ECONOMETRICS - FINAL EXAM, 3rd YEAR (GECO & GADE)

May 31, 2021 – 9:00 AM

Family name:	**Name:**
DNI/ID:	**Instructor:**

Question 1	**A**	**B**	**C**	**Blank**
Question 2	**A**	**B**	**C**	**Blank**
Question 3	**A**	**B**	**C**	**Blank**
Question 4	**A**	**B**	**C**	**Blank**
Question 5	**A**	**B**	**C**	**Blank**
Question 6	**A**	**B**	**C**	**Blank**
Question 7	**A**	**B**	**C**	**Blank**
Question 8	**A**	**B**	**C**	**Blank**
Question 9	**A**	**B**	**C**	**Blank**
Question 10	**A**	**B**	**C**	**Blank**
Question 11	**A**	**B**	**C**	**Blank**
Question 12	**A**	**B**	**C**	**Blank**
Question 13	**A**	**B**	**C**	**Blank**
Question 14	**A**	**B**	**C**	**Blank**
Question 15	**A**	**B**	**C**	**Blank**
Question 16	**A**	**B**	**C**	**Blank**
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	Final 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 TO ANSWER THIS TEST

REMINDER

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

Question 1. Which of the following p-values will lead us to reject the null hypothesis if the level of significance equals 0.05?

A) 0.152.
B) 0.051.
C) 0.025.

Question 2.- Multicollinearity occurs whenever,

A) The dependent variable is highly correlated with the independent variables.

B) The independent variables are highly orthogonal.

C) There is a high linear relationship among the independent variables.

Question 3. Consider the model $\mathbf{Y} = \mathbf{X\beta} + \mathbf{U}$, with $E[U] = \mathbf{0}$ and the error variance-covariance matrix is $\text{Var}[\mathbf{U}] = \sigma^2\Sigma$, $\Sigma \neq \mathbf{I}$, where σ is a constant. Which of the following statements is TRUE?

A) The OLS estimator is UNBIASED.

B) The Gauss-Markov theorem holds and therefore the OLS estimator is the "best" of all possible estimators.

C) The Variance and Covariance Matrix of $\hat{\boldsymbol{\beta}}^{MCO}$ is $Var(\hat{\boldsymbol{\beta}}) = \sigma^2(\mathbf{X'X})^{-1}$.

Question 4.- Which of the following is an example of time series data?

A) Data on the unemployment rates in different parts of a country during a year.

B) Data on the gross domestic product of a country over a period of 10 years

C) Data on the consumption of wheat by 200 households during a year.

Question 5. In order to obtain an unbiased estimator of $\boldsymbol{\beta}$ in the model $\mathbf{Y} = \mathbf{X\beta} + \mathbf{U}$, we need to impose that ________ (Please, choose the right one).

A) the error term has the same variance given any values of the explanatory variables.

B) the error term has an expected value of zero given any values of the independent variables.

C) the independent variables have exact linear relationships among them.

Questions **6 and 7** correspond to the following statement: The Table "Model 1" displays the estimation results for a model of annual fuel consumption (in millions of 1995 dollars) from 1960 to 1995, which relates the log gas consumption [**LOG(G)**] with: **Pg**, an index of gas prices, **Y**, disposable *per capita* income (in thousands of dollars), **Pnc**, price index of new cars, **Puc**, price index of used cars, and **Ppt**, cost index of public transport.

Model 1

Model 1: OLS, using the observations 1960-1995 (T = 36)
Dependent variable: LOG(G)

	Coefficient	*Std. Error.*	*t-Statistic*	*p-value*
Constant	3.71415	0.0631232	58.8398	<0.00001
Pg	-0.0305398	0.0110512	-2.7635	0.00968
Y	0.000221807	6.82898e-06	32.4803	<0.00001
Pnc	-------------	0.0790663	-1.6052	0.11892
Puc	-0.0275409	0.0254615	-1.0817	0.28802
Ppt	-0.00791789	0.0199616	-0.3967	0.69443

Mean of dep. var.	5.392989	S.D. of dep. var.	0.248779
R-squared	0.989930	Adjusted R-squared	0.988252
F(5, 30)	-----------	P-value (F)	<0.000001

Question 6.- According to the results in Model 1:

A) All the estimated parameters, except for the constant term, can be interpreted as elasticities and are individually significant at 1% level of significance.

B) All the estimated parameters, except for the constant term, can be interpreted as semi-elasticities and are individually significant at 10% level of significance.

C) Given the information available, it is possible to compute the least square estimate for the parameter of the variable **Pnc** (price index of new cars).

