QE: Computer Forecasting Exercises

These computer exercises are intended to familiarize students with statistical software in order to estimate econometric models for forecasting. It can also be used as an assignment for the material covered in the lectures in week 7, although this material will also be covered in the final QE problem set. Although this exercise could be done with most econometric packages, I recommend OxMetrics because it is very good for time series analysis and is freely available to all Oxford university members.

1 Forecasting inflation

For this exercise, we will use quarterly data on the UK GDP deflator in the file UKGDPdeflator.xls, available on weblearn. This data is obtained from the Federal Reserve Bank of St. Louis database FRED, and covers the period 1960Q1 to 2016Q4. The file contains one series, denoted here by P_t.

1. Using the data provided create a series for inflation $\pi_t = 400 \times \ln P_t / P_{t-1}$, and $\Delta\pi_t = \pi_t - \pi_{t-1}$.

2. Plot π_t and $\Delta\pi_t$ against time, and their correlograms. Comment on the results.

3. Let $\hat{\pi}_{t|t-1}$ denote a one-step-ahead forecast of inflation, i.e., a forecast made in period $t-1$ for inflation in period t. Explain why on the basis of the plots in part 2,
$$\hat{\pi}_{t|t-1} = \pi_{t-1} \tag{1}$$
might be a reasonable forecast.

4. To improve upon the forecast in part 3, you wish to use more information from the historical data. Estimate the following (AR(1)) model for $\Delta\pi_t$ (AR(2) for π_t)

$$\Delta\pi_t = \beta_0 + \beta_1 \Delta\pi_{t-1} + \epsilon_t \tag{2}$$

   by OLS over the period *up to 10 periods before the end of the sample.*

   Comment on the significance of the coefficients and the overall fit of the regression.

5. Compute the 10 one-step-ahead out of sample forecasts of inflation based on (2) and find the root Mean Square forecast error (RMSFE). Compare this with the RMSFE from the model (1).

6. You wish to test whether earlier lags of inflation have predictive power. Estimate the following AR(4) model:

$$\Delta\pi_t = \beta_0 + \beta_1 \Delta\pi_{t-1} + \beta_2 \Delta\pi_{t-2} + \beta_3 \Delta\pi_{t-3} + \beta_4 \Delta\pi_{t-4} + \epsilon_t \tag{3}$$

   by OLS and test that the additional lags are relevant.

7. Compare the RMSFEs of model (3) to the ones you found before. Comment on your results.

2 Forecasting Exchange Rates

Suppose you we are interest in predicting the value of USD/GBP future spot nominal exchange rates. For this purpose, you consider an autoregressive model for the dynamic behaviour of exchange rates:

$$s_t = \gamma_0 + \gamma_1 s_{t-1} + ... + \gamma_p s_{t-p} + \epsilon_t \tag{4}$$

where s_t is the natural logarithm of the spot exchange rate at time t and ϵ_t is iid.

In order to estimate the parameters of this model and obtain forecasts, we use exchange rate data from FRED on the US/UK exchange rate, which contains monthly averages of the spot USD/GBP nominal exchange rate from January 1971 to May 2017. The data is in the file EXUSUK.xls available on weblearn.

1. Using the dataset provided, plot the spot nominal exchange rate s_t against time and its correlogram. Comment on its time series properties. Perform the same exercise for Δs_t.

2. Perform an Augmented Dickey Fuller (ADF) test for s_t and Δs_t in order to determine the order of integration of s_t. Carefully explain how you select the lags in the ADF regression.

3. Explain what the assumption that $s_t \sim I(1)$ means for the coefficients of (4). Imposing this assumption, estimate the model over the sample up to March 2017.

4. Let $s_{t+l|t} = E(s_{t+l}|s_t, s_{t-1}, ...)$ denote the l-step ahead forecasts of the log exchange rate. Using the model estimated in part 3, predict the value of the nominal exchange rate in April 2017, May 2017 and June 2017 using information only up to March 2017.