Università Commerciale
Luigi Bocconi

MSc. Finance/CLEFIN
2020/2021 Edition

Financial Econometrics and Empirical Finance
Homework 1 – Instructions

This homework is worth **up to 2 points**. The submission deadline is **April 7, 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 April 8, 2021 at 12.01 AM your maximum grade will 1.75. If you submit on April 9, 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. 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. This file must be submitted to francesco.rocciolo@unibocconi.it from a @studbocconi.it account. Any submission from other type of accounts (e.g., hotmail, gmail etc.) will not be considered and simply be ignored.

Your tasks for this assignment are as follows:

1. Plot the histogram of energy returns along with the table of summary statistics. [REPORT THE PLOT and TABLE]. Is the distribution of the returns on energy normal? Explain what is the test you have applied. Does the series display any departures from normality? [WRITE MIN 30 WORDS – MAX 200 WORDS].
2. Produce an autocorrelogram (aka SACF and SPACF) for energy returns including 29 lags [REPORT THE PLOT]. What can you conclude about the stationarity of the time series? Which time series model may justify such a SACF? Is this consistent with the efficient market hypothesis (EMH)? [WRITE MIN 60 WORDS – MAX 300 WORDS].
3. Using the time series of energy returns, estimate a model including only a constant (aka CER model) and report the estimation output [REPORT THE TABLE].
4. Using the time series of energy returns, estimate by maximum likelihood a MA(9) with all the coefficients from the 1st to the 5th restricted to be zero and report the estimation output [REPORT THE TABLE]. Compare the information criteria (ICs) of this model with the ICs obtained for the CER model: which model seems to be preferred by which ICs? [WRITE MIN 30 WORDS – MAX 200 WORDS].
5. Perform a search among ARIMA models. Use the Akaike Information criterion (AIC) as the selection criterion when the maximum values for p and q equal to 8 and the maximum d equals 1. Produce a synthetic table reporting models and associated score for the criterion. [REPORT THE SYNTHETIC TABLE]. Report the graph of the AIC for the 20 best models [REPORT THE PLOT]. Which model would you select? Report the

OLS estimates of such a best model and comment on the economic meaning of the coefficients obtained. [REPORT THE ESTIMATION OUTPUT TABLE + WRITE MIN 30 WORDS – MAX 200 WORDS].

6. Suppose you need to specify a bivariate VAR model for energy returns and the factor F2. Perform (and report) an automatic model selection analysis including a maximum of 20 lags. Produce a synthetic table reporting models and associated score for the criterion. [REPORT THE SYNTHETIC TABLE]. Do different criteria lead to the same decision about the best model? [REPORT THE TABLE and WRITE MIN 30 WORDS – MAX 200 WORDS].
7. Estimate the model selected by the Schwartz Criterion (SC) and report the estimates. Are the coefficients significant? [REPORT THE TABLE and WRITE MIN 30 WORDS – MAX 200 WORDS]. Inspect the residuals from your VAR model. Do you think that there should be concerns about the specification of the model? [REPORT THE TABLE and/or PLOT. WRITE MIN 30 WORDS – MAX 200 WORDS]. Employ your VAR model to plot the forecasts of the energy returns. Also report forecasting accuracy measures. [REPORT THE PLOT and THE TABLE].
8. Suppose you need to specify a three-variable VAR model for energy returns, factor F2, and factor F3. Estimate (and report the estimates) of a VAR(2) and of the best model automatically selected using the Bayesian Information Criterion (BIC) when the maximum number of lags equals 12 [REPORT THE TABLE**S**]. Obtain the forecasting accuracy measures for these models (assuming these are different). Which of the model performs better in terms of forecasting accuracy? [REPORT THE TABLE and WRITE MIN 30 WORDS – MAX 200 WORDS]. Use such a model to plot the forecasts of the energy returns. [REPORT THE PLOT].
9. Similar to task 7, inspect the residuals from both models obtained in task 8. Do you think that there should be concerns about the specifications of these models? [REPORT THE TABLE and/or PLOT. WRITE MIN 30 WORDS – MAX 200 WORDS].
10. Using the model that provides the most accurate predictions, estimate and plot the (marginal and cumulative) impulse response function between 1 and 24 periods of the returns on energy to a one standard deviation shock to factor F3. To identify the structural shock to factor 2, use a Cholesky triangularization scheme that places on top factor F3, followed by factor F2, and then the energy returns series. Make sure to plot impulse response functions with super-imposed 90% confidence intervals obtained with 20,000 Monte Carlo simulations. [REPORT IRF TABLES and PLOTS].