

Name: _____

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ECONOMETRICS - 12-01-2022 - Time: 2 h 30'

1. Say if the following statements are unambiguously true (True), unambiguously false (False) or impossible to classify the way they are stated (Not necessarily). Write the motivations to your answers **only** in the space provided. A “Not necessarily” answer with no adequate motivation will be considered wrong.

- (a) If A is an $n \times n$ whose elements are all equal to x , there is at least one value of x that makes A idempotent.

True ☐

False ☐

Not necessarily ☐

- (b) If a test is χ^2 -distributed, its p value can never be 0.

True ☐

False ☐

Not necessarily ☐

- (c) Given an iid sample of random variables y_i and x_i , such that $E(y_i|x_i) = x_i^2$ and $V(y_i|x_i) = x_i^2$, the OLS estimator of the model $y_i = \beta_0 + \beta_1 x_i + \beta_2 x_i^2 + \varepsilon_i$ converges in probability to the vector $[0, 0, 1]'$.

True ☐

False ☐

Not necessarily ☐

- (d) The Godfrey test is the most important diagnostic test for dynamic models.

True ☐

False ☐

Not necessarily ☐

- (e) Given the ADL representation of a dynamic regression, the ECM representation can always be computed, but the converse is not true.

True ☐

False ☐

Not necessarily ☐

2. Suppose you observe, for a sample of $n = 200$ observations the following cross-product matrix:

	y_i	x_i	z_i
y_i	620	480	360
x_i	480	720	540
z_i	360	540	900

so, for example, $\sum_{i=1}^n y_i z_i = 360$. Given the model $y_i = x_i \beta + \varepsilon_i$, calculate

- (a) The OLS estimator: $\hat{\beta} =$ _____
- (b) The sum of squared residuals $SSR =$ _____
- (c) Test the hypothesis $H_0 : \beta = 0.5$
- Test type: _____ Distribution: _____ Test statistic: _____
- Decision: ☐ Reject ☐ Don't reject

Then, given the model $y_i = x_i \beta + z_i \gamma + \varepsilon_i$, calculate the same quantities as above, namely:

- (d) The OLS estimator: $\hat{\beta} =$ _____
- (e) The sum of squared residuals $SSR =$ _____
- (f) Test the hypothesis $H_0 : \beta = 0.5$
- Test type: _____ Distribution: _____ Test statistic: _____
- Decision: ☐ Reject ☐ Don't reject

3. The following data were taken from a sample of 6546 Italian households, included in the SHIW survey (Bank of Italy) for the year 2016:

Table 1: Statistiche descrittive

Variabile	Descrizione	Mean	Median	StDev	Min	Max
food	log of yearly food expenditure	8.442	8.476	0.5333	6.397	11.34
y	log of yearly net income	10.21	10.20	0.5814	8.519	13.20
w	log of total wealth	11.51	11.99	1.776	3.210	15.95
n	log of tyhe number of people in the household	0.6099	0.6931	0.5206	0.000	1.946
skids	share of children under 14	0.03567	0.000	0.1154	0.000	0.8333
lau	dummy, 1 if the household head has a universitu degree	0.1239	0.000	0.3295	0.000	1.000

Answer the following questions, using the numerical estimates that you find in table 2:

- (a) Do we have to worry about autocorrelation here? Why?

Table 2: Food consumption model

Model 1: OLS, using observations 1–6765 ($n = 6546$)

Missing or incomplete observations dropped: 219

Dependent variable: food

Heteroskedasticity-robust standard errors, variant HC1

	Coefficient	Std. Error	<i>t</i> -ratio	p-value
const	4.80884	0.119500	40.24	0.0000
y	0.323170	0.0138880	23.27	0.0000
w	0.00965942	0.00364833	2.648	0.0081
n	0.382344	0.0134381	28.45	0.0000
skids	-0.200923	0.0427551	-4.699	0.0000
Mean dependent var	8.453369	S.D. dependent var	0.524439	
Sum squared resid	1031.520	S.E. of regression	0.397115	
R^2	0.426968	Adjusted R^2	0.426618	
$F(4, 6541)$	1095.005	P-value(F)	0.000000	

White's test for heteroskedasticity: LM = 91.4475 with p-value = 2.02059e-13

RESET test for specification: $F(2, 6539) = 4.19303$ with p-value = 0.015141

Chow test with respect to lau: test statistic: $\chi^2(5) = 18.4959$ with p-value = 0.00238506

- (b) Test the hypothesis that the coefficient for the y variable equals 1, and briefly discuss the economic interpretation of the result:

Test type: _____ Distribution: _____ Test statistic: _____
Decision: ☐ Reject ☐ Don't reject

- (c) Comment the result for the RESET and Chow tests:

[illegible]

(d) Comment the result for the White test:

(e) Given the results contained in Table 2, what would you suggest for enhancing the model?