Question 7.- According to the results in Model 1 (use all available decimals in the calculations):

A) If the price index of new cars, **Pnc**, decreases by 1 point, gas consumption (**G**) is expected to decrease by 12.69% approx.

B) If the price index of new cars, **Pnc**, increases by 1 point, gas consumption (**G**) is expected to decrease by 0.1269% approx.

C) If the price index of new cars, **Pnc**, decreases by 1 point, gas consumption (**G**) is expected to increase by 12.69% approx.

Question 8.- In the model estimated by OLS $y_i = \hat{\beta}_1 + \hat{\beta}_2 x_i + \hat{u}_i$, which of the following is TRUE about the R^2? The R^2 ...

A) is the square of the sample correlation coefficient between the observed values of dependent and independent variables.

B) is 2 times the sample correlation coefficient between the observed values of dependent and independent variables.

C) is equal to the sample correlation coefficient between the observed values of dependent and independent variables.

Question 9.- Consider the regression $y_i = \hat{\beta}_1 + \hat{\beta}_2 x_i + \hat{u}_i = \hat{y}_i + \hat{u}_i \quad (i = 1, 2, ..., N)$ where $\hat{\beta}_1$ and $\hat{\beta}_2$ are the OLS estimates for the constant term and the slope, respectively, $\hat{y}_i$ denotes the fitted values for the dependent variable and $\hat{u}_i$ are the OLS residuals. Which of the following statements is TRUE?

A) $\sum_{i=1}^{N} \hat{u}_i \hat{y}_i \neq 0$ (the residuals are correlated with the fitted values).

B) $\sum_{i=1}^{N} \hat{u}_i x_i \neq 0$ (the residuals are correlated with the explanatory variable).

C) $\sum_{i=1}^{N} \hat{u}_i = 0$ (the sum of the residuals equals zero).

Question 10. An observation is an INFLUENTIAL observation if...

A) the size of the residual for that observation is "small" and "negative."

B) dropping it for the analysis changes the OLS estimates by a practically "large" amount.

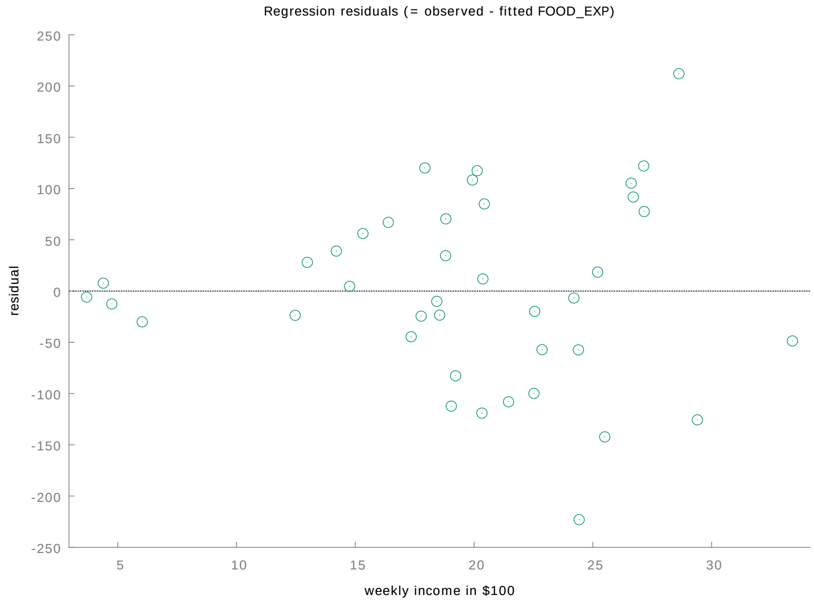
C) dropping it for the analysis changes the OLS estimates by a practically "small" amount.

Questions 11 to 14 correspond to the following statement: Given N=40 cross-sectional household observations on weekly food expenditure in euros (FoodEx) and weekly household income in euros (Inc) the model $FoodEx_i = \beta_1 + \beta_2 Inc_i + U_i$ has been estimated. Table A shows the LS estimate and Figure A shows a scatter plot of the residuals against the explanatory variable.

Table A

Dependent variable: *FoodEx* / **n=40**				
Variable	Coefficient	Std. Error	*t*-Statistic	*p*-value
Constant	36.69080	19.92479	1.841465	0.0734
Inc	0.128289	0.030539	4.200777	0.0002
R-squared	0.317118		Mean. of dep. var.	117.2817
F(1,38) statistic	17.6465			

Figure A. LS Residual vs Inc



Question 11. The plot in Figure A suggests that..

A) The error term could be homoscedastic.

