

# Econometrics - Module I

2016 - 06 - 29

Name: \_\_\_\_\_

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1. Say if the following statements are unambiguously true (TRUE), unambiguously false (FALSE) or impossible to classify the way they are stated (CAN'T SAY). Write the motivations to your answers **only** in the space provided. A "CAN'T SAY" answer with no motivations will be considered wrong.

- (a) Idempotent matrices must be square.

TRUE ☐ FALSE ☐ CAN'T SAY ☐

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- (b) Discrete random variables with infinite support cannot have finite moments.

TRUE ☐ FALSE ☐ CAN'T SAY ☐

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- (c) The sum of squared residuals from an OLS regression cannot be larger than the sum of the squares of the dependent variable.

TRUE ☐ FALSE ☐ CAN'T SAY ☐

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- (d) Given the model  $\mathbf{y} = \mathbf{X}\beta + \mathbf{e}$ , it's impossible that  $\mathbf{y}'\mathbf{M}_X\mathbf{y} > \mathbf{y}'\mathbf{y}$ .

TRUE ☐ FALSE ☐ CAN'T SAY ☐

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- (e) Suppose you test a hypothesis on the vector  $\beta$  expressed as  $R\beta = d$ , where

$$R = \begin{bmatrix} 0 & 0 & 0 & 0 & 1 & 0 \\ 0 & 0 & 1 & 0 & 0 & -1 \end{bmatrix} \quad d = \begin{bmatrix} 0 \\ 1 \end{bmatrix}$$

and all the standard conditions for inference are met. Then, the  $W$  test statistic is asymptotically distributed as a  $\chi^2_4$  random variable.

TRUE ☐ FALSE ☐ CAN'T SAY ☐

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2. Given the model  $y_i = \beta_0 + \beta_1 x_i + \beta_2 w_i + \varepsilon_i$ , you have the following cross-products:

$$\mathbf{X}'\mathbf{X} = 100 \cdot \begin{bmatrix} 1 & 0 & 0 \\ 0 & 2 & 1 \\ 0 & 1 & 3 \end{bmatrix} \quad \mathbf{X}'\mathbf{y} = 30 \cdot \begin{bmatrix} 1 \\ 2 \\ 3 \end{bmatrix} \quad \mathbf{y}'\mathbf{y} = 105.4$$

(a) compute  $\hat{\beta} = [ \text{_____} , \text{_____} , \text{_____} ]'$

(b) compute  $\hat{\sigma}^2 = \text{_____}$

(c) test the following hypothesis:

$H_0 : \beta_1 + \beta_2 = 0.5$     Test = \_\_\_\_\_    Test type = \_\_\_\_\_  
 Decision:                      CAN'T REJECT    ☐                      REJECT    ☐

3. The regression reported in Table 1 was computed on UK monthly data for the following variables:

$p_t$     logarithm of the price of petrol for cars at time  $t$   
 $k_t$     logarithm of casualties (people killed or seriously injured) in road accidents  
          at time  $t$

(a) Comment on the sign of the coefficient for the variable  $p_t$ . Does it conform to your prior intuition?

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(b) Comment on the two autocorrelation tests at the end of the table and their significance for the rest of the statistics contained in the table.

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(c) Comment on any other statistic in the table you consider relevant.

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(d) Calculate the short- and long-run elasticity of casualties to the price of petrol:

$$\delta_0 = \underline{\hspace{2cm}} \quad c = \underline{\hspace{2cm}}$$

(e) Suppose the price of petrol increases permanently by 3%; what is your estimate of the long-run effect on the number of monthly casualties?

$$\text{long-run effect} = \underline{\hspace{2cm}}$$

OLS, using observations 1969:03–1984:12 ( $T = 190$ )

Dependent variable:  $k_t$

	Coefficient	Std. Error	<i>t</i> -ratio	p-value
const	1.5234	0.3811	3.9970	0.0001
$p_t$	−0.1613	0.0609	−2.6499	0.0088
$k_{t-1}$	0.4508	0.0721	6.2523	0.0000
$k_{t-2}$	0.3118	0.0720	4.3293	0.0000
Mean dependent var	7.406439	S.D. dependent var	0.172103	
Sum squared resid	1.034553	S.E. of regression	0.076888	
$R^2$	0.815194	Adjusted $R^2$	0.800409	
$F(14, 175)$	55.13846	P-value( $F$ )	1.62e−56	

LM test for autocorrelation up to order 1 – Test statistic: LMF = 1.70984  
with p-value =  $P(F(1, 174) > 1.70984) = 0.192731$

LM test for autocorrelation up to order 12 – Test statistic: LMF = 0.880795  
with p-value =  $P(F(12, 163) > 0.880795) = 0.567713$

Table 1: Dynamic regression for casualties in road accidents

## Econometrics - Module II

2016 - 06 - 29

4. Say if the following statements are unambiguously true (TRUE), unambiguously false (FALSE) or impossible to classify the way they are stated (CAN'T SAY). Write the motivations to your answers **only** in the space provided. A "CAN'T SAY" answer with no motivations will be considered wrong.

- (a) The Sargan test cannot be computed for just-identified models.

TRUE ☐ FALSE ☐ CAN'T SAY ☐

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- (b) Neglected autocorrelation provokes inconsistency of the OLS estimator of the pooled linear model.

TRUE ☐ FALSE ☐ CAN'T SAY ☐

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- (c) In the longitudinal model  $y_{it} = \rho y_{it-1} + \alpha_i + \varepsilon_{it}$  the strong exogeneity assumption on  $\varepsilon_{it}$  is violated if  $\rho \neq 0$ .

TRUE ☐ FALSE ☐ CAN'T SAY ☐

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