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

June 20, 2018 – 15:30

First family name:	**Second family Name:**
Name:	**GECO/GADE:**
DNI/ID:	**Instructor:**
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Question 1	**A**	**B**	**C**	**Blank**
Question 2	**A**	**B**	**C**	**Blank**
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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 AND A HALF 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. Choose which of the following models (where U_i represents a random error) cannot be estimated by OLS:

A) $Y_i = e^{(\beta_1 + \beta_2 X_i + U_i)}$

B) $Y_i = \beta_1 + X_i^{1/\beta_2} + U_i$

C) $Y_i = \beta_1 + \beta_2 (\ln X_i)^2 + U_i$ where "ln" denotes the natural logarithm.

Question 2. Given the regression model $Y_t = \beta_1 + \beta_2 X_{t2} + \beta_3 X_{t3} + U_t$, we want to test the null $H_0 : \beta_2 - \beta_3 = 1$ against the alternative $H_1 : \beta_2 - \beta_3 \neq 1$. If the corresponding t-statistic, computed with a sample of 20 observations, is 0, then it must be true that:

A) …the sum of squared residuals of the model restricted to H_0 coincides with that of the unrestricted model.

B) …the sum of squared residuals of the model restricted to H_0 is larger than that of the unrestricted model.

C) …the difference between the OLS estimates of β_2 and β_3 is not equal to 1.

Question 3. Consider the model $Y_i = \beta_1 + \beta_2 X_i + U_i$ $(i = 1, ..., 30)$ which complies with all the standard assumptions. If $\bar{t}$ 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 $\Pr[t(28) \geq \bar{t}\,]$

B) The value of the t statistic is $\bar{t} = \hat{\beta}_2 \,/\, s\hat{t}d(\hat{\beta}_2)$, where $s\hat{t}d(\hat{\beta}_2)$ stands for the standard error of the OLS estimator of β_2

C) The marginal significance (p-value) of the previous test is $1 - \Pr[t(28) \geq \bar{t}\,]$

Question 4. Consider the model $Y_i = \beta_1 + \beta_2 X_i + U_i$. If the sample means of Y_i and X_i $(i = 1, ..., N)$ are equal and positive, then the OLS estimate for the constant term in the previous model

A) …is positive if the OLS estimate for the slope is positive and less than one.

B) …is equal to zero if the OLS estimate for the slope is not one.

C) …is negative if the OLS estimate for the slope is negative.

Questions 5 to 9 refer to the following statement: Using information about the cereal production (variable CER, in thousands of tons) and population (variable POB´, in million habitants) for 50 countries in 1999, we estimated by OLS the regression model in the following table, where LN stands for the natural logarithm:

Table CP

Dependent variable: LN(CER)

Method: Ordinary Least Squares

Sample size: 50

Observations included: 50

Variable	Coefficient	std error	t-statistic	p-value
C	5.799106	0.345901	16.76521	0.0000
LN(POB)	0.999744	0.098497	10.15005	0.0000

R squared	0.682169	Mean dependent var	9.019127
Adjusted R squared	0.675547	S.D. dependent var	1.711372
S.E. of regression	0.974810	Akaike criterion	2.826030
Sum of squared residuals	45.61225	Schwarz criterion	2.902511
Log-likelihood	-68.65076	F(1,48) statistic	103.0235

Question 5. According to Table CP, which of the following statements is TRUE?

A) If POB increases in 1 million inhabitants, the estimated percent change in cereal production is 99.97%

B) If POB increases by 1%, the estimated percent change in cereal production is close to 1%

C) If POB increases in 1 million inhabitants, the estimated change in cereal production is 999.7 metric tons.

Question 6. According to the results in Table CP, rounded to four decimal places, which of the following statements is TRUE?

A) The variability of LN(POB) explains 68.22% of the variability of LN(CER).

B) The estimate of the error variance is equal to 0.9748

C) The variability of POB explains 68.22% of the variability of CER.

Question 7. According to Table CP, and bearing in mind that

$2 \times \Pr[t(48) \geq 0.0026] = 0.9979$, we can conclude that the elasticity of cereal production in response to population:

A) Is different from 1 at a 5% level of significance.

B) Is not different from 1 at a 1% level of significance.

C) Is not different from 0 at a 5% level of significance.

Question 8. According to the correct answer to the previous question, choose which of the following statements is TRUE:

A) The cereal production per capita increases when the population decreases.

B) The cereal production per capita decreases when the population increases.

C) The cereal production per capita remains practically constant no matter the change in population.

Question 9. According to Table CP table, the interpretation of the constant term is:

A) The estimated value of (log) cereal production when the value of (log) population is zero.

B) The estimated value of cereal production, in thousands of metric tons, when the value of the (log) population is zero.

C) The estimated value of cereal production, in thousands of metric tons, when the population is equal to zero million people.

