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

July 05, 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

Questions 1 to 6 correspond to the following statement. Consider the following consumption function for beer:

$$Y_i = \beta_1 + \beta_2 X_{i2} + \beta_3 X_{i3} + \beta_3 X_{i4} + U_i, \quad i = 1, \dots, 30$$

where Y is the beer consumption in liters for the *i-th* household, X_{i2} is the consumer price index for beer purchased from stores, X_{i3} is the consumer price index of other alcoholic drinks (potential beer substitutes) purchased from stores, and X_{i4} is the disposable income for the *i-th* household. **Table 1** shows OLS estimates of the consumption function using a sample of 30 households in 2020. Finally, Ln stands for natural logarithm. **Use all available decimals to answer question 1 to 6**.

Table 1

OLS, n= 30
Dependent variable: **ln(Y)**

	Coefficient	std. Error.	T-Statistic	p-value
const	−7.336	3.7714	------	------
ln_X2	−1.165	0.2578	−4.518	0.0001
ln_X3	------	0.6109	−0.5291	0.6012
ln_X4	1.283	0.4346	2.953	0.0066

Mean of dep. var.	4.018531	S.D. of dep. var.	0.133258
Sum of squared Residuals	-------	S.E of regression	0.066445
R-squared	0.777099	Adjusted R-squared	0.751380
F-Statistic	-------	P-value (F)	1.25e-08
Log-likelihood	40.91990	Akaike criterion	−73.83979
Schwarz criterion	−68.23500	Hannan-Quinn criterion	−72.04677

Question 1. ($\Pr[t(26) \le 2.05] = 0.975$ and $\Pr[t(26) \le 1.70] = 0.95$) According to Table 1, the test of the null hypothesis $H_0 : \beta_1 = 0$ against the alternative $H_1 : \beta_1 \neq 0$ indicates that:

A) The null is rejected at both 5% and 10% level of significance.

B) The null is rejected at the 10% level of significance, but it is not rejected at 5%.

C) The null is NOT rejected neither at the 5% nor at 10% level of significance.

Question 2. According to the results in Table 1, the estimate change in the beer consumption if the consumer price index of other alcoholic drinks (potential beer substitutes) increases by 1%, remaining constant the rest of explanatory variables…

A) will decrease by approximately 0.3232 %, but this effect is NOT statistically significant at 10% level of significance.

B) will increase by approximately 0.1974 %, but this effect is NOT statistically significant at 10% level of significance.

C) Will decrease by approximately 0.8661 %, and this effect IS statistically significant at 10% level of significance.

Question 3. ($\Pr[t(26) \leq 2.05] = 0.975$ and $\Pr[t(26) \leq 1.70] = 0.95$) According to Table 1, the test of the null hypothesis $H_0 : \beta_2 = -1$ against the alternative $H_1 : \beta_2 \neq -1$ indicates that:

A) The null is rejected at both 5% and 10% level of significance.

B) The null is rejected at the 10% level of significance, but it is not rejected at 5%.

C) The null is NOT rejected neither at the 5% nor at 10% level of significance.

Question 4. According to Table 1, the Sum of Squared Residuals (SSR) is

A) 0.004422.

B) 0.132455.

C) 0.114788.

Question 5.- The *F* statistic for the joint hypothesis that all independent variables are not statistically significant $(H_0 : \beta_2 = \beta_3 = \beta_4 = 0)$ is approximately…

A) 22.6610.

B) 30.2146.

C) 3.4863.

Question 6. For the model estimated in Table 1, which of the following statements is is TRUE?

A) The sum of the residuals is NOT equal to zero and the residuals are NOT correlated with any of the explanatory variables.

B) The sum of the residuals IS equal to zero and the residuals ARE correlated with any of the explanatory variables.

C) The sum of the residuals IS equal to zero and the residuals are NOT correlated with any of the explanatory variables.

Question 7. In the model $Y_t = \beta_0 + \beta_1 X_t + U_t$, which of the following statements is TRUE?

A) It would not be possible to compute the OLS estimate of β_1 if the sample variance of X_t is equal to zero.

B) The OLS estimate of β_1 would be equal to 1 if the sample correlation between X_t and Y_t is equal to 1.

C) The OLS estimate of β_1 would be equal to the sample average of Y_t if the sample average of X_t is equal to zero.

Question 8. Consider the linear model with zero slope $Y_t = \beta + U_t,\ t = 1, \ldots, N$, in which Gauss-Markov assumptions hold. Let SST, SSE and SSR be the Total Sum of Squares, Explained Sum of Squares and Sum of Squared Residual, respectively. If the model is estimated by OLS, which of the following statement is TRUE?

A) SST = SSR.

B) SST = SSE.

C) $\hat{\beta} = SSE$.

Question 9. Which of the following statements is correct concerning the conditions required for OLS to be an UNBIASED estimator?

A) Zero variance of the error.

B) Zero mean of the dependent variable,

C) Zero expected value of the error.

Question 10. The model $\hat{y}_i = \hat{\beta}_0 + 3x_{i1} + 1x_{i2}$, has been estimated by OLS with a sample of size $n=4$. In addition, we know that:

$$\sum_{i=1}^{4} x_{i1} = 4; \quad \sum_{i=1}^{4} x_{i2} = 8; \quad \sum_{i=1}^{4} y_i = 40$$

then:

A) $\hat{\beta}_0 = 10$.

B) $\hat{\beta}_0 = 5$.

C) None of the above

Question 11. Consider the model $\mathbf{Y} = \mathbf{X}\boldsymbol{\beta} + \mathbf{U}$ that complies all the GAUSS-MARKOV assumptions. According to this, which of the following statements is TRUE?

A) The OLS estimator is the ONLY one that is a linear and unbiased estimator of $\boldsymbol{\beta}$.

B) The OLS estimator of $\boldsymbol{\beta}$ is the "best" of all possible estimators.

C) None of the above.

Question 12. Consider the model $y = \hat{\beta}_0 + \hat{\beta}_1 x_1 + \hat{\beta}_2 x_2 + \hat{u}$ that complies all the GAUSS-MARKOV assumptions. According to this, the OLS estimator of the variance of the error ($\hat{\sigma}^2$)...

A) is biased.

B) would not be possible to be computed when the degrees of freedom (*n-k*) of the model are equal to zero.

C) none of the above.

Question 13. Consider the model $y_i = \beta_1 + \beta_2 x_i + \varepsilon_i$, which satisfies the standard hypotheses, but $\text{var}(\varepsilon_i) = \sigma^2 \, {}^{1}\!/\!{}_{z_i^2}$ for all i=1,2, ..., N. Under these conditions, an efficient estimate of the β_2 parameter could be obtained by estimating by OLS the model:

A) $y_i z_i = \beta_1 z_i + \beta_2 x_i z_i + v_i$ with $\text{var}(v_i) = \text{var}(\varepsilon_i) = \sigma^2 \, {}^{1}\!/\!{}_{z_i^2}$ for all i =1,2, ..., N

B) $y_i z_i = \beta_1 + \beta_2 x_i z_i + v_i$ with $\text{var}(v_i) = \sigma^2$ for all i =1, 2, ..., N

C) $y_i z_i = \beta_1 z_i + \beta_2 x_i z_i + v_i$ with $\text{var}(v_i) = \sigma^2$ for all i=1, 2, ..., N

Question 14. An investor wishes to test the null hypothesis that the residuals of a model estimated by OLS come from a normal distribution. She 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 at any level of significance greater than 10%.

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^2_3.

Question 15. A researcher is interested in knowing the key factors that affect household income. Using information of 1000 households from around the US, she estimate the model $S_i = \beta_0 + \beta_1 BC_i + \beta_2 M_i + U_i$, where S is the annual household income (€), BC is a dummy variable that takes a value of 1 if the family lives in a Big City and zero otherwise and M is another dummy variable that takes a value of 1 if the family has a mortgage ("*hipoteca*" in Spanish) and zero otherwise.

According to the previous model, which of the following statements is TRUE?

A) The expected annual income of a family without a mortgage that is living in a big city is $\beta_0 + \beta_1 + \beta_2$

B) The expected annual income of a family without a mortgage that is living in a small city is β_0.

C) None of the above.

Question 16. 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 $H_0 : \beta_1 = 1$ against $H_1 : \beta_1 \neq 1$, then the marginal significance (*p*-value) of this test would be …

A) equal to $\Pr[t(28) \geq |\bar{t}\,|]$ where $\bar{t} = \left(\hat{\beta}_1 - 1\right) / \widehat{Var}(\hat{\beta}_1)$, and $\widehat{Var}(\hat{\beta}_1)$ stands for the variance of the error of the OLS estimator of β_1.

B) equal to $2^* \Pr[t(28) \geq |\bar{t}\,|]$, where $\bar{t} = \hat{\beta}_1 / \hat{std}(\hat{\beta}_1)$, and $\hat{std}(\hat{\beta}_1)$ stands for the standard error of the OLS estimator of β_1.

C) equal to $2^* \Pr[t(28) \geq |\bar{t}\,|]$, where $\bar{t} = \left(\hat{\beta}_1 - 1\right) / \hat{std}(\hat{\beta}_1)$, and $\hat{std}(\hat{\beta}_1)$ stands for the standard error of the OLS estimator of β_1.

Question 17. We estimated by OLS the model [M1] $q_t = \hat{\beta}_0 + \hat{\beta}_1 c_t + \hat{\beta}_2 p_t + \hat{u}_t$, $t = 1, 2, \ldots, 30,$ 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 the estimation of (M1). What would be the most appropriate form for the auxiliary regression?

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 will be a 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 will be a χ_6^2.

Questions 18 to 20 refer to the following statement. In the following figures you can observe four different time series: Figure A shows the annual Government Consumption Expenditure of Spain between 1954 and 1988. Figure B depicts, the GDP Annual growth rate (%) in Spain from 1954 until 1988. Figure C exhibits the daily returns of the stocks of Bank of Santander from January 2nd, 1990 to November 27th, 2006; Finally, Figure D shows the monthly number of marriages in Spain from January 1991 to December 2002.

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

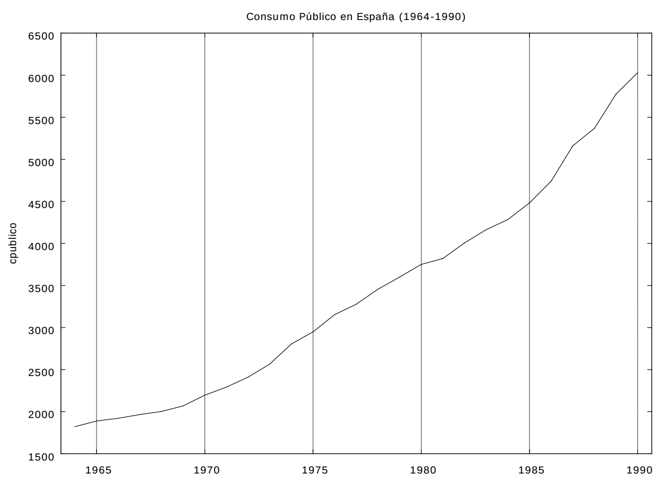


Figure B: GDP Annual growth rate (%) in Spain (1954-1988)

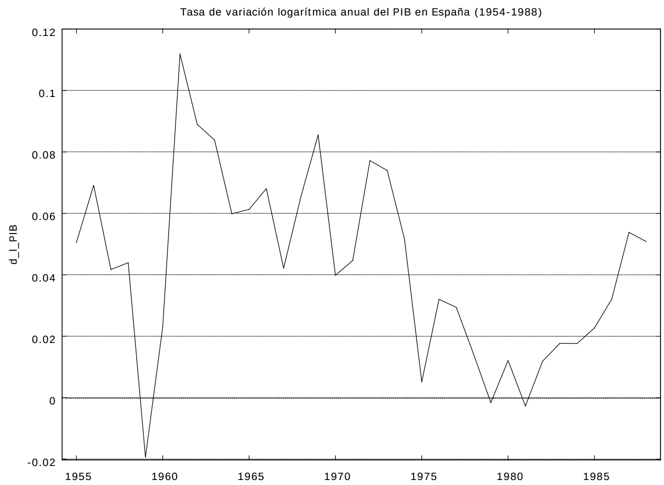


Figure C: Returns of the stocks of Bank of Santander (January 2, 1990 -November 11, 2006)

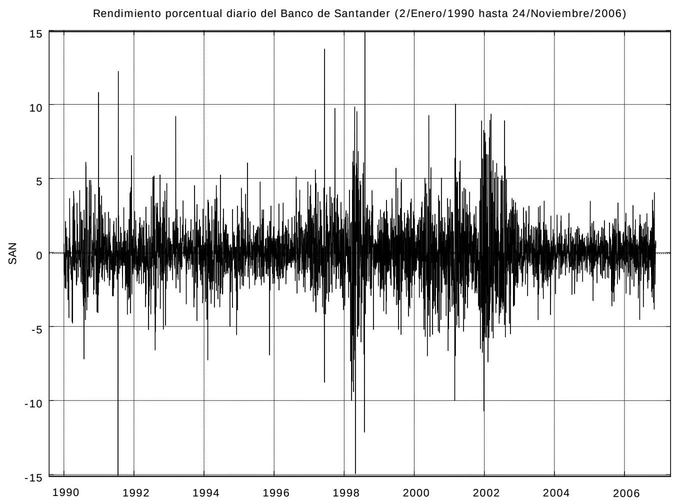
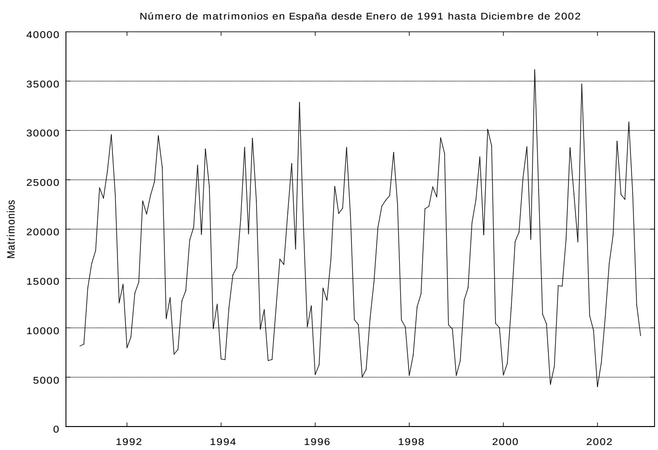


Figure D: Number of marriages in Spain (January 1991 - December 2002)



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

A) Both time series are mean stationary.

B) The returns of the stocks of Bank of Santander are mean stationary, nonetheless the Number of marriages in Spain are 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 in Figure A is mean and variance stationary.

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

C) None of the above.

Question 20. Looking at Figures A, C and D, which of the following statements is FALSE.

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

B) Although the returns of the stocks of Bank of Santander are mean stationary, they might not be variance stationary because of the observed cluster of volatility.

C) The number of marriages in Spain in Figure D is seasonal because it displays certain patterns which are systematically repeated every twelve months.

Calculations

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