

ECON7350: Applied Econometrics for Macroeconomics and Finance

Tutorial 3: Forecasting Univariate Processes - II

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

- estimate a set of specified ARMA models using `for` loops;
- reduce the set of models using information criteria and residuals analysis;
- generate forecasts and predictive intervals for a specified $\text{ARMA}(p, q)$;
- compare and evaluate forecasts obtained from different ARMA models.

Assignment Project Exam Help Problems

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 (`Adj_Close` in the data) at time t .
 - (a) Load the data into R and construct a data set with observations in the range 1 January 2011—31 January 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 , Δy_t and r_t ; comment on the stationarity of the processes that may have generated these observations.
 - (d) Compute and plot the sample ACFs and PACFs of y_t and Δy_t . Comment on your findings.
 - (e) Propose and estimate 25 $\text{ARMA}(p, q)$ models for Δy_t .
 - (f) Use the AIC and BIC to reduce the set of $\text{ARMA}(p, q)$ models.
 - (g) Draw time series plots of the estimated residuals you obtained for the ARMA models selected in part (f). Comment on your findings. Run the Ljung-Box test (at the $\alpha = 5\%$ significance level) to test the white noise hypothesis on estimated residuals obtained from each ARMA in the set obtain in part (f) and report the test results. Use this information to identify the adequate set of specified ARMAs.

- (h) Forecast changes in MRK stock prices in January, 2012. For each ARMA model in the adequate set, compare your predicted price changes with real price changes in the data. Compare the forecasts you obtained as well as their “quality” across ARMA models and comment on the robustness of the generated forecasts.
- (i) Forecast MRK prices y_t (levels this time, instead of changes) using an ARMA(2, 1) model only. Compare your predicted prices with real prices in the data. Compare the price forecasts obtained in this part with price forecasts obtained by transforming the forecasts in part (h). HINT: you will need convert predicted prices changes to predicted prices.
- (j) OPTIONAL: Repeat parts (d)–(h) for log returns r_t . Note that here you will forecast daily returns $(y_t - y_{t-1})/y_{t-1}$ in January, 2012. Hint: Recall that $(y_t - y_{t-1})/y_{t-1} \approx r_t$.

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