

# ECON7350: Applied Econometrics for Macroeconomics and Finance

## Tutorial 2: Forecasting Univariate Processes - I

At the end of this tutorial you should be able to:

- derive theoretical properties of ARMA processes;
- compute the theoretical ACF and PACF for a given ARMA processes;
- use R to compute and plot the sample ACF and PACF for time series data.

### Problems

- Assignment Project Exam Help**  
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1. Derive the expected value, variance, covariance, autocorrelation function (ACF), and partial autocorrelation function (PACF) for the following data generating processes (DGPs):
    - (a) AR(1):  $y_t = a_0 + a_1 y_{t-1} + \epsilon_t$ ,  $0 \leq |a_1| < 1$ ;
    - (b) MA(1):  $y_t = b_0 + b_1 \epsilon_{t-1} + \epsilon_t$ ;
    - (c) ARMA(1, 1):  $y_t = a_0 + a_1 y_{t-1} + b_1 \epsilon_{t-1} + \epsilon_t$ ,  $0 \leq |a_1| < 1$ .
  2. Compute the true ACF values for the following DGPs:
    - DGP1:  $y_t = 0.75y_{t-1} + \epsilon_t$ ;
    - DGP2:  $y_t = -0.75y_{t-1} + \epsilon_t$ ;
    - DGP3:  $y_t = 0.95y_{t-1} + \epsilon_t$ ;
    - DGP4:  $y_t = 0.5y_{t-1} + 0.25y_{t-2} + \epsilon_t$ ;
    - DGP5:  $y_t = 0.25y_{t-1} - 0.5y_{t-2} + \epsilon_t$ ;
    - DGP6:  $y_t = 0.75\epsilon_{t-1} + \epsilon_t$ ;
    - DGP7:  $y_t = 0.75\epsilon_{t-1} - 0.5\epsilon_{t-2} + \epsilon_t$ ;
    - DGP8:  $y_t = 0.75y_{t-1} + 0.5\epsilon_{t-1} + \epsilon_t$ .
  3. The data file `arma.csv` contains (simulated) data for each of the DGPs in Question 2. Import the data into R. Compute, plot, and describe the behaviour of the ACF and PACF for each DGP. Discuss the effects of parameter signs. Hint: use the `acf` and `pacf` commands, respectively.