Econometrics and Time Series Applied to Finance
MSc Finance & Big Data

Group Assignment

2021-2022

Instruction

Assignment in groups of two to three students. Type your answers to the tasks in a *Word* document. Upload your *Word* or *PDF* document to the platform *Course*, along with your R script. The submission of both the .doc(.pdf) document and R script is required for this assignment. The lack of one of the two files entails a failure of your submission and the assignment will not be graded. The **deadline** is the **16^{th} of January**, **29:59 CET Time**.
This assignment is worth 20 points total and a **minimum of 11 points** is required to pass the assignment. This assignment is worth **50% of your final grade** in this course.

1 Task 1 (4 Points)

Download the file *Stocks_AC.csv* from the the platform *Course*. This file contains daily adjusted closing (AC) stock prices of General Motors (GM), Ford (F), Merck (MRK), Pfizer (PFE), and Microsoft (MSFT) from January 2, 1987 to September 1, 2006.

1.1 (0.4 Points)

Print the names of the variables in the data set and plot the adjusted closing price time series of General Motors (GM) and Ford (F). Save the plot on your Word document. Describe the dynamics of the two series.

1.2 (1 Points)

Find the sample size (T) of the two series, compute General Motor and Ford returns, and plot General Motors returns against the Ford returns. Save the plot on your Word document and provide a description of it. Do the General Motors and Ford returns seem positively correlated? Do you notice any abnormal returns (i.e. outliers)? If "yes" do abnormal General Motors returns seem to occur with abnormal Ford returns? How correlated are the two return series?

1.3 (0.6 Points)

Create a boxplot of the General Motors and Ford returns. Save the boxplot on your Word document and interpret it.

1.4 (1 Points)

Repeat the Tasks 1.2 and 1.3 with Microsoft (MSFT) and Merck (MRK).

1.5 (1 Points)

Compute descriptive statistics (mean, standard deviation, skewness, kurtosis, median, 1st and 3rd quartile, min, max) of the four return series and save them in a table on your Word document. Comment the statistics and indicate if the series can be normally distributed or not. Motivate your answer.

2 Task 2 (Point 6)

2.1 (0.6 Points)

Plot the ACF and PACF of the four price series (General Motors, Ford, Microsoft and Merck), and the ACF and PACF of the return series. Save the plots on your Word document. Are the price and return series stationary or not? Motivate your answer.

2.2 (1 Points)

Compute the appropriate tests to check if the price series and the return series are: stationary, serially correlated, homoscedastic, and normally distributed.

Save the output from these tests on your Word document and comment the results. Which series do you think are stationary? Which are normally distributed? Why? What types of heteroscedasticity can you see in the return series? Which series would you use to fit an ARMA model and why?

2.3 (1 Points)

Based on your answers to the task 2.2, fit an AR(1) model on the General Motors series. Report the fit of the model on your Word document, and comment the parameter estimates by providing an economic interpretation of them. Perform diagnostic testing on the residuals of the model, i.e. check if the CLRM assumptions hold. There are any violations of these assumptions? What are the implications for OLS estimation? What are the possible solutions?

2.4 (1 Points)

Fit an ARMA-GARCH model for the General Motors series you used in 2.3. Report the results on your Word document and comment them. Perform diagnostic testing on the standardized residuals of the model and comment the results.

2.5 (1.2 Points)

Fit an EGARCH model for the GM series you used in 2.4. Report the results on your Word document and provide an interpretation of the parameter estimates. There is evidence of any asymmetric effects? If yes, what do these effects imply? Fit an EGARCH model on the Microsoft series, report the output on your Word document and compare these results with the results obtained from the EGARCH model fitted on the General Motors series.

2.6 (1.2 Points)

Fit a GARCH-DCC model with the General Motors and Microsoft series. Save the output on your Word document and comment the results. Plot the conditional correlation of the two series, save the plot on your Word document and comment the dynamics of this correlation highlighting the economic/financial implications of having a time-varying correlation.[Hint: The DCC fit in R refers to the Engle(2002) specification]

3 Task 3 (5 Points)

For this task, use the data set *TreasuryYields.txt*, which contains bond yields at 3-month maturity up to 30-year maturity. Bond yields are recorded at daily frequency, from January 2, 1990 to October 31, 2008.

3.1 (0.4 Points)

Extract from the data set the three-month, six-month, one-year, two-year, and three-year bond yields, plot the five yield series, and save the plot on your Word document. Could the series be cointegrated?

3.2 (1 Points)

Plot the ACF of the five yields, save the plots on your Word document. Test the yields for the presence of unit a root and conclude on the nonstationarity or stationarity of the time series of the yields.

3.3 (0.8 Points)

Compute (and save on your Word document) the correlation matrix among the five yields and evaluate the features of such correlations? What could be the risk of having all these yields as explanatory variables in a regression model? Regress the three-year yield on the 3-month yield, save the output and comment the results. Is the OLS estimator a valid estimator in this case? Motivate your answer.

3.4 (1 Points)

Save the residuals from the regression of the three-year yield on the 3-month yield in 3.3 and test for the presence of a cointegrating relationship between the two yield series. Can we conclude that the three-year and the 3-month yields are actually cointegtated? If "yes", what does it mean?

3.5 (1.2 Points)

Based on your results and conclusion in 3.4, can we express the relationship between the three-year yield and the 3-month yield through an error correction model (ECM)? Motivate your answer and if affirmative, estimate the appropriate ECM model. Provide an economic interpretation of the results.

3.6 (0.6 Points)

Regress the three-month yield on the 3-year yield. How (if) do results and conclusions in tasks 3.4 and 3.5 change?

4 Task 4 (5 Points)

For this task use again the data set *Stocks_AC.csv*

4.1 (0.6 Points)

Extract form the data set the time series of adjusted closing price (AC) of Pfizer (PFE). Perform the opportune transformation to obtain stationary series, and plot the series along with General Motor and Microsoft series obtained in 1. Save the plot on your Word document and comment the results.

4.2 (1.2 Points)

Estimate a VAR model for (in the following order) the General Motors, Microsoft and Pfizer series. Use the information criteria to determine the appropriate lag length [Hint: Use lag.max=5]. Save the estimation output of your selected VAR on the Word document and comment the results.

4.3 (1.2 Points)

Based on the fitted VAR above, run a Granger causality test on the VAR by specifying from which variable(s) the causality originates. Save the output on your Word document and comment the results.

4.4 (1.2 Points)

Obtain the impulse responses for the estimated VAR, save the plot on your Word document and comment the results.

4.5 (0.8 Points)

Compute the forecast error variance decomposition (FEVD), save the results on your Word document and comment them. Evaluate the sensitivenesso of your impulse responses and FEVD to the variable ordering.