ECON7350 - Tutorial 4 Solutions

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Engle-Granger Test

- If x_t and y_t are non-stationary and Order of integration d=1, then a linear combination of them must be stationary for some value of β and u_t. In other words:

$$y_t - \beta x_t = u_t$$

  where u_t is stationary.
- If we knew β , we could just test it for stationarity with something like a **Dickey–Fuller test** and be done. But because we don't know β , we must estimate this first, generally by using ordinary least squares (**by regressing y_t on x_t and an intercept**) and then run our stationarity test on the estimated u_t series, often denoted $\hat{u}_t$.
- The null hypothesis of the ADF test is that the residuals have a unit root. Therefore, the Engle-Granger test considers the null hypothesis that there is no cointegration.

Question 1 Summary

- *i3y*: is not empirically distinguishable from $I(1)$
- *i5y*: is not empirically distinguishable from $I(1)$ (ambiguous).
- *i90d*: is empirically distinguishable from $I(1)$
- *i180d*: is not empirically distinguishable from $I(1)$ (ambiguous)

Question 3

$$i5y = constant + i3y + i90d + i180 + u$$

Assuming first stage regression residuals are mean-indepedent, there are five possibilities.

1. i3y, i5y, i90d and i180d are all I(0).
2. Any three processes are I(1) and cointegrated while a fourth is I(0); for example, we could have i3y, i5y and i90d are cointegrated and i180d is I(0). The same could hold for any other combinations.
3. Any two processes are I(1) and cointegrated while the other two are I(0); for example, we could have i3y and i5y cointegrated while i90d and i180d are both I(0).
4. Any two processes are I(1) and cointegrated, and the other two processes are also I(1) and cointegrated, but the four processes are not all cointegrated with each other in a single cointegration relation.
5. All four processes are I(1) and cointegrated in a single cointegration relation.