ECONOMETRICS EXTRAORDINARY FINAL EXAM
27th June 2022. 18:00

Family Name:	**Name:**
Grade:	**ID:**
Mobile:	**Email:**

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Question 2	A	B	C	Blank
Question 3	A	B	C	Blank
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Question 17	A	B	C	Blank
Question 18	A	B	C	Blank
Question 19	A	B	C	Blank
Question 20	A	B	C	Blank

Correct		Incorrect		Blank		Grade	

INSTRUCTIONS

This exam includes 20 multiple choice questions.

Your answers must be marked on the answer sheet that you will find in the first page. If you want to leave any question unanswered, choose the "Blank" option. This answer sheet is the only part of this exam that will be graded.

A correct answer adds 2 points to the final grade while an incorrect one subtracts 1 point. A blank answer does not add or subtract. The final grade is the number of points divided by 4.

Make sure that you checked your options, including “Blank”. Do not unclip the sheets. Use the blank space in the following pages to write notes or to do arithmetic calculations.

YOU HAVE ONE HOUR AND 15 MINUTES (75’) TO ANSWER THIS

REMINDER

YOU ARE NOT ALLOWED TO USE DEVICES WITH CONNECTIVITY TO THE INTERNET, INCLUDING MOBILE PHONES, TABLETS, SMARTWATCHES OR MP3/4 PLAYERS

1. You estimate the model $y_i = \beta_0 + \beta_1 x_i + u_i$, using the following dataset:

y_i	x_i
3	1
7	3
8	5

   If $\widehat{\beta}_0$ and $\widehat{\beta}_1$ are the OLS estimates for the parameters, the value of $\widehat{\beta}_0$ is:

   A) 9/4.
   B) 5/4.
   C) 3/4.

2. In a simple linear regression model the variance of the slope estimator will be lower when (*ceteris paribus*):

   A) Total variability of the regressor is lower.
   B) Variance of the error term is larger.
   C) Sample size is larger.

3. You want to estimate the following model using OLS: $y_i = \beta_0 + \beta_1 x_i + u_i$ and you have the following information:

$$\overline{x} = 50,\ \overline{y} = 50,\ \widehat{var}(x) = 4,\ \widehat{var}(y) = 9,\ \widehat{corr}(x, y) = \frac{1}{3}.$$

   Knowing that $\widehat{\beta}_0$ and $\widehat{\beta}_1$ are the OLS estimates for the parameters, the value of $\widehat{\beta}_1$ is:

   A) 0.5.
   B) 0.725.
   C) 2.172.

4. You use a sample of firms to estimate a OLS model where annual research and development expenditures (rd) are explained using annual sales ($sales$). Both variables are measured in millions of dollars. The model is the following one:

$$rd = \beta_0 + \beta_1 sales + u,$$

   And the results from the OLS estimation are:

Model 1: OLS, using observations 1-32
Dependent variable: rd

	coefficient	std. error	t-ratio	p-value
const	−0.577216	20.5155	−0.02814	0.9777
sales	0.0406263	0.00244865	16.59	<0.0001

R^2 0.901727 Adjusted R^2 0.898451

   Choose the RIGHT option:

A) If annual sales increase by 1 %, the annual investment in research and development is expected to increase by approximately 0.0406263 %.

B) If annual sales increase by 1 million dollar, the annual investment in research and development is expected to increase by approximately 40,626 dollars.

C) If annual sales increase by 1 %, the annual investment in research and development is expected to increase by approximately 4.06 %.

Questions 5 to 10 refer to the following statement. Consider a model (Model 2) to explain salaries of managers (*salary*, in miles of dollars), in terms of annual firm sales (*sales*, in millions of dollars), the return on equity (*roe*, in percentage), and the return on firm shares (*ros*, in percentage):

$$log(salary) = \beta_0 + \beta_1 log(sales) + \beta_2 roe + \beta_3 ros + u\cdot$$

And the results from the OLS estimation are:

Model 2: OLS, using observations 1-209
Dependent variable: log(salary)

	coefficient	std. error	*t*-ratio	*p*-value
const	4.31171	0.315433	13.67	<0.0001
log(sales)	0.280315	0.0353200	7.936	<0.0001
roe	0.0174167	0.00409230	4.256	<0.0001
ros	0.000241656	0.000541802	0.4460	0.6561

Mean dependent var	6.950386	S.D. dependent var.	0.566374
Sum squared resid	47.86082	S.E. of regression	0.483185
R^2	0.282685	Adjusted R^2	0.272188
$F(3, 205)$	26.92930	p-value (F)	1.00e–14

5. If annual firm sales increase by 5 %, the estimated variation of *salary* is expected to be (*ceteris paribus*):

   A) 2.8031 %.

