

# Exercise\_2

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## Exercise 2

Deadline Tuesday 14th June 2:30 pm

You MUST work in groups (max 3/4 people). The groups can chance for next assignments. If you change there is a greater possibility to learn from your classmates.

Send me by email ([giuseppe.cinquemani@unicatt.it](mailto:giuseppe.cinquemani@unicatt.it)) your work including your writings and your REPLICABLE codes (you must test it and be sure it works properly) in a zip file named “ex1 and a reference name”(the name can one of the group or a fantasy name). Your writing must contain name and surname of all the authors at the beginning of each file in the zip file. Remember all the members of the working group MUST be able to answer about the code and the writings you send me, even if you did not contribute all in the same way.

The solution will be a collection of the best of your works. Extra bonus will be assigned to those asked to present the results during the dedicated class.

### 1. Data Generating Process

Simulate an AR(i), a MA(i) and an ARMA(i,j) study the correlogram, where you must choose i and j as positive integers, while the parameters can be positive or negative. Repeat the experiment for two i and two j. Chose at least two parameters positive and two negative for each model you define. Briefly comment your results. (Hint: the idea is to play with different models in order to understand the nature of the series from a visual inspection).

### 2. Forecasting comparison

Simulate one model at your choice for example an AR(1) (do not simulate a nonstationary process) and divide your sample in two parts, the first for estimation and forecast, the second for comparison with the forecast. Remember that the forecast must have the same length of the sample saved for comparison. Use MAE and RMSE to compare AR(1), ARMA(2,1), naive forecast (just repeat the last observation of the sample used for estimation purposes as many times as the comparison sample), mean forecast (just repeat the mean of the sample used for estimation purposes as many times as the comparison sample)

Comment your results

### 3. Nelson Plosser data

Study the data and the results of Nelson Plosser <http://hedibert.org/wp-content/uploads/2015/03/nelson-plosser-1982.pdf> using the dataset in package (urca or tseries)

Download the same series from FRED and repeat the results of NP for the extended sample.

It is your choice using data in level in log level or detrend them. Comment the choice you made.

For each variable plot the original data (chose whether in logs) and ACF/PACF, the time detrended data and the data without stochastic trend.

Test formally the stationarity of you series with one or two tests at your choice.

#### 4 Cointegration

Download from FRED the following interest rates: 3 Months Treasury Bill, 2 Years Treasury Bonds and 10 Years Treasury Bonds.

The difference between 10YR and 3M is known as term spread. It is a proxy of the risk in holding longer maturities with respect to liquid cash or very short term Treasury Bills.

The difference between 10YR and 2YR is considered in the US an good indicator of future recession if negative (<https://www.chicagofed.org/publications/chicago-fed-letter/2018/404>).

Study the stationarity of the series you download and verify any cointegration relationship in the two cases.

Comment your results.