



Financial Econometrics and Empirical Finance Homework 2 – Instructions

This homework is worth **up to 2 points**. The submission deadline is **May 3, 2021, at 11.59 PM, Italian time**. Late submissions will incur a 0.25 point penalty, *per day*. This means that if you submit on May 4, 2021 at 12.01 AM your maximum grade will be 1.75. If you submit on May 5, 2021, your maximum grade will be 1.50 and so forth.

The submission must include **only a single PDF file** representing the work (output tables, figures, and comments, as instructed below) of the entire group. In the first page of your PDF you should write the name of the group members and their student ID. Also, the PDF file should contain the “group number” (e.g., if you are Group 1 your file should be named “Group 1.pdf”). Below, we use the squared brackets (“[]”) to specify which outputs (to be copied and pasted as images in the PDF) and the min/max number of words in the comments that we expect you to include in the PDF file. The file must be submitted to francesco.rocciolo@unibocconi.it from a @studbocconi.it account. Any submission from other types of accounts (e.g., hotmail, gmail etc.) will not be considered and simply be ignored.

This homework implies that when going from point 4 to point 5 you **have to make a selection** (to address either Section A or Section B). Please be aware that you will have to solve **only one of them**, depending on the results you get from working on points 2 and 3. Further details are explained at point 4 that follows. After you solve section A **OR** B, you are expected to work on points 5, 6, 7, and 8 (all of them).

Your tasks for this assignment are as follows:

1. Plot the data on WGS2YR and WGS3MO in one single graph and produce a table with summary statistics including correlations. Comment the summary statistics. [WRITE MIN 30 WORDS – MAX 200 WORDS].
2. Use the Augmented Dickey-Fuller unit root test to assess whether WGS2YR and WGS3MO are a I(1) series [REPORT THE TABLE]. Include the intercept and a trend. Comment on the results suggested by the test [WRITE MIN 30 WORDS – MAX 100 WORDS].
3. Test whether WGS2YR and WGS3MO series are cointegrated using the Engle-and Granger’s univariate regression framework (with an intercept and a quadratic deterministic trend) and Johansen’s test (use the option that gives you five different set of results across specifications of the deterministic trend components and the intercept) [REPORT THE TABLES and WRITE MIN 30 WORDS – MAX 200 WORDS]. In the case of differences in the implications of the tests, use the Johansen’s test to reach a conclusion about whether the series are cointegrated [WRITE MIN 30 WORDS – MAX 100 WORDS].

4. Using the results from points 2 and 3 above, refer to the table below to determine which section of point 4 of the homework you will have to solve next. Irrespective of the section you will work on (A OR B), move next to points 5, 6, 7, and 8.

	The series are cointegrated	Section to solve (see below)
At least one series is not I(1)	NO	A
All of the series are I(1)	NO	A
	YES	B

Section A

- Proceed to take the first difference of any of the series (WGS2YR and/or WGS3MO) that has turned out to be I(1), to make it stationary. Using the resulting, stationary series, perform a systematic search over p among VAR(p) models. Use the Schwartz criterion (SC) as the selection criterion and use a maximum p equal to 12. Which model would you select? How many total parameters are estimated? Estimate the selected model and provide some comments on the estimates. [REPORT THE PLOT and TABLE; WRITE MIN 30 WORDS – MAX 200 WORDS].
- Compute the roots of the characteristic system of equations for this VAR model to make sure that it is stable and hence stationary. Report both the table listing the roots and the picture of the roots plotted vs. the unit circle. [REPORT THE PLOT and TABLE].

Section B

- Using the series WGS2YR and WGS3MO, perform a systematic search among VEC models (VECM), by using lags between 2 and 4. Use the Schwartz criterion (SC) as the selection criterion. Which model would you select? [REPORT THE PLOT and TABLE; WRITE MIN 30 WORDS – MAX 200 WORDS].
 - Estimate the selected VECM for the two series WGS2YR and WGS3MO that incorporates the cointegrating relationship. Comment the economic implications of your results. [REPORT THE TABLE; WRITE MIN 30 WORDS – MAX 200 WORDS].
- With reference to the residuals estimated from the equation for the WGS2YR series in the model selected at point 4, plot the residuals and produce a table with their summary statistics [REPORT THE PLOT and THE TABLE]. Also plot a histogram incorporating the kernel density and the theoretical Gaussian density with the same mean and variance as the residuals [REPORT THE PLOTS AND PLACE THEM ALL IN THE SAME GRAPH]. Can you observe evidence of volatility clustering? Is the unconditional density of the returns leptokurtic? [WRITE MIN 100 WORDS – MAX 300 WORDS].
 - Estimate a t-Student EGARCH(1,1) for the residuals using maximum likelihood [REPORT THE TABLE]. Plot the filtered daily conditional standard deviation [REPORT THE PLOT].
 - Test whether both the standardized residuals and the squared standardized residuals from the EGARCH(1,1) display any remaining structure that would need to be modelled and provide comments. Print/report any useful evidence to support your conclusions [REPORT TABLES and PLOTS. WRITE MIN 100 WORDS – MAX 300 WORDS].

8. Estimate a GARCH(2,2) model [REPORT THE TABLE]. With reference to the variance forecasts from both the model estimated at point 7 and the GARCH(1,1), estimate the following regression:

$$\varepsilon_{t+1}^2 = a + b\sigma_{t+1|t}^2 + e_{t+1|t}$$

and test the hypothesis that $a = 0$ and $b = 1$ jointly. Comment on the results from the two models and on the R^2 obtained from the regressions [REPORT THE TABLES. WRITE MIN 100 WORDS – MAX 300 WORDS]. Plot the forecasts of the variance from each of the two models (from point 7 and 8) in a single graph and comment on any differences [REPORT THE PLOT. WRITE MIN 100 WORDS – MAX 300 WORDS].