   B) 1.4016 %.

   C) 280,315 dollars.

6. If *roe* increase by 1 point, the estimated variation of *salary* is expected to be (*ceteris paribus*):

   A) 1.74 %.

   B) 0.0174 %.

   C) 1,741.67 dollars.

7. From Model 2, it can be known that:

   A) $Pr[t(205) \geq 0.4460] = 0.3439$

   B) $Pr[-0.4460 \leq t(205) \leq 0.4460] = 0.3439$

   C) $Pr[t(205) \geq -0.4460] = 0.6561$

8. Consider the test of the null hypothesis $H0 : \beta_2 = 0$, against the alternative $H1 : \beta_2 > 0$:

A) There are no enough data to know if this null hypothesis is rejected or not at 1 %, 5 % or 10 % levels of significance.

B) The null hypothesis is rejected at the 5 % and at the 10 % levels of significance, but not at the 1 % level of significance.

C) The null hypothesis is rejected at the 1 %, at the 5 % and at the 10 % levels of significance

9. If the two-sided critical value from a $t(205)$ at the 1 % level of significance is equal to 2.6, then the 99 % confidence interval for β_1 is equal to:

A) $[0.092, 0.314]$.

B) $[0.220, 0.482]$.

C) $[0.188, 0.372]$.

10. Now you estimate the following model (Model 3):

Model 3: OLS, using observations 1-209
Dependent variable: log(salary)

	coefficient	std. error	t-ratio	p-value
const	4.82200	0.288340	16.72	<0.0001
log(sales)	0.256672	0.0345167	7.436	<0.0001

Mean dependent var	6.950386	S.D. dependent var.	0.566374
Sum squared resid	52.65600	S.E. of regression	0.504358
R^2	0.210817	Adjusted R^2o	0.207005
$F(3, 205)$	55.29659	p-value (de F)	2.70e–14

The F statistic to test that neither the *roe* nor the *ros* influence expected salaries of managers is equal to:

A) 55.29659.

B) 10.2695.

C) 35.4375.

Questions 11 to 13 refer to the following statement. A researcher wants to know the effect of family income, sports activity and gender on the weight in kg (W) of 8 years-old kids . Family income is measured as monthy income in miles of euros (I). To include sports activity, two dummy variables are defined: S, which takes the value of 1 if the kid does less than 4 hours of sports activity per week and 0 otherwise, and D, which takes the value of 1 if the kid does 4 or more hours of sports activity per week and 0 otherwise. Finally, variable H takes the value of 1 when the kid is a male and 0 if the kid is a female. In the sample there are 1,000 8 years-old kids (90 % of them taking taking the value of 1 in the variable S).

The researcher specifies the following models, where $ln(I)$ is the natural log of family income:

$$\text{i) } W_i = \beta_0 + \beta_1 ln(I)_i + \beta_2 S_i + u_i$$
$$\text{ii) } W_i = \beta_0 + \beta_1 ln(I)_i + \beta_2 D_i + u_i$$
$$\text{iii) } W_i = \beta_0 + \beta_1 ln(I)_i + \beta_2 S_i + \beta_3 D_i + u_i$$
$$\text{iv) } W_i = \beta_0 + \beta_1 ln(I)_i + \beta_2 D_i + \beta_3 H_i + \beta_4 D_i \times H_i + u_i$$

and the estimation of model iv) yields the following results:

$$\widehat{W_i} = 26.5 + 0.2ln(I)_i - 0.4D_i + 1.2H_i - 0.3D_i \times H_i$$

11. Choose the RIGHT option:

    A) Model iii) shows perfect collinearity

    B) Model iii) shows non-perfect collinarity.

    C) In model ii) β_0 is interpreted as the expected weight of kids doing 4 or more hours of sports activity per week, regardless the family income.

12. From the estimation of model iv), the expected weight for a male kid doing 6 hours of sports activity per week and with monthly family income equal to 5,000 euros is equal to:

    A) 26.82 kg.

    B) 28.02 kg.

    C) 27.32 kg.

