a cointegration test
22. Perform a cointegration test of the two ETF price time series
23. Perform a cointegration test of the two ETF return time series

Written report Write a report clearly providing an answer to each of the numbered instructions.
A single written report in pdf (maximum 10 pages) structured into

- Time Series,
- Moving averages,
- Correlation analysis,
- Gaussianity and Stationarity tests,
- Cointegration tests,

will need to be uploaded to Moodle before the deadline of 21/02/2024.

Coding and Editing Students are allowed to use any programming language and any editing software for the report. The code will need to be uploaded as well (you can choose your preferred format). To avoid a warning from the Moodle platform it is possible to upload the code as a zip file.

Marking The marking will be based on the following criteria:

- Clarity of presentation;
- Validity of results;
- Consistency of language and mathematical notation;