

## MASTER 1, Time Series

### Homework

Due date: March 31 at 3.30 pm

Maximum number of students per group: 3

#### Remarks:

- You can do the work in a team of three persons.
- There is no need to include the programs.
- You can use any software; you can program yourself the program when it is needed.
- You do not need to type the responses. You can scan a hand written document.
- Some material is not yet covered, in particular MLE of ARMA and information criteria (lecture of March 5), unit root tests (lecture of March 12), out-of sample forecasting comparison, and GARCH estimation (lecture of March 19). For the moment, you can do Problem I, questions 1 and 2 of Problem 3.

**Problem I:** Take a price index, the inflation, the GDP, the short-term interest rate, and the daily consumption of electricity of a developed country. You could take them from FRED or Mark Watson's website or any other source. It is better to work with the log of the index and the log of the GDP.

1. Study their time series properties: plot, descriptive statistics, ACF and PACF; do the same work for the first difference. Comment the results.
2. Find the best AR(p) process for each of the variables. Use the OLS estimation.
3. Provide 1-step and 3-step ahead forecasts for each variable.

**Problem II:** Take the inflation, the GDP and the short-term interest rate of a developed country over a long period, including 2024. You could take them from FRED.

1. Find out the best ARMA model for the 3 variables. You have to follow all the steps discussed during the classes.
2. Study the forecasting in sample and out-of-sample, you must compare two or 3 models for each variable.

**Problem III:** Take your favorite stock price; take daily data, at least 4 years of observations, including 2023.

1. Explain why it is better to work with (daily) log-returns.
2. Provide descriptive statistics (mean, variance, skewness, kurtosis, ACF, PACF) of the log-returns.
3. Find the best ARMA-GARCH model of the data.
4. Provide diagnostics.