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University of New South Wales
School of Economics
Financial Econometrics
Tutorial 5

1. (Error correction and common trend)

Suppose that I(1) series y_t and x_t are cointegrated and $\varepsilon_t = y_t - \beta x_t$ is an independent white noise process. Assume that $\Delta x_t = \gamma \Delta x_{t-1} + \eta_t$ where η_t is also an independent white noise process. Here β and γ are constant parameters. Show that the changes in y_t and x_t are governed by the vector error correction model

$$\Delta x_t = \alpha_1 (y_{t-1} - \beta x_{t-1}) + \phi_{11} \Delta x_{t-1} + u_{1t} ,$$

$$\Delta y_t = \alpha_2 (y_{t-1} - \beta x_{t-1}) + \phi_{21} \Delta x_{t-1} + u_{2t} .$$

Express the coefficients α_1, α_2, ϕ_{11}, ϕ_{21} in terms of the original parameters β and γ. Express the shocks u_{1t} and u_{2t} in terms of the white noise processes ε_t and η_t. What is the common trend in this example and why?

2. In light of stylized facts of financial returns, how likely is that an AR(p) or MA(q) or their combination ARMA(p,q) model are suitable for modelling financial return series? Which stylized facts are likely to be violated?

3. (Cointegration and error correction model)

This question is based on the data in the Excel file **fisher_update.XLS**. The file contains 171 quarterly observations, from 1969Q4 to 2012Q2, on the Australian Consumer price Index (P) and on the yield to maturity of 90-day bank accepted bills (R).

(a) Generate the inflation rate as: INF=400*(log(P(1))-log(P)). When we construct the inflation rate this way, we lose the last observation, namely, 2012Q2. We change the sample to 1984Q1 to 2012Q1, which is the post-float period of the exchange rate. Plot R and INF. Comment on whether or not R and INF co-move.

(b) Throughout this and the following parts of the question, continue to use the sample **1984Q1-2012Q1**. Assume that both R and INF are I(1) processes. Estimate the regression

$$\mathrm{R}_t = \beta_0 + \beta_1 \mathrm{INF}_t + \varepsilon_t$$

and perform an ADF test, without intercept and time trend, on the residuals from the regression. What do you conclude?

(c) Carry out the Engle-Granger cointegration test. Comment on the result.

(d) Regardless of your result in (c), assume that R_t and INF_t are cointegrated. If the cointegration error $\varepsilon_t = \mathrm{R}_t - \beta_0 - \beta_1 \mathrm{INF}_t$ is positive at t, what would you say about the likely movements in R_{t+1} and INF_{t+1}?

(e) Estimate the following two error-correction equations separately using OLS

$$\Delta \mathrm{R}_t \quad = c_1 + \alpha_1 (\mathrm{resid01})_{t-1} + \sum_{j=1}^{4} (\phi_{11,j} \Delta \mathrm{R}_{t-j} + \phi_{12,j} \Delta \mathrm{INF}_{t-j}) + u_{1t} \,,$$

$$\Delta \mathrm{INF}_t = c_2 + \alpha_2 (\mathrm{resid01})_{t-1} + \sum_{j=1}^{4} (\phi_{21,j} \Delta \mathrm{R}_{t-j} + \phi_{22,j} \Delta \mathrm{INF}_{t-j}) + u_{2t} \,.$$

Comment on your results. Do you observe error correction mechanism in the estimated equations?

(f) Can you reduce the "size" of the model in (e) by dropping some lags? Re-estimate the error-correction equations when insignificant lagged terms of $\Delta \mathrm{R}_t$ and $\Delta \mathrm{INF}_t$ are dropped from the equations you estimated in part (e). Comment on the new results.

4. Simulation Exercise in Excel.

The Analysis ToolPak is a Microsoft Office Excel add-in program that is available when you install Microsoft Office or Excel.

To use the Analysis ToolPak in Excel, however, you need to load it first.

1. Click the **Microsoft Office Button** , and then click **Excel Options**.
2. Alternatively you may get to **Excel Options** from open Excel file, **File** -> **Options**
3. Click **Add-Ins**, and then in the **Manage** box, select **Excel Add-ins**.
4. Click **Go**.
5. In the **Add-Ins available** box, select the **Analysis ToolPak** check box, and then click **OK**.

a. **Tip** If **Analysis ToolPak** is not listed in the **Add-Ins available** box, click **Browse** to locate it.
b. If you get prompted that the Analysis ToolPak is not currently installed on your computer, click **Yes** to install it.

6. After you load the Analysis ToolPak, the **Data Analysis** command is available in the **Analysis** group on the **Data** tab.

Generate 2 random walk series:

$$y_t = y_{t-1} + \varepsilon_t, \ \varepsilon_t \sim iid \text{ WN N}(0,1)$$

$$x_t = x_{t-1} + u_t, \ u_t \sim iid \text{ WN N}(0,1)$$

To do this in excel first generate two standard normal random variables. **Data -> Data Analysis -> Random number generation**. We need:

Number of variables 2

Number of random numbers 1000

Distribution: Normal

OK

This gives you two random normal variables. Set $y_1 = 0,\ x_1 = 0$. Generate y_t, x_t t>1 using the equations above.

Regress y on x using **Data** -> **Data Analysis -> Regression**

Select range for y and x and press ok.

Analyse the output of the regression. Do you expect these results? What is going on?