

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 stationarity¹.
 - (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 $(y_t - y_{t-1})/y_{t-1} \approx r_t$.

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