

Econometrics Test

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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 not square, then it cannot be invertible.

TRUE ☐ FALSE ☐ CAN'T SAY ☐

- (b) If a matrix is not square, then it cannot be full rank.

TRUE ☐ FALSE ☐ CAN'T SAY ☐

- (c) Imagine that

$$E[y_t|x_t] = \alpha x_t^\beta$$

then, the parameters α and β can be estimated via OLS.

TRUE ☐ FALSE ☐ CAN'T SAY ☐

- (d) Suppose the relationship between two positive variables is correctly described by the model

$$\ln y_t = 10 - 0.5 \ln x_t + \varepsilon_t;$$

then, the elasticity of y with respect to x is 0.5.

TRUE ☐ FALSE ☐ CAN'T SAY ☐

- (e) In the model $y_t = \phi y_{t-1} + \varepsilon_t$, the parameter ϕ can be estimated consistently via OLS.

TRUE ☐ FALSE ☐ CAN'T SAY ☐

2. Suppose you have a bivariate Bernoulli random variable with this probability function

	$X = 0$	$X = 1$	
$Y = 0$	$1 - p - q + \pi$	$p - \pi$	$1 - q$
$Y = 1$	$q - \pi$	π	q
	$1 - p$	p	1

- (a) find $E(Y|X = 0)$ as a function of p , q and π :

$$E(Y|X = 0) = \underline{\hspace{10cm}}$$

- (b) find $E(Y|X = 1)$ as a function of p , q and π

$$E(Y|X = 1) = \underline{\hspace{10cm}}$$

- (c) it can be proven that $E(Y|X) = \beta_0 + \beta_1 X$; find β_0 and β_1 as a functions of p , q and π

$$\beta_0 = \underline{\hspace{10cm}} \quad \beta_1 = \underline{\hspace{10cm}}$$

- (d) show (in the space provided below) that, if $\pi = pq$, then $E(Y|X) = E(Y)$

3. The following model was estimated on 179 European regions, on data for the year 2011 (source: Eurostat). The dependent variable is the log of life expectancy at birth (ie, the number of years a newborn baby born in 2011 can be expected to survive). The explanatory variables are the log of GDP per capita (`l_gdp`) and the log of the ratio hospital beds/number of doctors (`l_bd`) .

	Coefficient	Std. Error	t -ratio	p-value
const	4.01052	0.0200971	199.5571	0.0000
<code>l_gdp</code>	0.0385556	0.00201971	19.0897	0.0000
<code>l_bd</code>	-0.0181820	0.00299302	-6.0748	0.0000
Mean dependent var	4.374453	S.D. dependent var		0.038368
Sum squared resid	0.061323	S.E. of regression		0.018666
R^2	0.765970	Adjusted R^2		0.763310
$F(2, 176)$	288.0200	P-value(F)		3.13e-56
Log-likelihood	460.1296	Akaike criterion		-914.2593
Schwarz criterion	-904.6971	Hannan-Quinn		-910.3819

White's test for heteroskedasticity –

Test statistic: $LM = 11.6096$, p-value = $P(\chi^2(5) > 11.6096) = 0.0405471$

- (a) Comment on the size and sign of the coefficients. How would you explain that the coefficient of GDP is positive? How would you explain that the coefficient of `l_bd` is negative?
- (b) Comment on the heteroskedasticity test. Does this invalidate any of your previous conclusions?
- (c) Suggest ways to build a better model than the above. What would you do to improve it?