

Second midterm test in Advanced
Econometrics

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1. A vector autoregression is given in its standard form ($(\varepsilon_{1t}, \varepsilon_{2t})'$ is white noise)

$$\begin{bmatrix} X_t \\ Y_t \end{bmatrix} = \begin{bmatrix} 0.5 & 0.5 \\ 0 & 1 \end{bmatrix} \begin{bmatrix} X_{t-1} \\ Y_{t-1} \end{bmatrix} + \begin{bmatrix} \varepsilon_{1t} \\ \varepsilon_{2t} \end{bmatrix}.$$

- (a) Defining $x = (X, Y)'$, transform the system to its error-correction form $\Delta x_t = \mathbf{\Pi}x_{t-1} + \varepsilon_t$ and determine $\mathbf{\Pi} = \gamma\beta'$, γ , and β . What are the cointegrating vectors in this example? What is the cointegrating rank here?
- (b) The characteristic polynomial for a cointegrated VAR has some unit roots and some stable roots. What is this characteristic polynomial for the system in (a)?

2. In a vector autoregressive system of dimension 3, you find evidence that the cointegrating rank is 1. Inspired by this finding, you regress the first variable X on the other two variables Y and Z . You think that this is a cointegrating regression.
- (a) Why can this procedure fail entirely? Presuming that the DF test on the residuals fails to reject, can it make sense to try again and to regress Y on X and Z ?
 - (b) If you find autocorrelation in the residuals of this cointegrating regression, do you think it makes sense to add lags of Y and Z to the regressors?
 - (c) Imagine you join another variable to the system, such that it has a dimension of 4. If that variable is stationary, what is the cointegrating rank of the 4-dimensional system?

3. A panel consists of 100 yearly measurements at five woodland locations. Available variables are an index of tree species diversity and three covariates: concentration of carbon dioxide in the air, concentration of sulphur in the air, average temperature over the year. You wish to determine the effects of the pollutants and of climate on the tree diversity.
 - (a) Do you feel that a fixed-effects or a random-effects model is more adequate here? Why?
 - (b) You run a Hausman test, and the test rejects. Would you revise your answer to (a) in the light of this result?
 - (c) Try and provide an interpretation of the individual ‘effect’ in this example.