Econometrics test

PhD in Economics (XXVth cycle)

2023, January 9th — 3 hours

Name: _____ Surname: _____

1. Consider the following equations:

$$x_t = 1 + \varepsilon_t, \qquad y_t = 1 + 0.2x_{t-1} + u_t \qquad \text{and} \qquad z_t = 1 + 0.5x_{t-1} + 0.3y_{t-1} + \eta_t,$$

where $\begin{bmatrix}\varepsilon_t & u_t & \eta_t\end{bmatrix}$ is a trivariate white noise with zero mean and constant covariance matrix $\mathbf{\Sigma}$.

(a) Select all the right definitions. Suppose $x_t = \Delta X_t$, then the process X_t is

◯ a white noise ◯ trend stationary ◯ a random walk
◯ mean reverting ◯ difference stationary ◯ a random walk with drift

(b) Is the process z_t stationary?

◯ YES ◯ NO ◯ CAN'T SAY

Because _____

(c) Using only matrix notation, write the three equations as a VAR(1) model.

$$\begin{bmatrix} x_t \\ y_t \\ z_t \end{bmatrix} =$$

(d) Using only matrix notation, write the same model for the first differences.

$$\begin{bmatrix} \Delta x_t \\ \Delta y_t \\ \Delta z_t \end{bmatrix} =$$

(e) Given the equation (c) is it possible to conclude that the VAR(1) is stationary?

◯ YES ◯ NO ◯ CAN'T SAY

Why? _____

2. With reference to the previous exercise, consider the VAR(1) model

(a) Is it possible to apply the Wold's Representation Theorem?

◯ YES, the observationally equilvalent model is

$$\begin{bmatrix} x_t \\ y_t \\ z_t \end{bmatrix} =$$

◯ NO, because _____

_____

_____

(b) Compute all the unconditional expectations.

$E(x_t) =$ _____, $E(y_t) =$ _____, $E(z_t) =$ _____

(c) Suppose $\hat{y}_t = \underset{(0.075)}{1} + \underset{(0.0025)}{0.2}\, x_{t-1}$, is the OLS estimate of the second equation over a sample of $T = 1000$ observations. The numbers in parentheses are the estimated standard errors. Does x_t 'Granger-causes' y_t?

◯ YES ◯ NO

Test: _____ Distribution: _____ Test statistic: _____

Decisione: DON'T REJECT ◯ REJECT ◯

(d) Suppose $\hat{z}_t = \underset{(0.075)}{1} + \underset{(0.002)}{0.5}\, x_{t-1} + \underset{(0.0016)}{0.3}\, y_{t-1}$, is the OLS estimate of the third equation over a sample of $T = 1000$ observations. The numbers in parentheses are the estimated standard errors and $corr(x_t, y_t) = 0$ for each t. Does x_t 'Granger-causes' y_t?

◯ YES ◯ NO

Test: _____ Distribution: _____ Test statistic: _____

Decisione: DON'T REJECT ◯ REJECT ◯