Name: ______________________________

Matricola: ____________________ email: ____________________

ECONOMETRICS - 2022-06-17 - Time: 2 h 30'

1. Say if the following statements are unambiguously true (True), unambiguously false (False) or impossible to classify the way they are stated (Not necessarily). Write the motivations to your answers **only** in the space provided. A "Not necessarily" answer with no adequate motivation will be considered wrong.

   (a) If $E(Y|X) = 1 + X^2$ and $E(X) = 2$, then $E(Y) = 5$.
   True ◯ False ◯ Not necessarily ◯

   (b) A consistent estimator may not be asymptotically normal.
   True ◯ False ◯ Not necessarily ◯

   (c) An asymptotically normal estimator may not be consistent.
   True ◯ False ◯ Not necessarily ◯

   (d) The *power* of a test is the probability of making the right decision.
   True ◯ False ◯ Not necessarily ◯

   (e) Heteroskedasticity makes the OLS estimator inefficient.
   True ◯ False ◯ Not necessarily ◯

2. The following model

$$y_i = \beta_0 + \beta_1 x_i + \beta_2 z_i + \beta_3 x_i^2 + \beta_4 x_i z_i + \beta_5 z_i^2 + \varepsilon_i$$

was estimated, using a sample of size $n = 240$, with some constraints:

	(A)	(B)	(C)
const	3.491***	2.969***	3.002***
	(49.49)	(48.56)	(42.19)
x	1.060***	1.055***	1.059***
	(15.59)	(21.70)	(21.34)
z	−1.089***	−1.004***	−1.015***
	(−15.73)	(−20.15)	(−19.72)
x^2		0.4873***	0.4883***
		(15.08)	(15.07)
xz			0.01821
			(0.3928)
z^2			−0.03222
			(−0.8916)
R^2	0.677	0.836	0.836
$\hat{\sigma}^2$	1.178	0.600	0.597

t-statistics in parentheses

(a) Test the hypothesis that model A can be preferred to model B

Test type: ________ Distribution: ______ Test statistic: ______
Decision: ○ Reject ○ Don't reject

(b) Test the hypothesis that model A can be preferred to model C

Test type: ________ Distribution: ______ Test statistic: ______
Decision: ○ Reject ○ Don't reject

(c) Test the hypothesis that model B can be preferred to model C

Test type: ________ Distribution: ______ Test statistic: ______
Decision: ○ Reject ○ Don't reject

(d) Using the model you believe is preferable, compute the marginal effect of z_i on y_i for $x_i = z_i = 1$

`model` = __________ $\frac{\partial y}{\partial z}$ = __________

3. Figure 1 displays the plot of weekly data related to the COVID-19 pandemic in Italy between September 2020 and May 2022. The y_t variable is the log of the average number of COVID-related deaths over week t, while x_t is the log of the average number of COVID patients in hospital in the same week.[1]

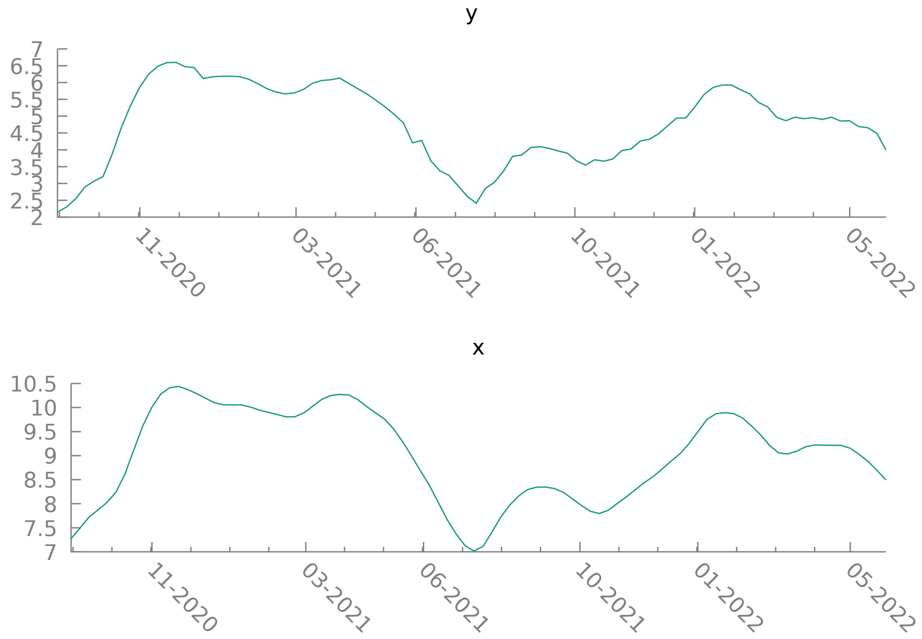

Figure 1: COVID-related deaths (y) and hospitalised patients (x)

The following model was estimated:

$$\widehat{\Delta y_t} = \underset{(0.37415)}{-1.40726} + \underset{(0.074674)}{1.06032}\,\Delta x_t - \underset{(0.059963)}{0.228018}\,y_{t-1} + \underset{(0.072331)}{0.277745}\,x_{t-1} \tag{1}$$

$$T = 92 \quad \bar{R}^2 = 0.7822 \quad F(3, 88) = 109.93 \quad \hat{\sigma} = 0.11591$$

(standard errors in parentheses)

(a) Rewrite the model in ADL form:

$y_t =$ __________ $+$ __________ $y_{t-1}+$ __________ x_t+ __________ x_{t-1}

(b) Compute the following short-run multipliers

$d_0 =$ __________ $d_1 =$ __________ $d_2 =$ __________ $d_3 =$ __________

(c) Compute the long-run multiplier

$LRM =$ __________

(d) The covariance matrix for the parameters in equation (1) is

const	Δx_t	y_{t-1}	x_{t-1}	
0.13999	0.0099803	0.021294	−0.026790	const
	0.0055763	0.0019327	−0.0021369	Δx_t
		0.0035956	−0.0042668	y_{t-1}
			0.0052317	x_{t-1}

[1]Data source: Protezione Civile website, `https://github.com/pcm-dpc/COVID-19`

Test the hypothesis $LRM = 1$:

Test type:	________	Distribution:	______	Test statistic:	______
Decision:	◯	Reject	◯	Don't reject	

(e) Describe the practical implications of the test above. Would the death rate of COVID patients be higher, lower or unchanged during prolonged periods when contagion is higher than usual?