Erasmus School of Economics

MOOC Econometrics

Test Exercise 6

Notes:

- See website for how to submit your answers and how feedback is organized.
- This exercise uses the datafile `TestExer6` and requires a computer.
- The dataset `TestExer6` is available on the website.

Goals and skills being used:

- Experience the process of practical application of time series analysis.
- Get hands-on experience with the analysis of time series.
- Give correct interpretation of outcomes of the analysis.

Questions

This test exercise uses data that are available in the data file T estExer6. T he q uestion o f i nterest i s t o model monthly production of Toyota passenger cars and to investigate whether the monthly production of all other brands of Japanese passenger cars has predictive power for the production of Toyota. Monthly production data are available from January 1980 until December 2000. The data for January 1980 until December 1999 are used for specification and estimation of models, and the data for 2000 are left out for forecast evaluation purposes.

In answering the questions below, you should use the seasonally adjusted production data denoted by 'toyota-sa' and 'other-sa'. We will denote these variables by y = toyota-sa and x = other-sa.

(a) Make time series plots of the variables y_t and x_t, and also of the share of Toyota in all produced passenger cars, that is $y_t/(y_t + x_t)$. What conclusions do you draw from these plots?

(b) (i) Perform the Augmented Dickey-Fuller (ADF) test for y_t. In the ADF test equation, include a constant (α) and three lags of Δy_t, as well as the variable of interest, y_{t-1}. Report the coefficient of y_{t-1} and its standard error and t-value, and draw your conclusion.

(ii) Perform a similar ADF test for x_t.

(c) Perform the two-step Engle-Granger test for cointegration of the time series y_t and x_t. In step 1, regress y_t on a constant and x_t. In step 2, perform a regression of the residuals e_t in the model $\Delta e_t = \alpha + \rho e_{t-1} + \beta_1 \Delta e_{t-1} + \beta_2 \Delta e_{t-2} + \beta_3 \Delta e_{t-3} + \omega_t$. What is your conclusion?

(d) Construct the first twelve sample autocorrelations and sample partial autocorrelations of Δy_t and use the outcomes to motivate an AR(12) model for Δy_t. Check that only the lagged terms at lags 1 to 5, 10, and 12 are significant, and estimate the following model: $\Delta y_t = \alpha + \sum_{j=1}^{5} \beta_j \Delta y_{t-j} + \beta_6 \Delta y_{t-10} + \beta_7 \Delta y_{t-12} + \varepsilon_t$ (recall that the estimation sample is Jan 1980 - Dec 1999).

(e) Extend the model of part (d) by adding the Error Correcion (EC) term $(y_t - 0.45 x_t)$, that is, estimate the ECM $\Delta y_t = \alpha + \gamma(y_{t-1} - 0.45 x_{t-1}) + \sum_{j=1}^{5} \beta_j \Delta y_{t-j} + \beta_6 \Delta y_{t-10} + \beta_7 \Delta y_{t-12} + \varepsilon_t$ (estimation sample is Jan 1980 - Dec 1999). Check that the EC term is significant at the 5% level, but not at the 1% level.

(f) Use the models of parts (d) and (e) to make two series of 12 forecasts of monthly changes in production of Toyota passenger cars in 2000. At each month, you should use the data that are then available, for example, to forecast production for September 2000 you can use the data up to and including August 2000. However, do not re-estimate the model and use the coefficients as obtained in parts (d) and (e). For each of the two forecast series, compute the values of the root mean squared error (RMSE) and of the mean absolute error (MAE). Finally, give your interpretation of the outcomes.