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

May 31, 2019 – 15:30

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

Question 1. 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 100 observations, is 0, then it must be true that:

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

B) …the sum of squared residuals of the model constrained to comply with 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 2. The model $Y_i = \beta_0 + \beta_1 X_i + U_i$ is such that the standard deviation of the error is $std(U_i) = \sigma \frac{1}{\sqrt{Z_i}}$, where Z_i is an observed variable and σ is a constant. Under these conditions, which of the following models has homoscedastic errors?

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

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

C) $\frac{Y_i}{\sqrt{Z_i}} = \beta_0 \cdot \sqrt{Z_i} + \beta_1 \cdot \frac{X_i}{Z_i} + V_i$

Question 3. Consider the model $\mathbf{Y} = \mathbf{X}\boldsymbol{\beta} + \mathbf{U}$, with $E[U] = \boldsymbol{\mu} \neq \mathbf{0}$ and the error variance-covariance matrix is $\mathrm{Var}[\mathbf{U}] = \sigma^2 \Sigma$, $\Sigma \neq \mathbf{I}$, where μ and σ are constant. 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 have zero "unconditional" mean.

Question 4. Which of the following methods provides evidence about the possible autocorrelation of the errors in a regression model?

A) …White's statistic.

B) …the Jarque-Bera statistic.

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

Question 5. 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. Suppose that a researcher is interested in conducting the White's heteroscedasticity test using the residuals from (M1). Which would be the most appropriate way to apply this test?

A) $\hat{u}_t^2 = \hat{\alpha}_0 + \hat{\alpha}_1 c_t + \hat{\alpha}_2 p_t + \hat{\alpha}_3 c_t^2 + \hat{\alpha}_4 p_t^2 + \hat{\alpha}_5 p_t c_t + \hat{\varepsilon}_t$ and the White statistic distribution under the null is χ_5^2.

B) $\hat{u}_t^2 = \hat{\alpha}_0 + \hat{\alpha}_1 c_t + \hat{\alpha}_2 p_t + \hat{\alpha}_3 c_t^2 + \hat{\alpha}_4 p_t^2 + \hat{\alpha}_5 p_t^3 + \hat{\alpha}_6 p_t^3 + \hat{\alpha}_7 p_t c_t + \hat{\varepsilon}_t$ and the White statistic can be computed as $N \times R^2$, where N=30 is the number of observations and R^2 is the coefficient of determination of such an auxiliary regression.

C) $\hat{u}_t^2 = \hat{\alpha}_0 + \hat{\alpha}_1 c_t + \hat{\alpha}_2 p_t + \hat{\alpha}_3 c_t^2 + \hat{\alpha}_4 p_t^2 + \hat{\alpha}_5 p_t c_t + \hat{\varepsilon}_t$ and the White statistic distribution under the null is χ_6^2.

Question 6. Consider the model $Y_i = \beta_1 + \beta_2 X_i + U_i$ $(i = 1, ..., 32)$ 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 $\Pr[t(30) \geq \bar{t}\,]$

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

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

Question 7. Some 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 $\hat{\beta}_2 = 2.5$, $\hat{\beta}_3 = 4$, $\bar{Y} = 4$, $\bar{X}_2 = 2$, $\bar{X}_3 = 3$. If $X_{62} = 2$ and $X_{63} = 3$, where X_{6k} stands for the 6th observation of the *k*-th regressor (k = 2, 3), then:

A) The point forecast for Y_6 is 9

B) The point forecast for Y_6 is 4

C) The point forecast for Y_6 is 13

Question 8. Consider the general linear model $\mathbf{Y} = \mathbf{X}\boldsymbol{\beta} + \mathbf{U}$. If we detect approximate (not exact) collinearity between two columns of matrix $\mathbf{X}$, then:

A) We could fix the problem by dropping from the specification the regressor with the smallest Variance Inflation Factor, defined as $VIF = 1/(1 - R_k^2)$, where R_k^2 is the R^2 value obtained by regressing the kth predictor on the remaining predictors.

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.

Questions 9 to 15 refer to the following statement. In finance, the beta of an investment indicates whether the investment is more or less volatile than the market. It is also a measure of the systematic risk that cannot be eliminated by diversification. If a stock fluctuates more (less) than the market over time, then it has a beta greater (less) than 1. We estimated the model in Table 1 to calculate the beta of Telefonica, which is the slope of the relationship between the return of Telefónica (TEF) and the market return (IBEX35). **Note: In your calculations, use all the digits available in the table.**

Table 1. LS using a sample from January 2nd, 1990 to November 24th, 2006

Dependent variable: TEF
Method: Ordinary Least Squares
Sample size: 4409

Variable	Coefficient	std error	t-statistic	p-value
C	0.040439	0.018168	2.226	0.0261
IBEX35	1.047860	----------	75.62	0.0000

Mean dependent var	0.087038	S.D. dependent var	1.827317
Sum of squared residuals	6406.385	S.E. of regression	1.205688
R squared	0.564745	Adjusted R squared	0.564646
F(1,4407) statistic	----------	P-value (F)	0.00000
Log-likelihood	7079.805	Akaike criterion	4163.610
Schwarz Criterium	14176.39	Hannan-Quinn criterion	14168.12

Question 9. According to Table 1, which of the following statements is TRUE?

