Elements of Econometrics. 2022-2023.
Class 22. Cointegration

Problem 1. What is the order of integration of the time series? What series are called integrated I(0)? What series are called integrated I(1) and so on? What type of time series are MA(1), AR(1) and random walk ?

Problem 2. Explain what do you understand by difference-stationary and trend-stationary time series. Why is it important to know whether a variable is difference- or trend-stationary?

Problem 3. Consider a time series process

$$\ln Y_t = \alpha + \beta t + u_t;\ t = 1, 2, ..., T$$

Examine the order of integration of In Y_t.

Problem 4. What time series are called cointegrated?

Problem 5. Consider two time series variables Y_t and X_t both are integrated of order one. Explain how you will test that Y_t and X_t are cointegrated.

Problem 6. (Computer practice) Using file EXPEND.WF1, investigate whether time series COSM, DPI and PRELCOSM are cointegrated

Problem 7. Explain the meaning of spurious regression. Why is it important to know whether the time series used in the regression model are stationary? Consider two variables Y_t and X_t, where

$$Y_t = \alpha + Y_{t-1} + \varepsilon_t$$
$$X_t = \beta + X_{t-1} + \nu_t.$$

ε_t and ν_t are unrelated white noise processes. A researcher regresses Y_t on X_t and tests the significance of the slope coefficient. Discuss in detail the result he will get.

Problem 8. How can you make sure that some regression is spurious? Give an example and describe your actions.

Problem 9. (Computer practice) How to construct and use models in differences? What are their comparative advantages and disadvantages?

Problem 10. Briefly explain the following: Error correction model.

Problem 11. How to use **error correction model in practice?** What are their comparative advantages and disadvantages?

Problem 12. Explain what is Granger Causality. How to test Granger Causality? What are possible results of this test?

Problem 13. Explain what is Vector Autoregression??

Problems from real exams

Problem 14. (ICEF Exam)
Consider an $ADL(2,1)$ model:

$$Y_t = \alpha_1 + \alpha_2 Y_{t-1} + \alpha_3 Y_{t-2} + \alpha_4 X_t + \alpha_5 X_{t-1} + u_t;\ t = 1, 2, ..., T. \quad (1)$$

where both Y_t and X_t are $I(1)$, u_t is the disturbance term where $\mathrm{E}(u_t) = 0;\ \mathrm{E}(u_t^2) = \sigma^2$ and $\mathrm{E}(u_s u_t) = 0$ for any $s \neq t$. We will assume that all variables are in logarithmic form so, for example α_4 can be interpreted as a short term *X*-elasticity of *Y*.

(a) Explore long run dynamics of this model and find the long term *X*-elasticity of *Y*. How would you estimate a cointegrating relationship between Y_t and X_t?

(b) Transform the model (1) into the one relating to the first differences of *X* and *Y*. What are advantages and disadvantages of this model?

(c) Supposing that the cointegrating relationship between *X* and *Y* had been found, express the model (1) as an error correction type model, and describe briefly its dynamics.