Econometrics Test
2014 - 09 - 23

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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) A matrix whose rank is 3 is singular.
   TRUE ◯ FALSE ◯ CAN'T SAY ◯

   (b) If an estimator has a limit in probability, then it is consistent.
   TRUE ◯ FALSE ◯ CAN'T SAY ◯

   (c) If an estimator is consistent, then it has a limit in probability.
   TRUE ◯ FALSE ◯ CAN'T SAY ◯

   (d) In a linear model, if regressors are collinear, the sum of squared residuals may become negative.
   TRUE ◯ FALSE ◯ CAN'T SAY ◯

   (e) Suppose you have two zero-mean variables y_i and x_i. Then the elasticity of y with respect to x can be calculated by regressing $\log(y_i)$ on $\log(x_i)$.
   TRUE ◯ FALSE ◯ CAN'T SAY ◯

2. Suppose that you estimate a model $y_i = \mathbf{x}_i'\boldsymbol{\beta} + \varepsilon_i$ via OLS, and then test for the linear restrictions $R\boldsymbol{\beta} = d$. Prove analytically that $(R\hat{\boldsymbol{\beta}} - d)' \left[R\left(\mathbf{X}'\mathbf{X}\right)^{-1} R'\right]^{-1} (R\hat{\boldsymbol{\beta}} - d) = \tilde{\mathbf{e}}'\mathbf{P}_{\mathbf{X}}\tilde{\mathbf{e}}$, where $\tilde{\mathbf{e}}$ is the vector of residuals from the restricted model and $\mathbf{P}_{\mathbf{X}}$ is the projection matrix for the matrix $\mathbf{X}$.

3. The ADL model reported below uses as dependent variable u_t the natural logarithm of the unemployment rate for Italy; the explanatory variable x_t is the log of the index of total industrial production (source: Istat). Data are monthly.

OLS, using observations 2004:04–2014:07 ($T = 124$)

	Coefficient	Std. Error	t-ratio	p-value
const	0.648773	0.188988	3.4329	0.0008
u_{t-1}	0.767676	0.0878374	8.7397	0.0000
u_{t-2}	0.447214	0.105422	4.2421	0.0000
u_{t-3}	−0.253271	0.0869407	−2.9131	0.0043
x_t	−0.121500	0.0348289	−3.4885	0.0007

Mean dependent var	2.118190	S.D. dependent var	0.223617
Sum squared resid	0.058709	S.E. of regression	0.022212
R^2	0.990455	Adjusted R^2	0.990134
$F(4, 119)$	3086.960	P-value(F)	3.8e–119

Breusch-Godfrey test for autocorrelation up to order 3:
Test statistic: LMF = 1.400952, with p-value = 0.246

(a) Comment on the coefficient for x_t: does its sign conform to your economic intuition?

(b) Comment on the Godfrey test for autocorrelation.

(c) Comment on any other statistic in the table you think important.

(d) Rewrite the model in ECM form (two decimal digits are enough):

$$\Delta u_t = \_\_\_\_ \_\_\_\_ \Delta x_t \_\_\_\_ \Delta u_{t-1} \_\_\_\_ \Delta u_{t-2} \_\_\_\_ \left[u_{t-1} \_\_\_\_ x_{t-1}\right]$$

(e) Evaluate the instantaneous elasticity of unemployment to industrial production:

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(f) Evaluate the long-run elasticity of unemployment to industrial production:

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