B) The variability of LS residuals is independent of the level of household income.

C) The variability of LS residuals increases as income increases.

Question 12. The answer to the previous question suggests that a reasonable model for the error variance, $\mathrm{Var}(U_i)$, would be:

A) $\mathrm{Var}[U_i] = \sigma^2 \frac{1}{Inc_i^2} \quad (i = 1, \ldots, 40)$

B) $\mathrm{Var}[U_i] = \sigma^2 \quad (i = 1, \ldots, 40)$.

C) $\mathrm{Var}[U_i] = \sigma^2 Inc_i \quad (i = 1, \ldots, 40)$

Question 13. The answer to questions 11 and 12 suggests that (indicate which statement is **TRUE**):

A) The estimate for β_2 is statistically significant at both the 10% and 5% level of confidence.

B) The standard errors computed for the LS estimates of β_1 and β_2 in Table A are not correct.

C) The F-statistic in Table A is suitable to test whether the parameter β_2 is statistically significant.

Question 14. According to the answer to previous questions, which of the following statements is **TRUE?**

A) In the model $\frac{FoodEx_i}{Inc_i} = \beta_1 \frac{1}{Inc_i} + \beta_2 + V_i$, the LS estimator is BLUE (Best linear unbiased estimator).

B) The White heteroscedasticity-consistent standard errors are suitable for estimation the variances of the LS estimates of β_1 and β_2 in Table A.

C) The LS estimator of β_1 and β_2 in $FoodEx_i = \beta_1 + \beta_2 Inc_i + U_i$ is biased.

Question 15. The OLS estimation results for the model $Y_t = \beta_1 + \beta_2 X_{t2} + \beta_3 X_{t3} + U_t$, with a sample of size $N=5$, are $\hat{\beta}_2 = 2.5$, $\hat{\beta}_3 = 4$, $\bar{Y} = 4$, $\bar{X}_2 = 2$, $\bar{X}_3 = 3$. Then, the OLS estimate of $\hat{\beta}_1$ is:

A) 13

B) -13

C) 4

Question 16. Consider the model $Y_i = \beta_1 + \beta_2 X_i + U_i$ $(i = 1, ..., 32)$ which complies with all the standard assumptions. If t^* is the value of the usual t-statistic to test the null $H_0 : \beta_2 = 1$ against $H_1 : \beta_2 > 1$, which of the following statements is TRUE?

A) The marginal significance (p-value) of the previous test is $\Pr[t(30) \geq t^*]$.

B) The value of the t statistic is $t^* = \hat{\beta}_2 / \hat{std}(\hat{\beta}_2)$, where $\hat{std}(\hat{\beta}_2)$ is the standard error of the OLS estimator of β_2.

C) The marginal significance (p-value) of the previous test is $1 - \Pr[t(30) \geq t^*]$.

Questions 17 and 18 refer to the following statement. We want to analyze the relationship between the level of employment, X, and the level of sales, Y, in an industrial sector. This has been done using quarterly data from the first quarter of 1998 to the third of 2003, both included. A model has been specified including 4 seasonal dummy variables as regressors, D_{it}'s, taking the value of 1 in the *i-th* quarter ($i = 1, 2, 3, 4$) and 0 otherwise

Question 17. One can use the model $Y_t = \beta_1 + \beta_2 D_{2t} + \beta_3 D_{3t} + \beta_4 D_{4t} + \beta_5 X_t + U_t$ or, alternatively, the equivalent specification:

A) $Y_t = \beta_1 D_{1t} + \beta_2 D_{2t} + \beta_3 \mathrm{D}_{3t} + \beta_4 \mathrm{D}_{4t} + \beta_5 \mathrm{X}_t + \mathrm{U}_t$ where the interpretation of the coefficients $\beta_2, \beta_3, \beta_4$ is the same in both specifications.

B) $Y_t = \beta_1 + \beta_2 D_{1t} + \beta_3 \mathrm{D}_{2t} + \beta_4 \mathrm{D}_{3t} + \beta_5 \mathrm{X}_t + \mathrm{U}_t$ where the interpretation of the coefficients $\beta_2, \beta_3, \beta_4$ is NOT the same in both specifications.

C) $Y_t = \beta_1 + \beta_2 D_{1t} + \beta_3 \mathrm{D}_{2t} + \beta_4 \mathrm{D}_{4t} + \beta_5 \mathrm{X}_t + \mathrm{U}_t$ where the interpretation of the coefficients $\beta_2, \beta_3, \beta_4$ is the same in both specifications.

