

University of Colombo
Faculty of Arts
Masters in Economics – 2015/2016
Semester III
MECON 509: Econometrics
Answer Five (05) Questions Only
Time: Three (03) Hours Only

Answer Five (05) questions by selecting at least Two (02) questions from each part.
Calculator is allowed. Use Separate Book for each part.

Part A

1.
 - a) State the following functional form of the regression models
 - (i) The log-log model
 - (ii) The log linear model
 - (iii) Linear log model
 - (iv) Box-Cox model (2 Marks each)
 - b) State the elasticity formula for the above four functional forms (6 Marks)
 - c) Which model would be more appropriate to employ in empirical analysis ? (6 Marks)

2.
 - (i) State the OLS assumptions of the standard linear regression model (SLRM) (5 Mark)
 - (ii) The standard linear regression model assumes that each error term U_i is normally distributed, $U_i \sim N(0, \sigma^2)$. Why do we employ normality assumption in econometric analysis? Explain. (5 Marks)
 - (iii) What are the desirable properties of OLS estimators of the regression coefficients (5 Marks)
 - (iv) write down the sampling distribution of slope coefficient $\hat{\beta}_1$ of the regression equation (5 Marks)

3.
 - (i) What do you mean by Cointegration in a time series analysis (5 Marks)
 - (ii) State the Engle-Granger test for Cointegration analysis (5 Marks)
 - (iii) State whether LCPI and LCFPI variables are cointegrated using the results of Cointegration test given below (LCPI=log of consumer price index, LCFPI=log of consumer food price index) (5 Marks)
 - (iv) interpret the estimated Cointegration equation using the results given below. (5 Marks)

Cointegration Test

Date: 01/22/18 Time: 08:38
 Series: LCPI LCFPI
 Sample: 2003M01 2017M12
 Included observations: 180
Null hypothesis: Series are not cointegrated
 Cointegrating equation deterministics: C
 Automatic lags specification based on Schwarz criterion (maxlag=13)

Dependent	tau-statistic	Prob.*	z-statistic	Prob.*
LCPI	-3.724147	0.0198	-28.14242	0.0077
LCFPI	-3.686627	0.0220	-28.06113	0.0078

*MacKinnon (1996) p-values.

Intermediate Results:

	LCPI	LCFPI
Rho - 1	-0.114329	-0.113675
Rho S.E.	0.030699	0.030834
Residual variance	7.30E-05	0.000106
Long-run residual variance	0.000140	0.000204
Number of lags	1	1
Number of observations	178	178
Number of stochastic trends**	2	2

**Number of stochastic trends in asymptotic distribution

Estimated Cointegration Equation

Dependent Variable: LCPI
 Method: Fully Modified Least Squares (FMOLS)
 Date: 01/22/18 Time: 08:39
 Sample (adjusted): 2003M02 2017M12
 Included observations: 179 after adjustments
 Cointegrating equation deterministics: C
 Long-run covariance estimate (Bartlett kernel, Newey-West fixed bandwidth
 = 5.0000)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LCFPI	0.831376	0.007955	104.5082	0.0000
C	0.835707	0.042825	19.51433	0.0000
R-squared	0.996037	Mean dependent var		5.298398
Adjusted R-squared	0.996014	S.D. dependent var		0.340878
S.E. of regression	0.021520	Sum squared resid		0.081971
Long-run variance	0.001891			

4. Write short notes for the following
- (i) Standard error and t statistic
 - (ii) P value and significance level (α value)
 - (iii) Stationarity properties of a time series
 - (iv) Unit root test and nonstationarity series
 - (v) Goodness of fit and R^2

(4 Marks each)

Part B

5. The following equations were estimated by Ordinary Least Squares (OLS) method:

(a) $Y_i = \beta_2 X_i + u_i$

(b) $Y_i = \beta_3 + u_i$

- (i) Briefly explain the underline theory of deriving OLS estimators. (5 Marks)
- (ii) Show that the OLS estimators of β_2 and β_3 (say b_2 and b_3) are given by

$$b_2 = \frac{\sum XY}{\sum X^2}, \quad b_3 = \bar{Y} \quad (5 \text{ Marks})$$

- (iii) Stating any assumptions you make, and carefully indicating how they have been used, show that b_2 and b_3 are unbiased estimators for β_2 and β_3 . (5 Marks)
- (iv) Derive expressions for the variances of b_2 and b_3 and compare their magnitudes. (5 Marks)

6. There are 25 observations on X and Y which are assumed to be generated by the model:

$$Y_i = \beta_1 + \beta_2 X_i + U_i$$

Given that:

$$\sum X = 87, \quad \sum Y = 560, \quad \sum (Y - \bar{Y})^2 = 345$$

$$\sum (X - \bar{X})^2 = 1225, \quad \sum (X - \bar{X})(Y - \bar{Y}) = 487$$

- (i) Calculate b_1 and b_2 (the OLS estimate of β_1 and β_2), the standard error of regression ($\hat{\sigma}$) and the standard error of b_2 .

(5 Marks)

- (ii) State the assumption necessary for b_1 and b_2 to be unbiased. (5 Marks)
- (iii) Calculate a 95% confidence interval for β_2 . Are there any further assumptions, in addition to those stated in (ii), which are required for this confidence interval to be valid. Use $t_{0.025, 23} = 2.069$. (5 Marks)
- (iv) Explain how would you test the hypothesis that Y_i is independent of X_i . (5 Marks)

7. An econometrician estimates the following relationship between sales of newspapers (N), relative to the general price index (RELP), average incomes (INC) and advertising expenditures by newspaper publishers (ADVERT)

$$N_t = \beta_1 + \beta_2 \text{RELP}_t + \beta_3 \text{INC}_t + \beta_4 \text{ADVERT}_t + u_t$$

where $\beta_1, \beta_2, \beta_3, \beta_4$ model parameters and u_t is the random disturbance term satisfying the classical assumptions. The estimated equation is given as

$$N_t = 0.52 - 0.38 \text{RELP}_t + 0.70 \text{INC}_t + 0.31 \text{ADVERT}_t$$

(1.29) (0.10) (0.22) (0.15)

$$R^2 = 0.61, T = 50, \text{RSS} = 0.0887, \text{ESS} = 0.1387$$

where standard errors of the estimated coefficients are given in parentheses, T is the number of observations and the ESS and RSS are explained sum of squares and the residual sum of squares respectively. Use the 5 per cent level of significance for any hypothesis tests to be performed.

- (i) Test whether each variables, RELP, INC, ADVERT are statistically significant?. Does each coefficients have the expected sign? Use $t_{0.025, 46} = 2.02$. (5 Marks)
- (ii) Test the hypothesis that the coefficients of all variables are equal to zero. Use $F_{3, 46, 0.05} = 2.81$. (5 Marks)
- (iii) Suppose the econometrician wants to test the joint restriction of $H_0 : \beta_3 = 0.5$ and $\beta_2 = -\beta_4$. Derive the restricted model of the hypotheses. (5 Marks)
- (iv) The restricted model shows the $\text{RSS} = 0.1773$. Test the validity of the restrictions. Use $F_{2, 46, 0.05} = 3.21$. (5 Marks)

8. Write short notes on any **Four (04)** of the following:

- (i) Use of Dummy variables in regression analysis
- (ii) The Chow Test for stability analysis
- (iii) Multicollinearity
- (iv) The estimation of nonlinear models
- (v) Spurious regressions

(5 Marks each)
