UNIVERSITY OF LISBON

ISEG- Lisbon School of Economics and Management

Exam - January 2019

Advanced Econometrics

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Use an answer booklet of ISEG (folha de teste do ISEG)

Instructions (please read before starting): Write in a clear legible manner in ink/ballpoint. Do not use pencils or erasable pens. Calculators are permitted. If you are asked to derive something, give all intermediate steps also. Do not answer questions with a "yes" or "no" only, but carefully justify your answer.

Section A - Topics in Microeconometrics

Question 1

Consider a random sample $\left\{(Y_i, X_i')'\right\}_{i=1}^{n}$ and the following binary choice model:

$$p_i \equiv P[Y_i = 1|X_i] = G(X_i'\beta) \qquad i = 1, \ldots, n,$$

where Y_i is a binary random variable that can take values 0 or 1, X_i is a k-vector of explanatory variables, and β is a k-vector of parameters.

(a) *(2 marks)* Suppose that the function $G(\cdot)$ is such that $G(X_i'\beta) = X_i'\beta$. Address the problems that would arise by estimating the above model by Ordinary Least Squares. Discuss how you could overcome these problems by imposing suitable restrictions on the function $G(\cdot)$.

(b) *(2 marks)* Discuss the Latent Variable Threshold Model, including any identification issue that might arise. Show how this framework allows to model $P[Y_i = 1|X_i]$.

(c) Consider now the Logit model and $k = 1$:

  (i) *(2 marks)* Show that the expected value of the score vector evaluated at the true value of the parameter is zero.

  (ii) *(2 marks)* Obtain the marginal effect for the Logit model $\partial E(Y_i|X_i)/\partial X_i$, and discuss how it is related to the parameter β.

Section B - Topics in Time Series

Question 2

Consider the stationary $MA(2)$ process $Y_t = c + \varepsilon_t + \theta_1\varepsilon_{t-1} + \theta_2\varepsilon_{t-2}$, where ε_t is a white noise process with variance σ_ε^2 and c is a constant.

(a) *(2 marks)* Derive an expression for $\mu = E(Y_t)$.

(b) *(2 marks)* Derive an expression for $\gamma_0 = var(Y_t)$ and for $\rho_j = \gamma_j/\gamma_0$, where $\gamma_j = E[(Y_t - \mu)(Y_{t-j} - \mu)]$, $(j = 1, 2, ...)$.

(c) *(2 marks)* Write down the $AR(\infty)$ representation of $Y_t^* = Y_t - E(Y_t)$ assuming that it is invertible.

Question 3

Consider the $VAR(1)$ model $z_t = \Phi_1 z_{t-1} + \varepsilon_t$ where $z_t = (z_{1t}, z_{2t})'$ and ε_t is a 2×1 vector of white noise processes with

$$var(\varepsilon_t) = \begin{bmatrix} \sigma_1^2 & \sigma_{12} \\ \sigma_{12} & \sigma_2^2 \end{bmatrix}.$$

(a) *(2 marks)* Let

$$\Phi_1 = \begin{bmatrix} 0.4 & 0.2 \\ -0.2 & 0.8 \end{bmatrix}.$$

Obtain the roots of the characteristic equation and show that the process is stationary.

(b) *(2 marks)* Obtain the values of the elements of the matrices Ψ_ℓ, for $\ell = 0, 1, 2$ in the infinite moving average representation

$$z_t = \sum_{\ell=0}^{\infty} \Psi_\ell \varepsilon_{t-\ell}.$$

(c) *(2 marks)* Obtain the impulse response function for z_{1t} to a shock to the variable z_{2t} of size σ_2, for horizons $\ell = 0, 1, 2$.

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