

# ECON 3350/7350: Applied Econometrics for Macroeconomics and Finance

## Tutorial 2: Univariate Time Series - I

This tutorial aims to get you familiar with the fundamental features of univariate time series models.

1. Derive the expected value, variance, covariance, autocorrelation function (ACF), and partial autocorrelation function (PACF) for the time series  $y_t$  having the following data generating processes (DGP):

(a) AR(1):  $y_t = a_0 + a_1 y_{t-1} + \epsilon_t, 0 \leq |a_1| < 1.$

(b) MA(1):  $y_t = \beta_0 + \beta_1 \epsilon_{t-1} + \epsilon_t.$

(c) ARMA(1,1):  $y_t = a_0 + a_1 y_{t-1} + \beta_1 \epsilon_{t-1} + \epsilon_t, 0 \leq |a_1| < 1.$

2. Compute the true ACF values for the following DGPs:

(1) DGP1:  $y_t = 0.75y_{t-1} + \epsilon_t$

(2) DGP2:  $y_t = -0.75y_{t-1} + \epsilon_t$

(3) DGP3:  $y_t = 0.95y_{t-1} + \epsilon_t$

(4) DGP4:  $y_t = 0.5y_{t-1} + 0.25y_{t-2} + \epsilon_t$

(5) DGP5:  $y_t = 0.25y_{t-1} - 0.5y_{t-2} + \epsilon_t$

(6) DGP6:  $y_t = 0.75\epsilon_{t-1} + \epsilon_t$

(7) DGP7:  $y_t = 0.75\epsilon_{t-1} - 0.5\epsilon_{t-2} + \epsilon_t$

(8) 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 to Stata and use the variable  $t$  to declare time series. Compute, plot, and describe the behavior of the ACF and PACF of each DGP. Discuss the effects of parameter signs. Hint: Use the *ac* and *pac* commands, respectively.