

**Econometrics Test**  
2014 - 09 - 11

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

email: \_\_\_\_\_

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) All invertible matrices are square.

TRUE      ☐      FALSE      ☐      CAN'T SAY      ☐

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- (b) An estimator which does not have a limit in probability cannot be consistent.

TRUE      ☐      FALSE      ☐      CAN'T SAY      ☐

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- (c) An estimator which is not asymptotically normal cannot be consistent.

TRUE      ☐      FALSE      ☐      CAN'T SAY      ☐

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- (d) In a linear model,  $y_i = \beta x_i + \varepsilon_i$ , if  $E(y_i|x_i) = \beta x_i$ , then  $E(\varepsilon_i|x_i) = 0$  by construction.

TRUE      ☐      FALSE      ☐      CAN'T SAY      ☐

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- (e) If  $V(y_i|x_i) = 33.8$ , then the linear model  $y_i = \beta x_i + \varepsilon_i$  is heteroskedastic.

TRUE      ☐      FALSE      ☐      CAN'T SAY      ☐

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2. Prove analytically that if you add variables to a linear model the  $R^2$  index cannot decrease.
3. The following table shows a model in which the dependent variable is the *net migration rate* in Italian provinces in the year 2013, defined as

$$100000 \times \frac{\text{Immigrants} - \text{Emigrants}}{\text{Population}}$$

The table contains standard errors with the associated  $t$ -ratios and  $p$ -values computed with the OLS formula (under “Standard”) and with White’s heteroskedasticity-robust variant (under “Robust”).

	Coefficient	Standard			Robust		
		Std. Error	$t$ -ratio	p-value	Std. Error	$t$ -ratio	p-value
const	−223.5527	356.1226	−0.6277	0.5315	468.0984	−0.4776	0.6340
lpop	32.9178	26.5220	1.2412	0.2173	37.4347	0.8793	0.3812
unemp	−13.9582	7.1942	−1.9402	0.0551	10.2599	−1.3605	0.1766
nord	285.9531	75.8641	3.7693	0.0003	77.5847	3.6857	0.0004
centro	288.7007	73.3828	3.9342	0.0002	67.6325	4.2687	0.0000
isole	34.8913	67.5552	0.5165	0.6066	75.4782	0.4623	0.6449
Mean dependent var		229.5803	S.D. dependent var	278.0114			
Sum squared resid		4247285	S.E. of regression	202.0873			
$R^2$		0.495850	Adjusted $R^2$	0.471612			
$F(5, 104)$		20.45757	P-value( $F$ )	3.58e−14			
Log-likelihood		−736.9553	Akaike criterion	1485.911			
Schwarz criterion		1502.113	Hannan–Quinn	1492.483			

White’s test for heteroskedasticity –

Test statistic: LM = 43.4223, p-value = 7.33137e-05

The explanatory variables are:

Variable	Description
lpop	log of total population in the province in 2012
unemp	unemployment rate in the province in 2012
nord	Dummy variable, Northern Italy
centro	Dummy variable, Central Italy
isole	Dummy variable, Sicily or Sardinia

- (a) Comment on the sign and magnitude of the coefficients for the variables **lpop** and **unemp**. Do results conform to your prior intuition?
- (b) Comment on the sign and magnitude of the coefficients for the geographic dummies.
- (c) Comment on the results of the heteroskedasticity test.
- (d) Comment on any other statistic you consider relevant.