

# Empirical Finance: Methods & Applications

## Problem Set 2

### Exercise 1

Simulate the following processes

$$\begin{aligned}y_t &= c + \varepsilon_t, \\y_t &= c + \beta t + \delta t^2 + \varepsilon_t, \\y_t &= c + y_{t-1} + \varepsilon_t, \\y_t &= c + \phi_1 y_{t-1} + \varepsilon_t, \\y_t &= c + \phi_1 y_{t-1} + \phi_2 y_{t-2} + \phi_3 y_{t-3} + \varepsilon_t, \\y_t &= c + \varepsilon_t + \theta_1 \varepsilon_{t-1}, \\y_t &= c + \varepsilon_t + \theta_1 \varepsilon_{t-1} + \theta_2 \varepsilon_{t-2}, \\y_t &= c + \phi_1 y_{t-1} + \varepsilon_t + \theta_1 \varepsilon_{t-1},\end{aligned}$$

where  $c = 0.2, \beta = 0.1, \delta = 0.05, \phi_1 = 0.4, \phi_2 = 0.3, \phi_3 = 0.2, \theta_1 = 0.4, \theta_2 = 0.3$ , and  $\varepsilon_{t-1} \sim N(0, 1)$ . For each process, simulate 1000 observations, and then plot the process, the autocorrelation function (ACF) and partial autocorrelation function (PACF).

### Exercise 2

Collect the following data (e.g., Bloomberg, Datastream, Yahoo Finance)

- S&P500 Index (SP500)
- GBPUSD exchange rate (GBPUSD)
- TBILL Rate (TBILL).
- VIX Index (VIX)

For each series, select the appropriate specification and then estimate the key parameters.