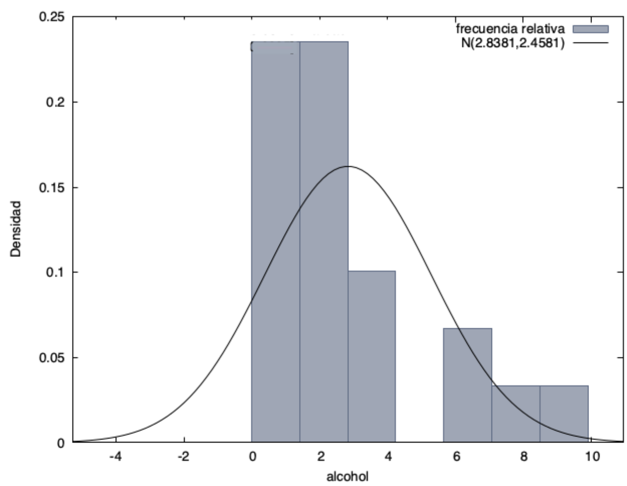
13. From the estimation of model iv), choose the RIGHT option:

    A) If we compare 2 male kids with same family income we would expect that the weight of the kid with $D = 1$ is 0.4 kg lower than the weight of the kid with $S = 1$.

    B) If we compare a male kid against a female kid, both with $D = 1$ and same family income, we would expect the male kid to weight 1.2 kg more than the female kid.

    C) If we compare a male kid against a female kid, both with same family income but the male kid with $D = 1$ and the female kid with $S = 1$, we would expect the male kid to weight 0.5 kg more than the female kid.

14. Below you have the histogram and the summary statistics of the variable *alcohol*, which measures wine consumption per capita in liters per month. In addition, the Jarque-Bera statisic is equal to 6.78181, with p-value equal to 0.0336783.



Summary statistics
(21 valid observations)

Mean	2.8381
Median	1.9000
Minimum	0.60000
Maximum	9.1000
Standard deviation	2.4581
C.V.	0.86612
Skewness	1.3478
Ex. kurtosis	0.69571

Choose the RIGHT option:

A) Variable *alcohol* is skewed to the right.

B) The null hypothesis that the variable *alcohol* is normally distributed is rejected at the 1 % level of significance

C) The null hypothesis that the variable *alcohol* is normally distributed is not rejected at the 5 % level of signficance.

15. You estimate the following model: $y_i = \beta_0 + \beta_1 x_{1i} + \beta_2 x_{2i} + u_i$ and the values for the Breusch-Pagan and the White statistics are 6.19692 and 9.3612, respectively. If $P(\chi^2(2) \geq 6.19692) = 0.0451186$ and $P(\chi^2(5) \geq 9.3612) = 0.0954958$, choose the RIGHT option:

    A) The null hypothesis of homoscedasticity is rejected at the 5 % level of significance using both Breusch-Pagan and White statistics.

    B) The null hypothesis of homoscedasticity is rejected at the 10 % level of significance using both Breusch-Pagan and White statistics.

    C) The null hypothesis of homoscedasticity is rejected at the 5 % level of significance using the White statistic but it is not rejected at 5 % level of significance using the Breusch-Pagan statistic

16. Regarding the error term from the model: $y_t = \beta_0 + \beta_1 x_t + u_t$ for $t = 1, \cdots T$:

    A) If $Cov(u_t, u_t) = \sigma^2 I$ and $Cov(u_t, u_{t+s}) \neq 0$, with $s \neq 0$, OLS is linear, unbiased and efficient.

    B) If $Cov(u_t, u_t) = \sigma^2 \times t$ for $t = 1, \cdots, T$ and $Cov(u_t, u_{t+s}) = 0$, with $s \neq 0$, the t, F and LM tests are no longer valid.

    C) If $Cov(u_t, u_t) = \sigma^2 \times t$ for $t = 1, \cdots, T$ and $Cov(u_t, u_{t+s}) = 0$, with $s \neq 0$, the OLS confidence intervals are valid.

