CHUKA  **UNIVERSITY**

UNIVERSITY EXAMINATIONS

EXAMINATION FOR THE AWARD OF DEGREE OF MASTER OF ECONOMICS

MSEC 832: ECONOMETRICS I

STREAMS: **TIME: 3 HOURS**

DAY/DATE: WEDNESDAY 06/10/2021 **8.30 A.M. – 11.30 A.M.**

INSTRUCTIONS
Answer question ONE and any other THREE

Question one

a) State the Gauss-Markov Theorem. (2 marks)

b) Consider the following general linear regression model:

$$Yi = \beta_1 x_{1i} + \beta_2 x_{2i} + \ldots + \beta_k x_{ki} + e_i \quad (1.0)$$

$$I = 1, 2, \ldots, N$$

Or $$Y = X\beta + e \quad (1.1)$$

Where the matrices and vectors are conventionally defined.

i. What are the classical linear regression model assumptions in order to estimate the unknown parameters in (1.0) using OLS? (5 marks)

ii. Derive the ordinary least squares (OLS) estimators of β and its variance. (5 marks)

iii. Show that the OLS estimator is unbiased. (5 marks)

iv. Suppose the error terms (e) in the above the Maximum Likelihood (ML) estimators are equivalent. (5 marks)

c) State two consequences of violating the assumptions of homoscedasticity. (2 marks)

d) Discuss 2 types of specification errors. (4 marks)

e) Not all variables qualify to be used as instrumental variables. Discuss any two criteria that one must consider in selecting instrumental variables. (2 marks)

Question two

A model of production function given below was again estimated using a different sample data with 30 annual observations

$\log y_t = \beta_1 + \beta_2 \log L_t + \beta 3 \log K_t + e_t, t = 1,2, \ldots, 30$

The estimated regression gave the following results:

Correlation between Variables:

$r_{logK, logL} = 0.91334$

$\log \hat{y}_t = 0.98 + 0.81 \log L_t + 0.28 \log K_t$ $R^2 = 0.76$ $\overline{R}^2 = 0.74$

(0.58) (029) (0.28) $\hat{\sigma} = 0.33$ SSE = 8.85

Durbin-Waston Statistics = 0.33 P-value = 0.001

Rho = 0.77

Under $H_0 : \beta_2 + \beta_3 = 1$, $F_{1,27} = 0.67$

a) Is multicollinearity likely to be a problem? Explain (5 marks)

b) Differentiate the problem of multicollinearity with the problem of model misspecification. (5 marks)

c) Briefly, what are the consequences of multicollinearity on least squares estimation? (5 marks)

d) Can you recommend ways on how to deal with the problem of multicollinearity? (5 marks)

Question three

a) Discuss 4 problems encountered when assumptions of classical linear regression are violated and provide the remedy for each. (10 marks)

b) Using data from 1988 for houses sold in Andover, Massachusetts, from Kiel and McClain (1995), the following equation relates housing price (*price*) to the distance from a recently built garbage incinerator (*dist*):

$$\log(\widehat{price}) = 9.40 + 0.312 \log(dist)$$

$$n = 135 \; R^2 = 0.162$$

i. Interpret the coefficient on log(*dist*). Is the sign of this estimator what you expect it to be?

(3 marks)

ii. Do you think simple regression provides an unbiased estimator of the ceteris paribus elasticity of prices with respect to *dis*t? (Think about the city's decision on where to put the incinerator.) (4 marks)

iii. What other factors about a house affect its price? Might these be correlated with distance from the incinerator? (3 marks)

Question four

a) Describe the specific principle and important assumptions when each of the following estimation methods is deemed appropriate to estimate the unknown parameters of (1.1).

i. Maximum likelihood estimation (3 marks)

ii. Method of moments (MM) (2 marks)

iii. Instrumental variable (IV) (3 marks)

iv. Generalized method of moments (GMM) (2 marks)

b) Consider the regression model:

$y = x\beta + \varepsilon$ (4.1)

where y is N x 1 vector of observations on the dependent variable, y:

X is N x K matrix of observations on regressors $x_1, x_2, x_3 .., x_k$;

β is K x 1 vector of unknown parameters $\beta_1, \beta_2, \beta_3, \ldots, \beta_k$; and ε is N x 1 vector of random error terms with zero mean and variance $\sigma^2 I_N$

Using model in (4.1), if some elements of X are endogenous regressors, derive the Two Stage Least Squares (2SLS) estimator for the structural parameters. Denote Z as a matrix of instruments (10 marks)

Question five

a) Make brief note on the stages of econometrics research (6 marks)

b) Give an advantage of (i) using least squares estimation over method of moments, and (ii) using method of moments over maximum likelihood estimation. (4 marks)

c) The table below presents data on a sample of 5 persons randomly drawn from a large firm giving their annual salaries, years of education, and years of experience with the firm they are working for.

Salary (Y) ($'000')	40	25	38	28	50
Years of Education (X_1)	3	6	8	10	9
Years of Education (X_1)	35	28	30	42	55

i. If their annual salaries depended on their years of education and age, use the matrix method to fit a multiple linear regression. (5 marks)

ii. Compute the coefficient of determination and make a comment on the results. (5 marks)

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