CENTRAL UNIVERSITY

END OF SECOND SEMESTER EXAMINATION: 2016/2017

FACULTY OF ARTS AND SOCIAL SCIENCES

DEPARTMENT OF ECONOMICS

ECON 308 (3 CREDITS)

ECONOMETRICS I

LEVEL 300

14ᵀᴴ JUNE, 2017.

3 HOURS

STUDENT ID No..

INSTRUCTIONS

Answer Question ONE and any other TWO questions (show working for full marks)

DO NOT TURN OVER THIS PAGE UNTIL YOU HAVE BEEN TOLD TO DO SO BY THE INVIGILATOR

LECTURER: Dr. Anthony Amoah

Central University   Department of Economics   Dr. A. Amoah

QUESTION ONE (40 MARKS) Compulsory Question

1. Considering that from $Y = a + bX + e$ the normal equations of regression are given as

$$\sum Y = na + b \sum X$$

$$\sum XY = a \sum X + b \sum X^2$$

    a. Re-write the system of equations in a matrix form   **(2 Marks)**

    b. Using the Cramer's rule, derive a and b.   **(7 Marks)**

2. Table 1 below shows the tons of millet per hectare (Y) resulting from the use of various amounts of locally produced organic fertilizer per hectare (X) at Salaga in the Northern Region of Ghana. Theoretical and empirical evidence are consistent that the relationship between Y and X is linear of the form $Y_t = \beta_0 + \beta_1 X_t$, although the nature of the linearity is unknown.

Table 1: Fertilizer Application and Output Millet per hectare ('000000 tons/ha) at Salaga

Year (t)	Output per ha (Y)	Fertilizer per ha (X)
2010	4	1
2011	5	4
2012	7	5
2013	12	6

    a. Estimate the value of the slope coefficient (β_1) of X.   **(5 Marks)**

    b. Estimate the value of the constant or intercept term (β_0)   **(5 Marks)**

    c. Based on the results obtained in (a) & (b) above, specify the estimated regression line and interpret your results.   **(6 Marks)**

    d. Generate the residuals series, ε_t **(5 Marks)**

    e. Compute the coefficient of determination and comment on the goodness of fit

                                                (5 Marks)

    f. As part of its austerity measures to stabilise the Ghanaian cedi, Cabinet is considering removing subsidies on the production of organic fertilizers. What will be the likely impact of this policy on millet production at Salaga if the policy takes effect?   **(5 Marks)**

QUESTION TWO (30 MARKS)

1. With relevant examples, explain the following
   a. Time Series Data (2 Marks)
   b. Cross-Section Data (2 Marks)
   c. Pooled Data (2 Marks)
   d. Panel Data (2 Marks)

2. The disturbance term u_i is a surrogate for all those variables that are omitted from the model but that collectively affect Y. Explain any **FOUR** reasons that justify the use of this stochastic term. (12 Marks)

3. Outline in the appropriate sequence the traditional methodology of econometrics.
   (8 Marks)

4. Briefly distinguish between a sample regression function (SRF) and a population regression function (PRF) (2 Marks)

QUESTION THREE (30 MARKS)

1. Explain the term econometrics (3 Marks)

2. Specify a simple Keynesian consumption function that is
   a. Linear in parameter
   b. Non-linear in parameter
   c. Linear in variable
   d. Non-linear in variable
   (4 Marks)

3. State ten fundamental assumptions underlying the method of Ordinary Least Squares (OLS) (10 Marks)

4. Using Table 1.0, compute
   a. the conditional expected value of Y, $E(Y|X)$ (6 Marks)
   b. unconditional expected value of Y, $E(Y)$ (4 Marks)
   c. Comment briefly on the difference. (3 Marks)

Table 1.0: Weekly family consumption expenditure and Income patterns

Weekly family consumption expenditure Y, Ghs.	WEEKLY FAMILY INCOME X, Ghs					
	100	**140**	**180**	**220**	**260**	**300**
	65	80	110	135	137	150
	70	93	115	137	145	152
	74	95	120	140	155	175
	80	103	130	152	165	178
	85	108	135	157	175	180
	88	113	140	160	189	185
	-	115	-	162	-	191
Conditional Mean Ghs						

QUESTION FOUR (30 MARKS)

1. With the aid of an econometric model, specify the following
   a. Sample Regression Function (SRF)
   b. Population Regression Function (PRF)
   c. True relationship
   d. Estimated Relationship
   . e. True regression line
   f. Estimated regression line

   (6 Marks)

2. Using the matrix approach, show that the OLS estimator b of β in the model
   $Y_i = \beta_0 + \beta X_i + u_i$ is linear, unbiased and the best.   **(24 Marks)**

QUESTION FIVE (30 MARKS)

1. Show that the mean value of the estimated $Y = \hat{Y}_i$ is equal to the mean value of the actual Y.   **(5 Marks)**

2. Given $\hat{u}_i = Y_i - \hat{Y}_i$, show that the r-squared (r^2) equals the estimated sum of squares divide by the total sum of squares. **(5 Marks)**

3. Using the deviation form, show that one of the statistical properties of OLS estimators is that the $\hat{u}_i$ are uncorrelated with the predicted Y_i. **(5 Marks)**

4. Outline five type of violations that will happen if the assumptions of the classical linear regression model is violated. **(5 Marks)**

5. Kwabena Stochastic, a third-year student at the Economics Department of Central University specifies a time series regression model,
   $$Y_t = \beta_0 + \beta_1 X_{1t} + \beta_2 X_{2t} + \beta_3 X_{3t} + u_t$$

You are told that the specified model which satisfies all the fundamental assumptions underlying the classical linear regression was subsequently estimated by Ordinary Least Squares (OLS) and the results are presented below:

$$\hat{Y}_t = -2.6019 + 0.7341 X_{1t} + 4.4270 X_{2t} - 0.0968 X_{3t}$$
$$(1.3067) \quad (0.1303) \quad (1.7215) \quad (0.0461)$$

Where standard errors are in parenthesis, the residuals sum of squares $(\varepsilon'\varepsilon) = 12.7$, total sum of squares is 100 and $t=$ 1992, 1993, 1994…..2014.

i. Perform a t-test at 1% level of significance for the null hypothesis that the linear relationship between $\hat{Y}_t$ and X_{1t} is statistically different from zero.

ii. Perform a t-test at 5% level of significance for the null hypothesis that the linear relationship between $\hat{Y}_t$ and X_{2t} is statistically different from zero.

iii. Conduct a statistical test at 5% level of significance based on the null hypothesis that the explanatory variables are jointly equal to zero.

iv. Assuming that $\hat{Y}_t$ and X_{3t} are quantity demanded of apples and price of apples respectively. You are required to interpret this results. Which economic theory underlines this? Compute and draw an inference whether the price significantly explains the quantity demanded of apples?

(10 Marks)

More grace for success!

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