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

May 19, 2017 – 12:00

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

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 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

Questions 1 to 4 refer to the following statement: The following regression model is specified to explain the number of years of education of a sample of individuals as a function of their family income and their sociodemographic background:

$$y_i = \beta_1 + \beta_2 D_i + \beta_3 x_i + u_i$$

…where y_i stands for the number of years of schooling of the *i*-th individual, x_i denotes the family income for the *i*-th individual (in million euros) and D_i is a dummy variable which value is one, if the individual was raised in a urban environment, and zero otherwise. Some OLS-related (OLS: Ordinary Least Squares) calculations are:

$$X^T X = \begin{bmatrix} 8 & 4 & 68 \\ . & 4 & 42 \\ . & . & 652 \end{bmatrix} \; ; \; X^T Y = \begin{bmatrix} 113 \\ 66 \\ 1024 \end{bmatrix}$$

Question 1. According to the previous results, the number of individuals in the sample who were raised in urban and non-urban environments are, respectively:

A) 8 and 4

B) 4 and 4

C) 4 and 8

Question 2. According to the previous results, the average family income for individuals who were raised in an urban and non-urban zone are, respectively:

A) 10.5 million euro and 6.5 million euros

B) 42 million euro and 26 million euros

C) 68 million euro and 42 million euros

Question 3. According to the previous results, the average number of schooling years for all the individuals in the sample is:

A) 14.125

B) 11.130

C) We do not have enough information to compute this average

Question 4. According to the regression model, the differential effect of living in an urban zone on the number of years of education is, *caeteris paribus* (i.e., assuming that the family income is the same):

A) $\beta_1 + \beta_2$

B) β_2

C) $\beta_1 - \beta_2$

Question 5. Consider the models (1) $Y_t = \beta_1 X_t + U_t$, where Y_t and X_t are nominal variables, and (2) $\left(Y_t/P_t\right) = \beta_1 \left(X_t/P_t\right) + V_t$, where P_t is a deflator. The OLS estimator of β_1 is efficient:

A) In model (2), if model (1) is such that $E[U_t] = 0$, $E[U_t^2] = \sigma^2$ and $E[U_t U_l] \neq 0$ for all $t \neq l$.

B) In model (2), if model (1) is such that $E[U_t] = 0$, $E[U_t^2] = \sigma^2 P_t^2$ and $E[U_t U_l] = 0$ for all $t \neq l$.

C) In model (1), if model (2) is such that $E[V_t] = 0$, $E[V_t^2] = \sigma^2 P_t$ and $E[V_t V_l] = 0$ for all $t \neq l$.

Question 6. Consider the time series model $Y_t = \beta_1 + \beta_2 X_t + U_t$, where the errors (U_t) are such that $U_t = U_{t-1} + A_t$, where (A_t) is a white noise process, that is, a non-autocorrelated random variable with zero mean and constant variance. Which of the following statements is FALSE?

A) The errors in the model are non-stationary.

B) The OLS estimator of β_2 in the model $\nabla Y_t = \beta_2 \nabla X_t + A_t$ is efficient, where $\nabla = \left(1 - \mathrm{B}\right)$ denotes the first difference operator.

C) The time series Y_t is stationary.

Question 7. When estimating by OLS the regression model $Y_t = \beta_0 + \beta_1 X_{t1} + \beta_2 X_{t2} + U_t$, t=1, 2, …, N, then it is always true that:

A) $\sum_{t=1}^{N} (Y_t - \bar{Y})^2 > \sum_{t=1}^{N} (\hat{Y}_t - \bar{Y})^2 + \sum_{t=1}^{N} \hat{U}_t^2$

B) $\sum_{t=1}^{N} Y_t^2 > \sum_{t=1}^{N} \hat{U}_t^2$

C) $\sum_{t=1}^{N} Y_t > \sum_{t=1}^{N} \hat{Y}_t$

Question 8. Which of the following assumptions is NOT required to prove the Gauss-Markov Theorem for the General Linear Model (GLM): $\boldsymbol{Y} = \boldsymbol{X\beta} + \boldsymbol{U}$:

