Assignment 4 for the Applied Econometric Time series course (MSc 5314)

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Hand in to Claire Thürwächter

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Consider the bivariate error correction system

$$\Delta r_{St} = \alpha_S(r_{Lt-1} - \beta r_{St-1} - \mu) + \sum_{i=1}^{2} a_{i,11}\Delta r_{St-i} + \Delta a_{i,12}\Delta r_{Lt-i} + \epsilon_{St} \quad \alpha_S \geq 0$$

$$\Delta r_{Lt} = -\alpha_L(r_{Lt-1} - \beta r_{St-1} - \mu) + \sum_{i=1}^{2} a_{i,21}\Delta r_{St-i} + \Delta a_{i,22}\Delta r_{Lt-i} + \epsilon_{Lt} \quad \alpha_L \geq 0$$

where $r_{St} \sim I(1)$ and $r_{Lt} \sim I(1)$, and ϵ_{St} and ϵ_{Lt} are white noise processes.

1a. Argue why r_{St} and r_{Lt} must be cointegrated. What is the cointegration vector? What is the long-run equilibrium?

1b. Formulate the null hypothesis that r_{Lt} does not Granger cause r_{St}.

1c. Explain the adjustment mechanism towards the long-run equilibrium if (i) $r_{Lt-1} > \beta r_{St-1}+\mu$ and (ii) $r_{Lt-1} < \beta r_{St-1}+\mu$ assuming $\alpha_S, \alpha_L > 0$, and (iii) $r_{Lt-1} > \beta r_{St-1}+\mu$ and (iv) $r_{Lt-1} < \beta r_{St-1} + \mu$ assuming $\alpha_S > 0$ and $\alpha_L = 0$.

1d. Assume that $r_{St} \sim I(1)$ and $r_{Lt} \sim I(1)$ (as before) but not cointegrated. Why is it a problem to run the regression $r_{St} = \mu + \beta_1 r_{Lt} + \varepsilon_t$?

2. Do exercise 4 (but not 4f) in the textbook (pp.402-403)[2]. **Remark:** It is possible that the values you obtain differ from those reported in the text to the exercise since the sample is extended. However, the main conclusions should be the same.

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[2]The data for this exercise is available on the course web in the file `A4_2019.dta`. It contains quarterly observations for the 3-month T-bill (tbill) as well as the 5-year and 10-year Treasury rate (r5 and r10) for the U.S. from 1960Q1 to 2018Q3 ($T = 235$).