Question 10. The model for a given time series is $y_t = \beta_0 + \beta_1 t + a_t$, where β_0 and β_1 are the model parameters, t is the variable "time", such that $t = 1, 2, ..., N$ and a_t is an error with the usual properties (zero mean, constant variance and no autocorrelation). In this case, the corresponding model for the first order difference of y_t, that is, $\nabla y_t = y_t - y_{t-1}$, would be:

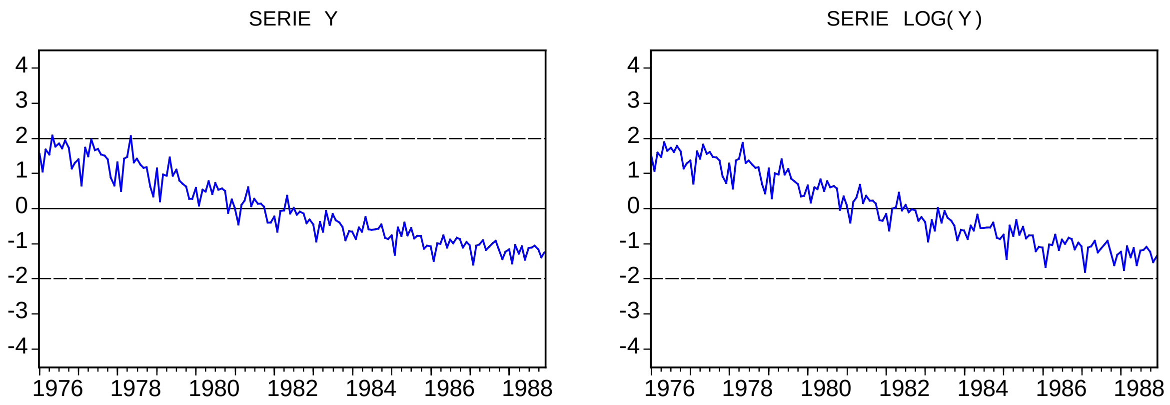
A) $\nabla y_t = \beta_0 + (1-B)a_t$

B) $\nabla y_t = \beta_0 + \beta_1(t-1) + (1-B)a_t$

C) $\nabla y_t = \beta_1 + (1-B)a_t$

Questions 11 and 12 refer to the following statement: The two panels in Figure N1 display a time series Y, including 156 monthly observations on the number of births registered in Spain from January 1976 to December 1988, as well as the corresponding natural log LOG(Y).

Figure N1



Question 11. Choose which of the following statements is TRUE:

A) The time series Y is not stationary in the mean because its local dispersion is not constant.

B) The time series LOG(Y) is stationary in the mean but not in the variance.

C) The time series LOG(Y) is not stationary in the mean, but its local dispersion looks reasonably constant.

Question 12. Choose which of the following statements is TRUE:

A) The series LOG(Y) is seasonal because it displays certain patterns which are systematically repeated every twelve months.

B) The time series LOG(Y) is seasonal because it displays general downward trend.

C) The time series LOG(Y) is stationary in the mean despite its seasonality.

Question 13. The model $Y_i = \beta_0 + \beta_1 X_i + U_i$ is such that $\operatorname{var}(U_i) = \sigma^2 \frac{1}{Z_i}$, where Z_i is an observable variable. Under these conditions, which of the following models has homoscedastic errors?

A) $\frac{Y_i}{Z_i} = \beta_0 \cdot \frac{1}{Z_i} + \beta_1 \cdot \frac{X_i}{Z_i} + V_i$

B) $Y_i \cdot Z_i = \beta_0 \cdot Z_i + \beta_1 \cdot Z_i \cdot X_i + V_i$

C) None of the above.

Question 14. 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 $\hat{\beta}_1 = 1.5$, $\hat{\beta}_2 = 2.5$ and $\hat{\beta}_3 = 4$. If $X_{62} = 5$ and $X_{63} = 3$, where X_{6k} stands for the 6$^{\text{th}}$ observation of the k-th regressor (k = 2, 3), then:

A) The point forecast for Y_6 is 24.5

B) We do not have enough information to compute the one-step-ahead interval forecast for Y_6

C) The point forecast for Y_6 is 25.5

Question 15. Which of the following methods is INAPPROPIATE to test whether the errors of a regression model are autocorrelated?

A) …White's statistic.

B) …the Breusch-Godfrey statistic.

C) …a time series plot of the model residuals.

Question 16. We estimated by OLS the model [M1] $q_t = \hat{\beta}_0 + \hat{\beta}_1 c_t + \hat{\beta}_2 p_t + \hat{u}_t$, $t = 1, 2, ..., 30$, where q_t denotes the forest surface burned in fires, c_t is the average temperature in July and p_t is the price per metric ton of burnt wood. An then we fitted by OLS the model [M2] $\hat{u}_t = \hat{\alpha}_0 + \hat{\alpha}_1 c_t + \hat{\alpha}_2 p_t + \hat{\rho}_1 \hat{u}_{t-1} + \hat{\rho}_2 \hat{u}_{t-2} + \hat{\varepsilon}_t$, obtaining $R^2 = 0.8$. If $\Pr[\chi^2_{(2)} \geq 5.99] = 0.05$, which of the following statements is TRUE?