A) The matrix $\boldsymbol{X}$ has k linearly independent columns

B) The model errors follow a normal distribution

C) The model errors are homoscedastic and non-autocorrelated

Question 9. Which of the following p-values lead to rejection of the null hypothesis with a 0.05 level of significance:

A) 0.152

B) 0.051

C) 0.025

Questions 10 to 14 correspond to the following statement. An analyst estimated by OLS a model relating the sales in a fast food franchise (Sales) with its pricing (Price) and advertising investment (Advert) using a 52-week sample ($n = 52$). The main estimation results are summarized in Table T1, where the shorthand "**ln**" indicates that the corresponding variable is log-transformed. In addition, Table T2 displays the variance-covariance matrix of the OLS parameter estimates.

Table T1

Dependent variable: ln Sales **Method: Ordinary Least Squares (OLS)** **Sample: 1 52**				
	Estimated coefficient	**Standard error**	**t-Statistic**	**p-value**
Constant	4.504225	0.046080	------	0.0000
Ln Advert	0.200333	-------	------	0.0000
Ln Price	------	0.062251	-3.36655	0.0015
R-squared	------	Mean dependent var.		4.781147
Adjusted R-squared	0.814167	Std. dev. dependent var.		0.135998
Residual standard deviation	0.058626	F-Statistic		112.7200
Sum of squared residuals	------	p-value (F-statistic)		0.000000

Table T2

Variance-covariance matrix of the OLS parameter estimates in Table T1			
	Constant	**Ln Advert**	**Ln Price**
Constant	0.002133	-0.000244	-0.002256

Ln Advert	-0.000244	0.000178	-0.000190
Ln Price	-0.002256	-0.000190	0.003875

Question 10: According to the information in Tables T1 and T2, the OLS standard error and the corresponding t-statistic for the elasticity of sales with respect to advertising investment are (use in your calculations all the decimals shown in the tables):

A) Cannot be computed with the available information

B) 0.0233 and 17.0156

C) 0.0133 and 15.0156

Question 11: According to the information in Tables T1 and T2, the R-squared (also known as determination coefficient) is:

A) 0.8569

B) 0.9134

C) 0.8215

NOTE: Be aware that Gretl computes the standard deviation of the dependent variable as the square root of the quasi-variance: $\hat{\sigma}_y^2 = \frac{1}{n-1}\sum_{t=1}^{n}\left(y_t - \hat{\mu}_y\right)^2$

Question 12: According to the information in Table T1, which of the following statements is TRUE?

A) If the model variables were in their original metric (i.e., without logs) the F-statistic to test the joint significance of price and advertising investment would be 112.72

B) If the model variables were in their original metric (i.e., without logs) the R^2 would be 0.821455

C) The percentage of the variability of log sales explained by log prices and log advertising investment is 82.1455%

Question 13: According to the Information in Table 1, the elasticity of sales with respect to prices:

A) Is not significant at 10%, 5%, or 1% levels of significance.

B) Knowing that $\Pr[F(1,49) > 74.95] = 0$, we CANNOT reject the null that this elasticity is negative and equal to -0.5 at any standard significance level.

C) We could test for the individual significance of this parameter by estimating the model in Table 1, omitting log prices as explanatory variable, and then computing an F-statistic comparing the sum of squared residuals in both regressions

Question 14: Let $\hat{u}_t$ be the OLS residual corresponding to the model in Table T1; $SR = \sum_{t=1}^{52} \hat{u}_t$, the sum of residuals, and $corr(Lprecio, \hat{u})$ the sample correlation between log prices and the model residuals. On the basis of the results in Table T1:

A) $SR = 0.00$ and $corr(Lprecio, \hat{u}) = 0.00$

B) $SR = 0.17$ and $corr(Lprecio, \hat{u}) = 0.82$

C) $SR = 0.17$ and $corr(Lprecio, \hat{u}) = 0.00$

Question 15. Consider the model $y_i = \beta_1 + \beta_2 x_i + \beta_3 z_i + u_i$ $(i = 1, 2, ..., 50)$, and its OLS residuals, denoted by $\hat{u}_i$ $(i = 1, 2, ..., 50)$. Assume that the OLS regression of $\hat{u}_i^2$ as a function of a constant term, x_i, z_i, x_i^2, z_i^2 and $x_i \cdot z_i$ for all $i = 1, 2, ..., 50$, yields a sum of squared residuals (SSR) of 28, with a sample variance of $\hat{u}_i^2$ equal to 2. If $\Pr[\chi^2(5) > 11.07] = 0.05$ and $\Pr[\chi^2(5) > 9.24] = 0.10$, the null that the errors (U_i) are homoscedastic:

A) …must be rejected with a 5% significance, but not with a 10%

B) …must be rejected with both, 10% and 5% levels of significance

C) …must be rejected with a 10% significance, but not with a 5%

Question 16. The name of test described in previous question is:

A) White test

B) Jarque-Bera test

C) Newey-West test

Question 17: When an OLS residual is "atypically large and positive" and another one is "atypically large and negative":

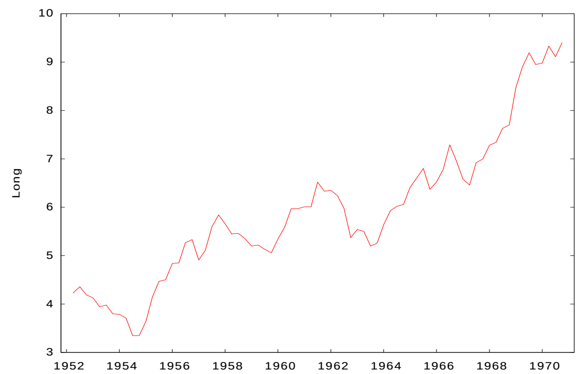
A) The residual plot is the best method to determine if the sample values corresponding to these residuals are influential or not.

B) In this situation we probably would reject the null that the OLS residuals are normally distributed

C) There are no formal statistics to test the influence of the sample values corresponding to abnormally high and/or low OLS residuals

Question 18: Figure 1 displays the quarterly percent return of long-term (20 years) UK Treasury bonds (R_UK) from 1952, 2nd quarter, until 1979, 4th quarter, both included.

Figure 1: R_UK



Which of the following statements is TRUE?

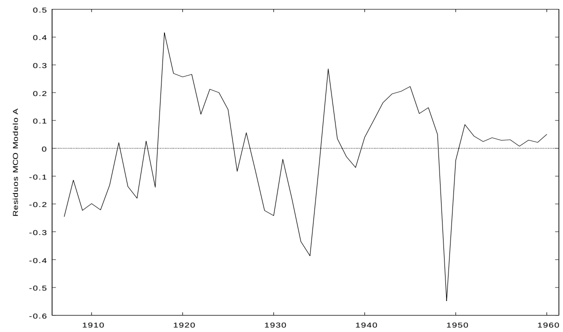
A) The series R_UK is stationary in the mean but not in variance

B) The series R_UK is not stationary in the mean

C) The series R_UK is stationary in the mean, with a historical average of around 6%

Question 19. Model A below summarizes some OLS results for a regression relating the annual (log) sales of a product with the corresponding values of (log) advertising. A plot displaying the profile of the corresponding residuals is also shown.

Model A: OLS estimation Observations from 1907 to 1960 (T=54) Dependent variable: Log (Sales)				
	Coefficient	Std. Error	t-statistic	p-value
Constant	2.2442	0.4476	5.014	0.0000
Log(Advertising)	0.7683	0.0661	11.63	0.0000
R-squared	0.7223	Residual standard deviation		0.1883



According to these results:

A) The residuals from model A are clearly stationary

B) Even if the residuals from model A were nonstationary, the R-squared value is very high, so the model does not have any problem and can be used for inference

C) The residuals from model A could be nonstationary and, in this case, the OLS estimates for the model parameters will not be efficient

Question 20. Which of the following statements are TRUE?

1. A regression between nonstationary series often yields a spurious relationship.

2. If two time series are cointegrated and both require one difference, $\nabla = (1 - \mathrm{B})$, to become stationary, there is at least a linear combination between both which requires two regular differences to become stationary

3. In a spurious regression the parameters are often significant and the R-squared is typically very high.

A) Statements 1 and 3 are true

B) Statements 2 and 3 are true

C) Statements 1 and 2 are true

Calculations

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

May 19, 2017 – 12:00

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

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**