A) Investing €1000 in TEF is safer than investing €1000 in IBEX35.

B) Investing €1000 in TEF is riskier than investing €1000 in IBEX35.

C) Investing €1000 in TEF has the same level of risk than investing €1000 in the IBEX35

Question 10. Building on the results in Table 1, we want to test the null $H_0: \beta = 1$ against the alternative $H_0: \beta > 1$ If $Prob[t(4407) \geq 3.45387] = 0.002$ Which of the following statements is TRUE?

A) The null must be rejected in favor of the alternative at both, the 5% and 15% level of significance.

B) The null cannot be rejected in favor of the alternative at neither, the 5% nor 15% level of significance.

C) None of the above.

Question 11. According to Table 1, you would conclude that ----- of the returns of Telefónica (TEF) are explained by their market risk exposure (IBEX35), and the other ---- is due to specific risks that Banco de Santander is facing. Choose the option that fits best in the previous blank spaces.

A) 43.53%, 56.47%

B) 56.47%, 43.53%

C) None of the above.

Question 12. According to Table 1, which of the following statements is true:

A) The R-squared of the regression is less than 60%, which clearly indicates that this regression model is not adequate.

B) The R-squared of the regression may be considered small, but there is a statistically significant predictor, so you can still draw relevant conclusions about how changes in the IBEX35 are associated with changes in the returns of Telefónica.

C) None of the above.

Question 13. According to Table 1, which of the following statements is TRUE:

A) The intercept is not statistically significant at the 1% level of significance, but the F-statistic = 5718 for the overall significance test determines that the slope of the model is statistically significant at 5% level of significance.

B) The intercept is not statistically significant at the 5% level of significance, but the F-statistic = 6916 for the overall significance test determines that the slope of the model is statistically significant at the 5% level of significance.

C) The standard deviation of the slope of the regression is 1.827317

Question 14: An investor wants to test the null that the residuals of the model in Table 1 are normally distributed. To do so, computes the Jarque-Bera statistic that is 4764.28 and the p-value (or marginal significance level) associated with the residual Jarque-Bera statistic is 0.0000, then:

A) ...the null is rejected both, with a 10% and 5% significance.

B) …the null is not rejected at the 10% level of significance, but it is rejected at the 15% significance.

C) …the Jarque-Bera statistic distribution under the null will be a χ_3^2.

Question 15. The investor wants now to test for heteroscedasticity in the CAPM model estimated in Table 1 using the White's test. Therefore, estimates an auxiliary regression and computes the White statistic = 1173, with $Prob\left[\chi_2^2 \geq 1173\right] = 0.000$. According to these results, the right conclusion is:

A) …the null that the variance of the errors is constant is **not rejected** at the 5% level of significance.

B) …the null that the variance of the errors is constant is **rejected** at the 5% level of significance.

C) …the White test statistic equals the R-squared of an auxiliary regression where the dependent variable is the squared residual of the model in Table 1 and the regressors are a constant, the IBEX and IBEX^2.

Question 16. The owner of an ice cream firm is interested in determining the key factors that affect ice cream consumption. He has daily records for all of 2018 of ice cream sales (denoted by Y and measured in millions of euros) versus the temperature (denoted by X and measured in ^{o}C) on the corresponding day. To provide concrete evidence that seasonality contributes to the ice cream consumption, he defines two new dummy variables, a Summer variable, S_t that is equal to 1 for the days of July, August and September and zero otherwise, and $W_t = 1 - S_t$. Finally, he estimates three models:

MODEL A $\quad \widehat{Y}_t = 3 + 0.75X_t$

MODEL B $\quad \widehat{Y}_t = 4 + 0.55X_t + 0.65S_t$

MODEL C $\quad \widehat{Y}_t = 4.65 + 0.55X_t - 0.65W_t$

According to this, which of the following statements is TRUE?

A) Models B and C are equivalent, but differ in the interpretation of some parameters.

B) According to model B, daily sales increase by 4 million euros in summer, in comparison with any other day of the year.

C) According to model A, two additional degrees in temperature increase the sales by one million euros, no matter the season.

Question 17. Using data for 120 Spanish firms, a researcher estimated a Cobb-Douglas production function: $Ln(Y_i) = \beta_0 + \beta_1 Ln(L_i) + \beta_2 Ln(K_i) + U_i$, where Y is the output of the firm, L is the amount of labor employed, K is the capital and Ln is the natural logarithm. If the researcher wants to determine whether function exhibits constant returns to scale, that is, if $\beta_1 + \beta_2 = 1$, which would the restricted model corresponding to this constraint?

