ECON 3350/7350: Applied Econometrics for Macroeconomics and Finance

Tutorial 3: Univariate Time Series - II

The point of this question is to suggest a general "road map" for analyzing univariate time series with ARMA models.

1. The file `Merck.csv` contains daily data of stock prices of Merck & Co., Inc. (MRK) during 2001-2013. In what follows, we use y_t to denote the adjusted closing prices (*adjclose* in the data) in time t.

   (a) Load the data to Stata, generate a date variable, declare the data as time series, and keep only observations during January 1, 2011 - January 31, 2012.

   (b) Construct the following variables:
   - Changes in prices: $\Delta y_t = y_t - y_{t-1}$
   - Log returns: $r_t = \log(y_t/y_{t-1})$

   (c) Draw time series plots of y_t and Δy_t and comment on their stationarity[1].

   (d) Compute and plot (using either *ac/pac* or *corrgram*) ACF and PACF of y_t and Δy_t. Comment on your findings.

   (e) Based on the ACF and PACF of Δy_t you obtained in (d), propose and estimate at least three ARMA(p, q) models for Δy_t.

   (f) Use AIC and BIC to select an ARMA(p, q) model. Estimate the AR and MA parameters of this model and report estimation results.

   (g) Draw a time series plot of the residuals you obtain via estimating the ARMA model selected in (f). Comment on your findings. Run the Ljung-Box test (at significance level $\alpha = 5\%$) for the white noises hypothesis and report test results. Note that you will need to adjust the degree(s) of freedom as you are analyzing estimation residuals.

   (h) Forecast MRK stock prices in January, 2012. Compare your predicted prices with real prices in the data.

   (i) Repeat (c) - (h) for the log returns r_t. Note that here you forecast the daily returns $(y_t - y_{t-1})/y_{t-1}$ in January, 2012. Hint: Recall that $(y_t - y_{t-1})/y_{t-1} \approx r_t$.

[1] You should use only 2011 data for parts (c)-(g).