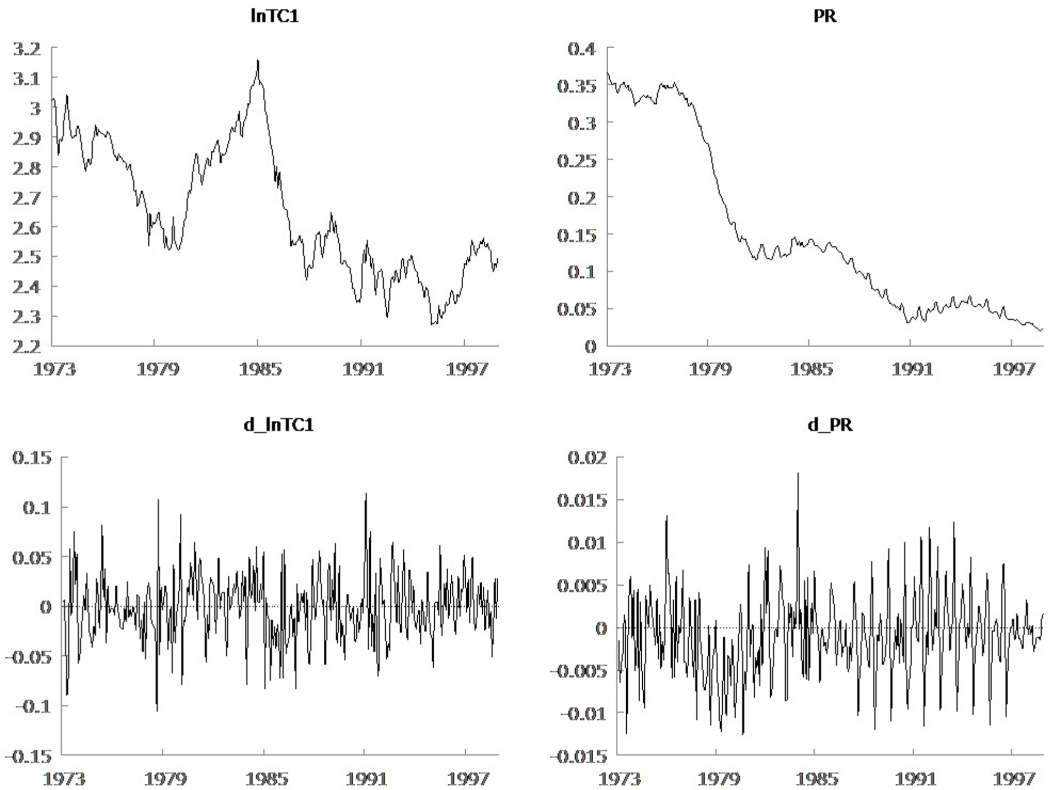
17. In the model $C_i = \beta_0 + \beta_1 RD_i + u_i$, where C_i is the weekly consumption for family i, and RD_i is its disposable income, some individuals show values much larger than the mean in the variable RD and in C. Those individuals:

    A) Will always show large residuals.

    B) Are extreme observations that do not influence the results from the OLS estimation.

    C) Are extreme observations and they can be influential.

Questions 18, 19 and 20 refer to the following statement. Below you can see several time series graphs using monthly data for the log of the exchange rate between Australian dollar and US dollar ($lnTC1$), relative prices between Australia and USA (PR) and the first regular differences of those time series (d_lnTC1 y d_PR, respectively). You can also see the OLS estimation results of two regression models to analyse the relationship between exchange rate and relative prices.



Model 4: OLS, using observations 1973:01-1998:12 (T = 312)
Dependent variable: lnTC1
HAC standard errors, bandwith 5 (Bartlett Kernel)

	coefficient	std. error	t-ratio	p-value
const	1.06854	0.0133347	80.13	<0.0001
PR	1.27935	0.117070	10.93	<0.0001

Mean dependent var	1.150822	S.D. dependent var.	0.094907
Sum squared resid	1.582135	S.E. of regression	0.071440
R^2	0.435209	Adjusted R^2o	0.433387
$F(2, 18)$	119.4232	p-value (de F)	9.86e–24
Log-likelihood	381.6307	Akaike criterion	−759.2615
Schwarz criterion	−751.7755	Hannan–Quinn	−756.2695
Rho	0.977960	Durbin-Watson	0.043041

Model 5: OLS, using observations 1973:02-1998:12 (T = 311)
Dependent variable: d_lnTC1
HAC standard errors, bandwith 5 (Bartlett Kernel)

	coefficient	std. error	t-ratio	p-value
const	− 0.00057924	0.000904466	0.6404	<0.5224
d_PR	0.3306825	0.437869	0.7552	0.4507

Mean dependent var	−0.000738	S.D. dependent var.	0.014701
Sum squared resid	0.066844	S.E. of regression	0.014708
R^2	0.002261	Adjusted R^2o	−0.000968
$F(2, 18)$	0.570340	p-value (de F)	0.450699
Log-likelihood	871.9358	Akaike criterion	−1739.872
Schwarz criterion	−1732.392	Hannan–Quinn	−1736.882
Rho	0.010565	Durbin-Watson	1.976362

18. d_lnTC1 is interpreted as:

   A) The absolute monthly growth rate of the exchange rate.
   B) The relative annual growth rate of the exchange rate.
   C) The relative monthly growth rate of the exchange rate.

19. From the above graphs:

   A) Both time series $lnTC1$ and PR are mean non-stationary.
   B) Time series $lnTC1$ is mean non-stationary but time series PR is mean stationary.
   C) Both times series $lnTC1$ and PR are mean-stationary.

20. From Models 4 and 5:

   A) The times series $lnTC1$ and PR are cointegrated.
   B) The relationship between $lnTC1$ and PR is spurious.
   C) Model 5 is not useful to analyse if the variables are cointegrated because its adjusted R-squared is lower than in Model 4.

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