Econometrics - Module I
2016 - 07 - 13

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) If a matrix is square, its transpose may not be square.
   TRUE ◯ FALSE ◯ CAN'T SAY ◯

   (b) A square matrix full of zeros is idempotent.
   TRUE ◯ FALSE ◯ CAN'T SAY ◯

   (c) All consistent estimators are efficient.
   TRUE ◯ FALSE ◯ CAN'T SAY ◯

   (d) Given the linear model $y_i = \beta_0 + \beta_1 x_i + \varepsilon_t$, if $E(x_i) > 1$ then $\beta_0 \leq \beta_1$.
   TRUE ◯ FALSE ◯ CAN'T SAY ◯

   (e) Autocorrelation implies heteroskedasticity.
   TRUE ◯ FALSE ◯ CAN'T SAY ◯

2. Suppose the four models below were estimated on the same dataset, containing 1000 observations:[1]

$$
\begin{aligned}
y_i &= 30 + 0.37x_i + 0.61z_i + \text{resid} && (1)\\
y_i &= 30 + 0.6\,(x_i + z_i) + \text{resid} && (2)\\
y_i - x_i &= 30 + 0.62\,(z_i - x_i) + \text{resid} && (3)\\
y_i - \frac{x_i + z_i}{2} &= 31 + \text{resid} && (4)
\end{aligned}
$$

Suppose that the sum of squared residuals for the four models above equal

$$SSR_1 = 480 \quad SSR_2 = 484 \quad SSR_3 = 481 \quad SSR_4 = 495$$

Test the following hypotheses:

(a) $H_0 : \beta_1 = \beta_2$ Test stat. = _____ Test type = _____
Decision: CAN'T REJECT ◯ REJECT ◯

(b) $H_0 : \beta_1 + \beta_2 = 1$ Test stat. = _____ Test type = _____
Decision: CAN'T REJECT ◯ REJECT ◯

(c) $H_0 : [\beta_1, \beta_2]' = [0.5, 0.5]'$ Test stat. = _____ Test type = _____
Decision: CAN'T REJECT ◯ REJECT ◯

3. The regression reported in Table 1 was computed on 2014 data for 106 Italian provinces, by using the following variables:

`robb`	number of reported robberies per 100,000 inhabitants
`lpop`	log of total population
`unemp`	unemployment rate
`linc`	log of the mean income per household
`fsha`	percentage of foreigners on resident population

(a) Comment on the sign and magnitudes of estimated coefficients and suggest an interpretation for the results.

[1] The following convention is adopted: the coefficient for the constant term is β_0, the one for x_i is β_1 and the one for z_i is β_2.

OLS, using observations 1–106; Dependent variable: robb
Heteroskedasticity-robust standard errors, variant HC1

	Coefficient	Std. Error	t-ratio	p-value
const	−700.530	267.856	−2.6153	0.0106
lpop	28.7139	5.96101	4.8169	0.0000
unemp	1.84623	1.42014	1.3000	0.1972
linc	32.8913	21.3690	1.5392	0.1276
fsha	1.80956	2.12500	0.8516	0.3969

(19 regional dummy variables omitted)

Mean dependent var	40.22264	S.D. dependent var	32.93265
Sum squared resid	49271.05	S.E. of regression	24.51258
R^2	0.567338	Adjusted R^2	0.445981

White's test for heteroskedasticity - Test statistic: LM = 46.5448
with p-value = $P(\chi^2_{26} > 46.5448) = 0.00792314$

Table 1: Number of reported robberies in Italian provinces (2014)

(b) Comment on the heteroskedasticity test and state whether the hypothesis tests reported in Table 1 can be considered credible or not.

(c) Suggest possible ways to improve the model.