Question 18. Consider the model $Y_t = \alpha_1 + \alpha_2 \mathrm{X}_t + \mathrm{V}_t$, where V_t is the error, and the model $Y_t = \beta_1 + \beta_2 D_{2t} + \beta_3 \mathrm{D}_{3t} + \beta_4 \mathrm{D}_{4t} + \beta_5 \mathrm{X}_t + \mathrm{U}_t$, where the dummy variables are defined as in the previous question. If we want to test whether sales depend on the quarter in which we are, keeping employment constant, the null hypothesis will be:

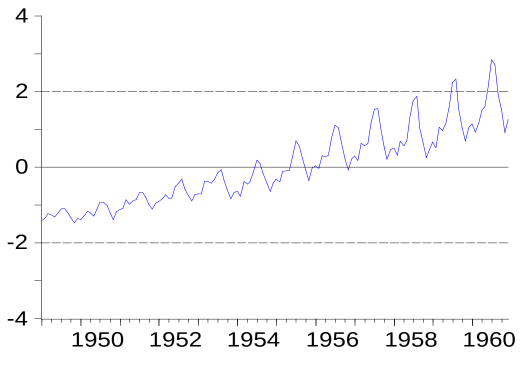
A) $\beta_2 = \beta_3 = \beta_4 = 0$

B) $\beta_2 = \beta_3 = \beta_4$

C) $\beta_1 = 0$

Questions 19 and 20 refer to the following three time series that show different properties:

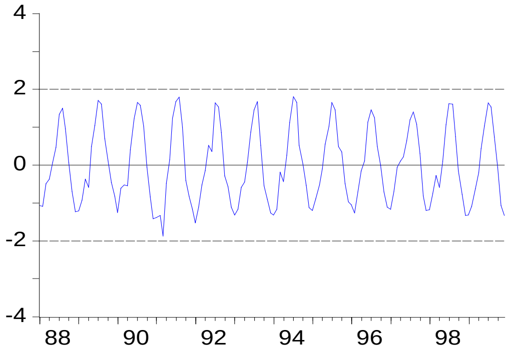
TS 1: Monthly total of a US airline passengers from 1949 to 1960 (Thousands)



Sample 1949:01 1960:12
Observations 144

Mean	280.2986
Median	265.5000
Maximum	622.0000
Minimum	104.0000
Std. Dev.	119.9663
Skewness	0.577068
Kurtosis	2.606228
Jarque-Bera	8.922525
Probability	0.011548

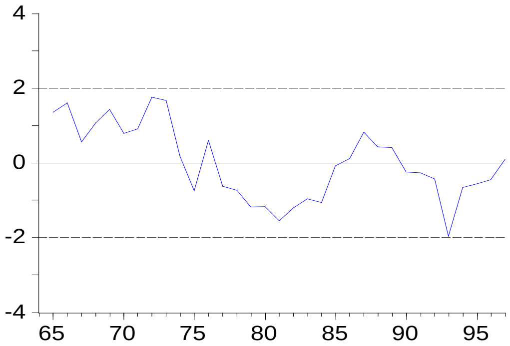
TS 2: Monthly averaged temperatures (°C) at the Retiro park in Madrid



Sample 1988:01 1999:12
Observations 144

Mean	15.04306
Median	14.05000
Maximum	27.40000
Minimum	2.200000
Std. Dev.	6.839996
Skewness	0.278520
Kurtosis	1.829484
Jarque-Bera	10.08241
Probability	0.006466

TS 3: Spanish Domestic Demand (annual variation in %)



Sample 1965 1997
Observations 33

Mean	3.367965
Median	3.173506
Maximum	7.955505
Minimum	-1.757371
Std. Dev.	2.610798
Skewness	0.104580
Kurtosis	2.083120
Jarque-Bera	1.216073
Probability	0.544419

Question 19. Looking at TS1, TS2 and TS3 we can state that:

A) None of the time series, TS1, TS2 and TS3, are mean stationary.

B) Although TS2 shows a clear seasonal component, it is mean stationary.

C) TS3 does not show a clear seasonal component, therefore it is mean stationary.

Question 20. Looking at TS1, TS2 and TS3 we can state that:

A) TS1 is variance stationary.

B) The local standard deviation of TS1 varies in proportion to its local mean.

C) According to the Jarque-Bera statistic for TS3, at the 5% level of significance, this time series is not normally distributed.

Calculations

ECONOMETRICS - FINAL EXAM, 3rd YEAR (GECO & GADE)

May 31, 2019 – 9:00

First family name:	**Second family Name:**
Name:	**GECO/GADE:**
DNI/ID:	**Instructor:**
Mobile:	**E-mail:**

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Correct	**Incorrect**	**Blank**	**Final grade**