A) Model [M2] is the auxiliary regression corresponding to a Breusch-Godfrey test and it suggests that model [M1] presents order autocorrelation up to the 2^{nd} order with a 5% level of significance.

B) Breusch-Godfrey statistic indicates that model [M1] presents autocorrelation of first, but not of second order.

C) Model [M2] is the auxiliary regression of White's test and it suggests that model [M1] presents heteroscedasticity with a 5% level of significance.

Question 17. Consider the model $\mathbf{Y} = \mathbf{X}\boldsymbol{\beta} + \mathbf{U}$, with $E[\mathbf{U}] = \mathbf{0}$, $\text{Var}[\mathbf{U}] = \sigma_t^2 \boldsymbol{\Omega}$ and $\boldsymbol{\Omega} \neq \mathbf{I}$, for all t =1,2, …, N. Which of the following general linear model assumptions may be unfulfilled:

A) Non-autocorrelated errors and non-stochastic regressors.

B) Non-autocorrelated errors and there is no exact multicollinearity.

C) The errors are not-autocorrelated and their variance is constant (homoscedasticity).

Questions 18 to 19 refer to the following statement. To study salary differences in a sample of 222 university lecturers from 7 different universities, we estimated by OLS the model shown in **Table M1**, relating the salary in euros/year of a lecturers (**SALARY**) with his/her years of tenure **(YEARS**) and seven dummy variables (**D1, D2,..., D6, D7**). The variable D1 takes value 1 if the lecturer belongs to the University 1 and zero otherwise, D2 takes the value 1 if the lecturer belongs to the University 2 and zero otherwise and so on... **Table M2** shows the estimation results for the same relationship, after transforming the dependent variable into natural logarithms **LOG (Salary)**.

Question 18. Considering the results in Tables M1 and M2:

A) The Model in table M2 is better than that in Table M1 because its determination coefficient (R-squared) is larger.
B) The Model in table M2 is better than that in Table M1 because its determination coefficient adjusted with degrees of freedom (Adjusted R-squared) is larger.
C) The determination coefficients of the models presented in tables M1 and M2 are not comparable.

Table M1

Dependent Variable: SALARY
Sample: 1 222

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	48217.91	3683.907	13.08879	0.0000
YEARS	1472.686	111.7223	13.18167	0.0000
D1	7306.227	4608.602	1.585346	0.1144
D2	3957.826	4645.357	0.851996	0.3952
D3	-2204.216	4420.479	-0.498637	0.6185
D4	1762.484	4160.125	0.423661	0.6722
D5	5800.969	4850.386	1.195981	0.2330
D6	14014.31	4333.016	3.234308	0.0014

R-squared	0.487389	Mean dependent var	79097.47
Adjusted R-squared	0.470621	S.D. dependent var	23872.69
S.E. of regression	17369.39	Akaike inf criterion	22.39818

Table M2

Dependent Variable: LOG(SALARY)
Sample: 1 222

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	10.82787	0.045447	238.2532	0.0000
YEARS	0.019539	0.001378	14.17646	0.0000
D1	0.096854	0.056854	1.703547	0.0899
D2	0.048644	0.057308	0.848823	0.3969
D3	-0.021660	0.054534	-0.397188	0.6916
D4	0.033463	0.051322	0.652033	0.5151
D5	0.062645	0.059837	1.046919	0.2963
D6	0.152362	0.053455	2.850300	0.0048

R-squared	0.514154	Mean dependent var	11.23316
Adjusted R-squared	0.498262	S.D. dependent var	0.302511
S.E. of regression	0.214279	Akaike inf criterion	-0.207703

Question 19. According to the results of the Table M2:

A) Each additional year of lecturer's tenure increases the expected salary in 0.019539 euros/year.

B) Each additional year of lecturer's tenure increases the expected salary by 1.9539%, approx.

C) Each additional year of lecturer's tenure decreases the expected salary by 1.9539%, approx.

Question 20. Consider the general linear model $\mathbf{Y} = \mathbf{X}\boldsymbol{\beta} + \mathbf{U}$. If we detect approximate (not exact) multicollinearity between two columns of matrix $\mathbf{X}$, then:

A) The system of normal equations $\boldsymbol{X}^T\boldsymbol{X}\hat{\boldsymbol{\beta}} = \boldsymbol{X}^T\boldsymbol{y}$ has infinite solutions.

B) The t statistic to test for the individual significance of the parameters will be biased upward with respect to a situation with no approximate multicollinearity.

C) This problem could be addressed by dropping from the specification one of the collinear variables, in particular if we want to improve the precision of the parameter estimates.

Calculations

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