

ECONOMETRICS EXTRAORDINARY FINAL EXAM

UNIVERSIDAD CARLOS III DE MADRID

JULY 1, 2022

NAME:

NIA:

GROUP:

INSTRUCTIONS:

1. Write your name and group clearly in all sheets.
2. Leave an ID card with your picture on the desk.
3. Each of the four questions will be answered on (both sides of) the sheet where it is written. You cannot use the space on other sheets, or additional sheets.
4. You can use both sides of this sheet only for calculations which will not be evaluated.
5. All parts in each question have the same value.
6. The exam lasts 120 minutes:
 - (a) Questions 1, 2 and 3 will be answered in the first 80 minutes using only a pen or pencil.
 - (b) Then you can take your personal computer, where the Wooldridge database will have been downloaded in advance. 5 minutes will be given to boot the computer. Question 4 will be answered in 35 minutes using GRETL. Only GRETL can be visible on the computer screen, no other programs can be running. A personal calculator can be used if GRETL's one is not working. Critical values and p-values can be obtained in GRETL.

NAME: _____ GROUP: _____

QUESTION 1 (20%): We wish to estimate an Engel curve for food, relating the proportion of the household income spent in food (Y) to the total household income in euros (X). It is known that the specification of the Engel curve is a Working-Leser model,

$$Y = \beta_0 + \beta_1 \ln X + u \text{ with } \mathbb{E}(u|X) = 0.$$

- a. How are the model coefficients affected when the household income is measured in thousands of euros?
- b. How are the model coefficients when we take logarithms in base 10 instead of natural logarithms for X ?
- c. Suppose that the model is estimated with X in levels. That is, we estimate the model

$$Y = \delta_0 + \delta_1 X + v.$$

Provide an expression for the asymptotic bias of the OLS estimate of δ_1 as an estimate of β_1 .

ANSWER:

NAME: _____ GROUP: _____

QUESTION 2 (20%): We want to estimate the price elasticity of the demand for milk. We have annual observations of quantities (Q) and prices (P). We also have data on the annual rainfall (R). We propose a supply and demand model where Q and P are in logarithms.

- a. Show that the OLS estimate of the price elasticity in the demand curve is necessarily inconsistent.
- b. Propose an instrumental variable to estimate the price elasticity of demand and explain how you would test that this instrumental variable is relevant using a t statistic.
- c. What restriction must the structural forms coefficients fulfill for the proposed instrumental variable to be relevant?

ANSWER:

NAME: _____ GROUP: _____

QUESTION 3 (20%): Consider a regression model with dependent variable Y and two explanatory variables, X_1 and X_2 (and the intercept).

- a. Obtain and interpret the first-order conditions of the OLS estimates of the model parameters. Then use these equations to derive an expression for the OLS estimate of the coefficient of X_1 .
- b. Suppose that $X_{1i} = \alpha_0 + \alpha_1 X_{2i}$, $i = 1, \dots, n$, where α_0 and α_1 are constants different from zero. Which consequences this would have on the estimate in a.?
- c. Suppose that the model is estimated without intercept. Which restrictions must be imposed on Y , X_1 and X_2 for consistency of the X_1 and X_2 coefficients?

ANSWER:

QUESTION 4 WITH GRETL (40%): Use the file **CARD** from Wooldridge containing a sample of 3010 men. We are interested in estimating the returns to education for men in the United States, by regressing $\ln(wage)$ on $educ, exper, exper^2, black, SMSA$ and $south$, where $wage$ is the weekly wage in dollar cents, $educ$ is years of education, $exper$ is years of experience, $black = 1$ if the person is black, $SMSA = 1$ if the person lives in an Standard Metropolitan Statistical Area and $south = 1$ if he lives in a Southern state. You can assume that the variables $exper, exper^2, black, SMSA$ and $south$ are exogenous.

- a. Argue why $educ$ can be an endogenous explanatory variable in this regression and which are the consequences on the OLS estimates if so. Explain what variables can be considered exogenous and what variables can be considered endogenous among the following: mother's education ($motheduc$), having lived near a university before starting work ($nearc4$), and the intelligence quotient (IQ).
- b. Test that $motheduc$ and $nearc4$ are relevant instruments, reporting the model used to perform the test, the hypothesis to be tested on the parameters of interest, the statistic to use in the test and the criterion to reject or not the hypothesis tested. Are the instruments weak?
- c. Can you test that $motheduc$ and $nearc4$ are exogenous? If you answer is positive, perform the test: report the auxiliary model used, the hypothesis to be tested on the parameters of interest, the statistic to use in the test and the criterion to reject or not the hypothesis tested.
- d. Obtain the Two Stage Least Squares estimates of your model using $motheduc$ and $nearc4$ as instruments and interpret the coefficient of $educ$. Test that the returns to education are larger than 10% per additional year of education.

ANSWER: