Econometrics Test
2014 - 09 - 11

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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) All square matrices are invertible.
   TRUE ◯ FALSE ◯ CAN'T SAY ◯

   (b) If an estimator is consistent, it is also asymptotically normal.
   TRUE ◯ FALSE ◯ CAN'T SAY ◯

   (c) If an estimator is asymptotically normal, it is also consistent.
   TRUE ◯ FALSE ◯ CAN'T SAY ◯

   (d) In a linear model $y_i = \beta x_i + \varepsilon_i$, heteroskedasticity of ε_i makes the OLS estimator $\hat{\beta}$ inefficient.
   TRUE ◯ FALSE ◯ CAN'T SAY ◯

   (e) In the ADL model $y_t = 0.8y_{t-1} - 0.2y_{t-2} + 0.5x_t - 0.4x_{t-1}$ the long-run multiplier does not exist.
   TRUE ◯ FALSE ◯ CAN'T SAY ◯

2. Suppose that you estimate a model $y_i = \boldsymbol{x}_i'\boldsymbol{\beta} + \varepsilon_i$ via OLS (call it model "A"), and then test for the linear restrictions $R\boldsymbol{\beta} = 0$ (call "B" the restricted model). Prove analytically that the resulting F test will be greater than 1 if and only if $\bar{R}^2_A > \bar{R}^2_B$.

3. The models reported in Table 2 have, as dependent variable, the score obtained in a maths test by 11258 classes (source: INVALSI). The explanatory variables are:

Variable	**Description**
`female`	Share of female pupils in the class
`immigrants`	Share of pupils in the class from immigrant families
`behind`	Share of pupils in the class who repeated at least one year
`centre`	Dummy variable, Central Italy
`south`	Dummy variable, Southern Italy
`clsize`	Total number of pupils in the class

Table 1 provides a few descriptive statistics.

	Mean	Median	Minimum	Maximum	Std. Dev.
`score_math`	46.474	45.147	16.254	91.869	10.688
`female`	0.48821	0.5	0	0.92857	0.11142
`immigrants`	0.047444	0	0	0.6	0.06843
`behind`	0.031567	0	0	0.82353	0.0495
`centre`	0.18733	0	0	1	0.3902
`south`	0.37129	0	0	1	0.48317
`clsize`	19.586	20	11	30	3.7727

Table 1: INVALSI data, descriptive statistics

1. Comment on the sign and magnitude of the coefficients for the variables `female`, `immigrants` and `behind`. Do results conform to your prior intuition?

2. Comment on the sign and magnitude of the coefficients for the variables `centre` and `south`. Is it possible to say that results are geographically homogenous?

3. Comment on the results of the two versions of the heteroskedasticity tests.

4. Comment on the relationship, which appears from the estimates, between math performance and class size. Do results conform to your prior intuition?

OLS estimates
Dependent variable: score_math (standard errors in parentheses)

	(1)	(2)	(1) robust s.e.	(2) robust s.e.
const	45.03**	46.61**	45.03**	46.61**
	(2.320)	(0.4754)	(2.318)	(0.4711)
female	−1.026	−0.9324	−1.026	−0.9324
	(0.8932)	(0.8927)	(0.9178)	(0.9179)
immigrants	−12.15**	−12.17**	−12.15**	−12.17**
	(1.808)	(1.808)	(1.730)	(1.728)
behind	−6.658**	−6.944**	−6.658**	−6.944**
	(2.373)	(2.371)	(2.477)	(2.472)
centre	1.255**	1.266**	1.255**	1.266**
	(0.2744)	(0.2744)	(0.2445)	(0.2443)
south	2.424**	2.363**	2.424**	2.363**
	(0.2365)	(0.2354)	(0.2433)	(0.2428)
clsize	0.09057		0.09057	
	(0.2393)		(0.2351)	
clsize^2	−0.0004418		−0.0004418	
	(0.006155)		(0.005977)	
Model reduction Wald test (1) → (2):	$W = 7.66468$ p-value = 0.02166		$W = 8.04005$ p-value = 0.01795	
n	11258	11258	11258	11258
$\bar{R}^2$	0.0258	0.0253	0.0258	0.0253

White's tests for heteroskedasticity on model (1):
Test statistic: $n \cdot R^2 = 954.758$, p-value = $\mathrm{P}(\chi^2_{31} > 954.758) = 0.000000$
Test statistic (squares only): $n \cdot R^2 = 909.905$, p-value = $\mathrm{P}(\chi^2_{11} > 909.905) = 0.000000$

Table 2: Estimates