A) $\ln Y_i = \beta_0 + (\beta_1 - \beta_2) \ln K_i + w_i$

B) $\ln \frac{Y_i}{K_i} = \beta_0 + \beta_2 \ln \frac{K_i}{L_i} + \eta_i$

C) $\ln \frac{Y_i}{L_i} = \beta_0 + \beta_2 \ln \frac{K_i}{L_i} + v_i$

Questions 18 to 20 refer to the following statement. Figures A, B, C and D display four time series with different properties:

Figure A: Government Consumption Expenditure in Spain (1954-1988)

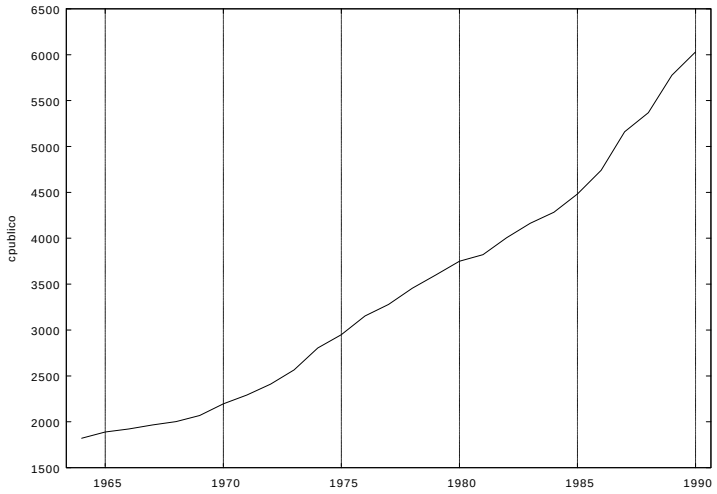


Figure B: Annual growth rate (%) of GDP in Spain (1954-1988)

Figure C: Returns of Banco de Santander stock (Jan 2, 1990 -Nov 11, 2006)

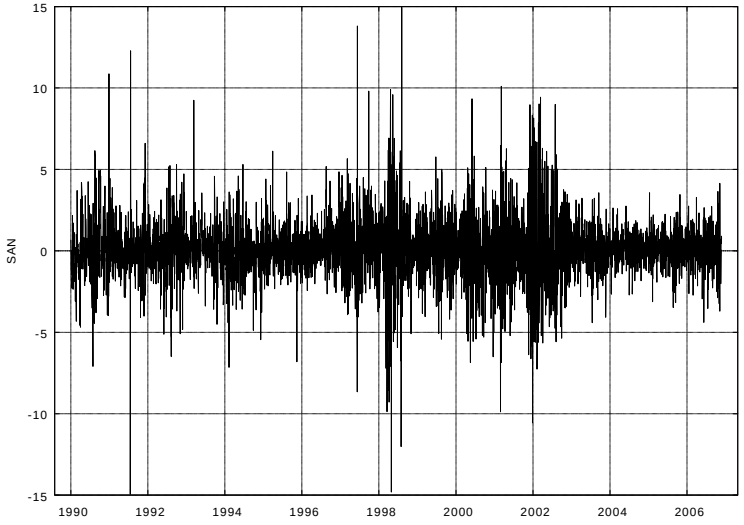
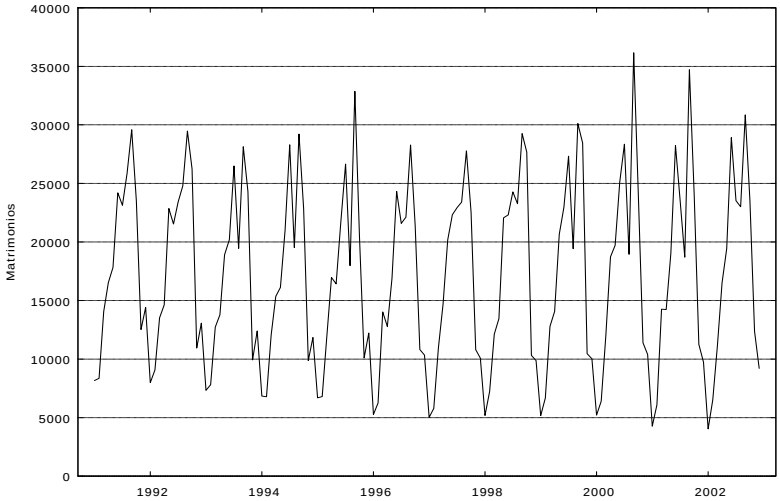


Figure D: Number of marriages in Spain (January 1991-December 2002)



Question 18. Looking at Figures C and D, we can state that:

A) Both time series are mean stationary.

B) Stock return of Banco de Santander is mean stationary, while the Number of marriages in Spain is not.

C) None of the above.

Question 19. Looking at Figures A and B, we can state that:

A) The Government Consumption Expenditure of Spain (Figure A) is mean and variance stationary.

B) The GDP Annual growth rate (%) (Figure B) is seasonal because it displays certain patterns which are systematically repeated every twelve months.

C) None of the above.

Question 20. According to Figures A, C and D, which of the following statements is FALSE?

A) The Government Consumption Expenditure of Spain (Figure A) is mean and variance stationary.

B) Although the returns of Banco de Santander stock are mean stationary, they might be nonstationary in variance because they display volatility clustering.

C) The number of marriages in Spain (Figure D) is not mean stationary because it is seasonal.

Calculations

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

May 31, 2019 – 9:00

First family name:	**Second family Name:**
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Question 20	**A**	**B**	**C**	**Blank**

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