Name: Matricola: email:

ECONOMETRICS - 19-02-2020

INSTRUCTIONS

1. Save this file to your local computer, fill it in as appropriate and save the edited version *under a different file name*: the name you should use for saving should be your "matricola" number and of course pdf extension. So for instance a student whose matricola is S1071010 should save the filled-in version of this document as `S1071010.pdf`.

   Note: you may experience problems in some software environments. I have tried to test the file under as many platforms as I could.

   - Under Linux, both evince and okular work OK for opening, editing and saving the file, xpdf does not.
   - The same goes for the internal pdf reader under OSX; on a Mac, you can also use Acrobat Reader, but I am told that in some cases you will have to jump a few hurdles.
   - If you use Windows, your best bet seems to be a recent version of Acrobat Reader.
   - As for Android, I've briefly tried xodo, that seems to get the work done, but I haven't tested it very thoroughly.
   - Under iOS, I think the internal pdf reader should work, but I have no first-hand experience.

   However, keep in mind that **no browser will let you fill in the form and save it**; so, whatever your operating system, be sure to download it first and open it with a proper pdf application (not Chrome, Firefox, Edge or any other browser).

2. For the "True/False/Not Necessarily" questions, say if the statements are unambiguously true (True), unambiguously false (False) or impossible to classify the way they are stated (Not necessarily). Give one answer only and write the motivations to your answers in the text box provided. **Answers with no motivations will be considered wrong.**

3. For superscripts and subscripts, use the `_` and `^` characters. For example, the expression R^2_u may be entered as `R^2_u`.

4. To enter matrices into a text box, use "," to separate columns and ";" to separate rows. For example, the matrix $\begin{bmatrix} 1 & 2 \\ 3 & 4 \end{bmatrix}$ should be entered as `[1, 2; 3, 4]`.

5. For the "Test" questions, the fields are meant to be filled in as follows:

   Test type refers to the type of the test (eg Wald, LR, t, F, etc.)

   Distribution refers to the density the test statistic should have under the null (eg Normal, χ^2_2, ...)

   Test statistic is the actual numerical value of the test

   and after that you should select one of the two tick boxes ACCEPT and REJECT. For example:

   Test type: `Wald` Distribution: `chi^2(3)` Test statistic: `12.43`
   Decision: Accept ☐ Reject ☑

EXERCISES

1. (a) The rank of an identity matrix is equal to its number of rows.

True ☐ False ☐ Not necessarily ☐

(b) If an estimator is consistent, it's also asymptotically normal.

True ☐ False ☐ Not necessarily ☐

(c) If an estimator is asymptotically normal, it's also consistent.

True ☐ False ☐ Not necessarily ☐

(d) In a linear regression model such as $y_i = \beta_0 + \beta_1 x_i + \varepsilon_i$, the marginal effect of x on y is constant.

True ☐ False ☐ Not necessarily ☐

(e) In the ADL model $y_t = 0.9y_{t-1} + 0.5x_t - 0.5x_{t-1} + \varepsilon_t$ the x_t variable has only a short-run impact in y_t, but not a long-run effect.

True ☐ False ☐ Not necessarily ☐

2. Suppose that, for the model $y_i = \beta_0 + \beta_1 x_i + \varepsilon_i$, you have the following OLS estimates for a sample of size n:

$$\hat{\boldsymbol{\beta}} = \begin{bmatrix} 1 \\ 2 \end{bmatrix} \qquad \hat{\sigma}^2 = 36 \qquad \hat{V} = \begin{bmatrix} 0.25 & -0.05 \\ -0.05 & 0.25 \end{bmatrix}$$

(a) Compute the following quantities:

$$n = \qquad \mathbf{y}'\mathbf{y} = \qquad \mathbf{X}'\mathbf{y} =$$

(b) Compute the average of the variables y and x:

$$\bar{Y} = \qquad \bar{X} =$$

(c) Compute the R^2 index, both in the centred and uncentred variants:

$$R^2_u = \qquad R^2 =$$

(d) Test the hypothesis $H_0 : \beta_1 = 0$

Test type: Distribution: Test statistic:

Decision: Accept Reject

(e) Test the hypothesis $H_0 : \beta_0 = \beta_1$

Test type: Distribution: Test statistic:

Decision: Accept Reject

3. The dataset `cars.gdt` contains 235 observations describing several cars over the years 2012 to 2020. The variables are:

Symbol	varname	description
T_i	`Year`	Year in which the price was recorded
P_i	`Price`	Price of the car (in thousand €)
C_i	`Crashtest`	Crash test score (higher = safer)
S_i	`Seats`	Number of seats
X_i	`Power`	Engine power in KW
M_i	`MaxSpeed`	Maximum speed in Km/h
D_i	`Diesel`	Fuel dummy, 0 if petrol, 1 if Diesel

(a) Calculate descriptive statistics for the variables P_i, X_i and M_i:

Variable	Mean	St. Dev	Min	Max
P_i				
X_i				
M_i				

(b) Estimate by OLS the model

$$\log(P_i) = \beta_1 + T_i\beta_2 + X_i\beta_3 + M_i\beta_4 + C_i\beta_5 + S_i\beta_6 + \varepsilon_t \tag{1}$$

and report the estimated coefficients and standard error. **If necessary, use robust standard errors.**

Coeff.	Estimate	std. err.
β_1		
β_2		
β_3		
β_4		
β_5		
β_6		

(c) Comment on the result obtained above: give an interpretation of the sign of the coefficients and their statistical significance

(d) Perform a RESET test and comment on its results:

(e) Perform a Chow test to check if the model is the same for petrol and Diesel cars: