ECONOMETRICS FINAL EXAM
Wednesday 29th May 2024

Family Name:	**Name:**
Grade:	**ID:**
Mobile:	**Email:**

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
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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		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 15 MINUTES (75’) TO ANSWER THIS

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

Question 1. When estimating a general linear model with multiple explanatory variables using ordinary least squares (OLS), a finite variance inflation factor (VIF) greater than 25 could indicate:

A. Heteroscedasticity.
B. Multicollinarity.
C. Perfect multicollineairity.

Question 2. The following regression models have been estimated using Ordinary Least Squares (OLS): [M1]: $\hat{Y} = \hat{\beta}_0 + \hat{\beta}_1 X_1$ and [M2]: $\hat{Y} = \hat{\alpha}_0 + \hat{\alpha}_1 X_1 + \hat{\alpha}_2 X_2$. If $\widehat{corr}(X_1, X_2) = 0$ and $\widehat{\alpha_2} > 0$, which of the following statements is TRUE:

A. $\hat{\beta}_1 = \hat{\alpha}_1$
B. $\hat{\beta}_1 > \hat{\alpha}_1$
C. $\hat{\beta}_1 < \hat{\alpha}_1$

Question 3. Consider a linear regression model that is initially estimated by OLS [original model] and heteroscedasticity is detected. Therefore, the model is re-estimated by OLS but using White's heteroscedasticity-robust variance-covariance matrix. In this case, the point estimates of the model parameters are:

A. Slightly higher than the original model.
B. Indeterminate compared to the original model.
C. Identical to the original model.

Question 4. In the estimated OLS model: $Y_i = \hat{\beta}_0 + \widehat{U}_i, (i = 1, \dots N)$, indicate which of the following statements is FALSE (Sum of Squared Residual = SSR, Total Sum of Squares = SST, Explained Sum of Squares = SSE):

A. $SSR < \text{SST}$
B. $R^2 = \text{SSE}$
C. $SSE = 0$

Question 5. A beginner student in Econometrics estimates two different models by OLS: $Y_i = \hat{\beta}_0 + \hat{\beta}_1 X_i + \widehat{U}_i$ and $X_i = \hat{\alpha}_0 + \hat{\alpha}_1 Y_i + \widehat{V}_i$. Could you help this student to choose the right answer:

A. The R^2 is the same in both models.
B. $\hat{\alpha}_1 = \hat{\beta}_1$
C. The sum of squared residuals (SSR) is the same in both models.

Question 6. In the model $Y_i = \beta_0 + \beta_1 X_i + U_i \ (i = 1, \dots 20)$, where all classical assumptions are met, we want to test $\text{H}_0\!: \beta_1 = 0$ against $\text{H}_1\!: \beta_1 \neq 0$. After computing the usual t-statistic (t*) for this hypothesis and knowing that the $P[-|t*| \leq t(18) \leq |t*|] = 0.97$. What can we conclude?:

A. Reject H_0 at the 5% but NOT at the 1% level.
B. Reject H_0 at BOTH the 5% and 1% levels.
C. Fail to reject H_0 at BOTH the 5% and 1% levels.

Read the following statement carefully to answer Questions 7-10. The following equation describes the price of detached houses (a standalone house that does not share any walls with other houses and it typically sits on its own parcel of land):

$$\ln(price) = \beta_0 + \beta_1 rooms + \beta_2 sqrmt + \beta_3 parcel\_size + U$$

where 'ln' represents the natural logarithm (base e), **price** is the price in thousands of euros, **rooms** is the number of rooms, **sqrmt** is the size of the detached house in square meters (m^2), and **parcel_size** is the size of the parcel in thousands of m^2. **Table 1** shows the OLS regression results for the previous model, estimated using a sample of 88 houses.

Table 1

Variable	Coefficient	std. error	t-ratio	p-value
Dep. Variable: ln (price)				
Method: OLS				
No. Observations: 88				
Const	4.759375	0.093536	50.88276	0.0000
rooms	0.025239	0.028593	0.882698	0.3799
sqrmt	0.003919	0.000452	8.667894	0.0000
parcel_size	0.060297	0.021934	2.749042	0.0073
R-squared	0.622277	Mean dependent var		5.633180
Adj. R-squared	0.608787	S.D. dependent var		0.303573
S.E. of regression	0.189876	F (3, 84)		46.12847
Sum of squared resid	3.028430	P-value (F)		0.000000

Question 7. (Complete the next statement with the right option) According to Table 1, holding constant all other factors ("ceteris paribus"), one additional room will increase the price by ...:

A. 2.5239% but this increase is not statistically significant at the 5% level of significance.

B. 252.39 euros, but this increase is not statistically significant at the 5% level of significance.

C. 252.39% but this increase is not statistically significant at the 5% level of significance.

Question 8. If the $\hat{covar}(\hat{\beta}_1, \hat{\beta}_2) = 0$ and $P(t(84) \geq 0.7455) = 0.23$ which of the following statements is true?:

A. The hypothesis $H_0: \beta_1 = \beta_2$ cannot be rejected (fail to reject) in favor of $H_1: \beta_1 < \beta_2$, even at a 50% significance level.

B. The value of the t-statistic (t*) for $H_0: \beta_1 = \beta_2$ is equal to 1.9659.

C. The hypothesis $H_0: \beta_1 = \beta_2$ should be rejected in favor of $H_1: \beta_1 > \beta_2$ at both the 10% and 5% significance levels.

To explore whether the price of houses built on very large parcels behaves differently, a dummy variable, denoted as "**Large**" is defined. This variable takes the value 1 if the size of the parcel has more than 2500 m² and 0 otherwise. Table 2 below shows the Ordinary Least Squares (OLS) estimation of the new model.

$$\ln(price) = \alpha_0 + \alpha_1 rooms + \alpha_2 sqrmt + \alpha_3 parcel_{size} + \alpha_4 \boldsymbol{Large} + \alpha_5 \boldsymbol{Large} \times sqrmt + U$$

Table 2

Variable	Coefficient	std. error	t-ratio	p-value
Dep. Variable: ln (price)				
Method: OLS				
No. Observations: 88				
Const	4.771439	0.099451	47.97764	0.0000
rooms	0.034803	0.028262	1.231451	0.2217
sqrmt	0.003231	0.000496	6.514933	0.0000
parcel_size	0.171110	0.065219	2.623611	0.0104
Large	-2.225233	0.967610	-2.299720	0.0240
$Large \times sqrmt$	0.007147	0.002747	2.601896	0.0110
R-squared	0.658945	Mean dependent var		5.633180
Adj. R-squared	0.638149	S.D. dependent var		0.303573
S.E. of regression	0.182611	F (5, 82)		31.68613
Sum of squared resid	2.734441	P-value (F)		0.000000

Question 9. According to Table 2, which of the following statements is TRUE?

A. Adding one additional square meter (sqrmt) will increase the price of detached houses with large parcels by 1.0378% and by 0.3231% for the rest.
B. Adding one additional square meter (sqrmt) will increase the price of detached houses with large parcels by 0.7147% and by 1.0378% for the rest.
C. The impact of the size of the detached house (sqrmt) on the price is the same, 0.3231%, regardless of whether the parcel is large or not.

Question 10. According to Tables 1 and 2 and knowing that $P[F(2,82) \geq 3.11] = 0.95$, the null hypothesis that the prices of detached houses behave similarly regardless of whether the parcel is large or not has an associated F-statistic:

A. Equal to 4.408. Consequently, the null hypothesis is rejected at the 10% level of significance.
B. Equal to 6.582. Consequently, the null hypothesis is rejected at the 5% level of significance.
C. We lack sufficient information to test this hypothesis.

Questions 11 to 14 refer to the following statement: Using data from some students taking a university course, the following regression model has been estimated using OLS:

$$FINAL = \beta_0 + \beta_1 MISS + \beta_2 TASK\% + \beta_3 FIRST + U$$

where $FINAL$ is the grade (from 0 to 10), $MISS$ is the number of missed sessions by each student, $TASK\%$ is the percentage of tasks delivered by each student and $FIRST$ is a binary variable that takes the value of 1 if it is the first time that the student takes the course and 0 otherwise. TABLE 3 shows some results from the estimation.

TABLE 3

Dependent Variable: FINAL Method: OLS Observations: 674				
Variable	Coefficient	Std. Error	t-ratio	p-value
Const	-----	-----	-----	0.000
MISS	-0.022281	0.010914	-----	-----
TASK%	0.004700	0.003001	1.57	0.118
FIRST	-0.243128	0.107119	-2.27	0.024

R-squared	0.0341	Mean dependent var	6.4722
Adjusted R-squared	0.0298	S.D. dependent var	-----
S.E. of regression	1.163498	F-statistic	-----
Sum squared resid	-----	P-value (F)	-----

Question 11. Knowing that the sample means of the variables $MISS$, $TASK\%$ and $FIRST$ are 5.721, 87.908 and 0.2299 respectively, which is the estimated value for the intercept?

A. 6.242
B. 87.387
C. 5.876

Question 12. From the results shown in TABLE 3, which is the correct answer?

A. A student doing the course for the first time is expected to achieve a better grade than a student that has already taken the course (holding everything else constant).
B. A student missing half of the sessions is expected to achieve a lower grade than a student missing one session in five (holding everything else constant).
C. The other two answers are incorrect.

Question 13. Knowing that Pr[t(670) ≤ 2.33193] = 0.99 and that Pr[t(670) ≤ 1.28282] = 0.9, a student wants to test the null hypothesis that missing one session implies an expected loss of 0.02 points in the grade ($H_0: \beta_1 = -0.02$) against the alternative hypothesis that the expected loss is lower than 0.02 points in the grade ($H_1: \beta_1 > -0.02$). Choose the right answer:

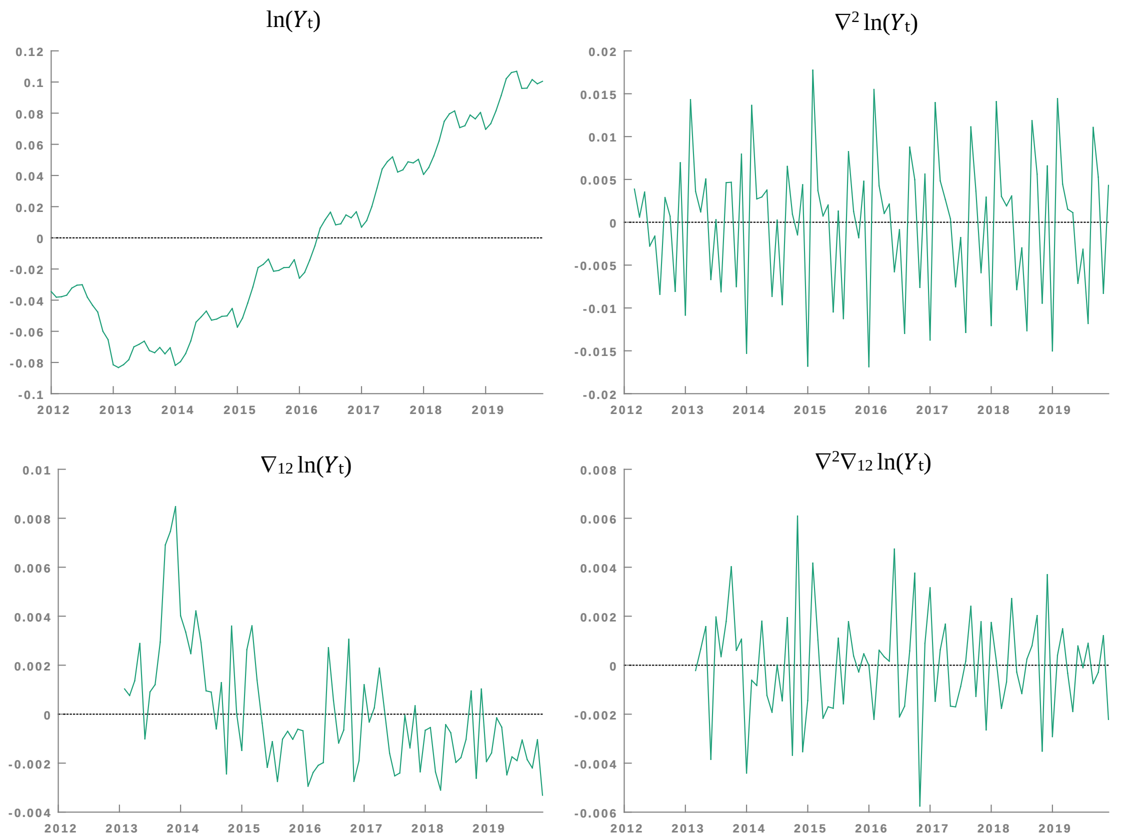
A. The null hypothesis is rejected at the 1% and at the 10% levels of significance.
B. The value of the t statistic for this hypothesis is equal to -2.04.
C. The null hypothesis is not rejected at the 10% level of significance.

Question 14. Choose the right answer regarding the hypothesis test on the joint significance of the slopes in TABLE 3:

A. The statistic follows a F(4,670) distribution and, as Pr[F(4,670) ≥ 3.34725] = 0.01, we reject H_0 at the 1% level of significance.
B. The statistic follows a F(3,670) distribution and, as Pr[F(3,670) ≥ 2.09198] = 0.1, we do not reject H_0 at the 10% level of significance.
C. The statistic follows a F(3,670) distribution and, as Pr[F(3,670) ≥ 2.6182] = 0.05, we reject H_0 at the 5% level of significance.

Questions 15 and 16 refer to the following statement: In the FIGURE 1, Y_t shows the monthly number of workers affiliated to the Social Security in Spain between 2012 and 2019. The other graphs in FIGURE 1 show different transformations for the time series Y_t: $\ln(Y_t)$ (natural log of Y_t), $\nabla^2 \ln(Y_t)$ (second regular difference of the natural log of Y_t), $\nabla_{12} \ln(Y_t)$ (seasonal difference of the natural log of Y_t), $\nabla^2\nabla_{12} \ln(Y_t)$ (second regular difference of the seasonal difference of the natural log of Y_t). All the series have been estandardized.

FIGURE 1



Question 15. According to the patterns shown in FIGURE 1:

A. The series $\ln(Y_t)$ does not show any seasonal component.

B. The series $\nabla^2\nabla_{12} \ln(Y_t)$ shows a clear trend.

C. The series $\nabla^2 \ln(Y_t)$ shows a clear seasonal component.

Question 16. Choose the right answer:

A. The series $\ln(Y_t)$ is mean-stationary but not variance-stationary.

B. The series $\nabla_{12} \ln(Y_t)$ is equal to $\ln(Y_t) - \ln(Y_{t-12})$

C. The series $\nabla^2 \ln (Y_t)$ is mean-stationary and variance-stationary.

Question 17. In a linear regression model, the existence of autocorrelation:

[1] Refers to the linear relationship between the dependent variable and one or more explanatory variables.
[2] Affects the validity of the usual hypotheses tests about the parameters of the model.
[3] Causes bias in the OLS estimator for the parameters of the model.
[4] Arises when the model errors show some pattern of time dependence.
[5] Can be detected using RESET.

A. The five statements are false.

B. Statements [1], [3] and [5] are correct.

C. Statements [2] and [4] are correct.

Question 18. Imagine that heteroscedasticity is detected in a linear model that has been estimated using OLS. If the functional form of the heteroscedasticity is known and you want to take it into account using Weighted Least Squares, this strategy would imply:

A. Placing more weight on those observations with larger variance.

B. Placing more weight on those observations with smaller variance.

C. Placing similar weight on every observation.

Question 19. With a sample of 1,000 individuals, a researcher uses OLS to estimate the model: $\hat{Y} = 5 + 1.5X$, where Y is the hourly wage in euros (2 decimal points) and X are the years of education. Then, and with the same sample, the researcher uses OLS to estimate the model $\hat{Z} = \hat{\beta}_0 + \hat{\beta}_1 X$, where Z is hourly wage in cents. Choose the right answer:

A. $\hat{\beta}_1 = 1.5$

B. $\hat{\beta}_1 = 0.015$

C. $\hat{\beta}_1 = 150$

Question 20. When there is a large degree of (non-perfect) collinearity in a classical linear regression model:

A. The confidence intervals for the model parameters are usually wide.

B. OLS is no longer unbiased.

C. OLS no longer shows minimum variance.

CALCULATIONS

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