

## 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 TestExer6. The question of interest is to model monthly inflation in the Euro area and to investigate whether inflation in the United States of America has predictive power for inflation in the Euro area. Monthly data on the consumer price index (CPI) for the Euro area and the USA are available from January 2000 until December 2011. The data for January 2000 until December 2010 are used for specification and estimation of models, and the data for 2011 are left out for forecast evaluation purposes.

- Make time series plots of the CPI of the Euro area and the USA, and also of their logarithm  $\log(\text{CPI})$  and of the two monthly inflation series  $\text{DP} = \Delta \log(\text{CPI})$ . What conclusions do you draw from these plots?
- Perform the Augmented Dickey-Fuller (ADF) test for the two  $\log(\text{CPI})$  series. In the ADF test equation, include a constant ( $\alpha$ ), a deterministic trend term ( $\beta t$ ), three lags of  $\text{DP} = \Delta \log(\text{CPI})$  and, of course, the variable of interest  $\log(\text{CPI}_{t-1})$ . Report the coefficient of  $\log(\text{CPI}_{t-1})$  and its standard error and  $t$ -value, and draw your conclusion.
- As the two series of  $\log(\text{CPI})$  are not cointegrated (you need not check this), we continue by modelling the monthly inflation series  $\text{DPEUR} = \Delta \log(\text{CPIEUR})$  for the Euro area. Determine the sample autocorrelations and the sample partial autocorrelations of this series to motivate the use of the following AR model:  $\text{DPEUR}_t = \alpha + \beta_1 \text{DPEUR}_{t-6} + \beta_2 \text{DPEUR}_{t-12} + \varepsilon_t$ . Estimate the parameters of this model (sample Jan 2000 - Dec 2010).
- Extend the AR model of part (c) by adding lagged values of monthly inflation in the USA at lags 1, 6, and 12. Check that the coefficient at lag 6 is not significant, and estimate the ADL model  $\text{DPEUR}_t = \alpha + \beta_1 \text{DPEUR}_{t-6} + \beta_2 \text{DPEUR}_{t-12} + \gamma_1 \text{DPUSA}_{t-1} + \gamma_2 \text{DPUSA}_{t-12} + \varepsilon_t$  (sample Jan 2000 - Dec 2010).
- Use the models of parts (c) and (d) to make two series of 12 monthly inflation forecasts for 2011. At each month, you should use the data that are then available, for example, to forecast inflation for September 2011 you can use the data up to and including August 2011. However, do not re-estimate the model and use the coefficients as obtained in parts (c) and (d). For each of the two forecast series, compute the values of the root mean squared error (RMSE), mean absolute error (MAE), and the sum of the forecast errors (SUM). Finally, give your interpretation of the outcomes.