UNIVERSITY OF FORT HARE
DEPARTMENT OF ECONOMICS

ALICE, BHISHO AND EAST LONDON CAMPUSES

ECO 313/313E

SUPPLEMENTARY EXAMINATION

2023

Subject: ECONOMETRICS 3
Time: 3 Hours

Marks: 100

This paper consists of 6 pages including the cover page

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Instructions

Answer FOUR (4) questions ONLY.
All questions carry EQUAL marks.

QUESTION 1 **[25 MARKS]**

Suppose the Eastern Cape Department of Tourism (ECDT) wants to investigate the impact of tourism on economic growth in the province. As an econometrics student, you are approached by the ECTD's Head of Department on how to conduct an econometrics study.

1.1 In one or two sentences, define the research question that you will address. **[4 marks]**

1.2 Explain what kind of data you will try to collect or source, and explain also how these data will assist you with your inquiry. **[6 marks]**

1.3 Specify the econometric model you would test, clearly defining all of your variables. **[10 marks]**

1.4 Describe what you would look for in your fitted regression to determine whether you have useful and meaningful findings. **[5 marks]**

QUESTION 2 **[25 MARKS]**

2.1 State and explain the type of data to be employed in the following scenarios. **[10 marks]**

2.1.1 The 2011 South African population census conducted by Statistics South Africa.

2.1.2 Annual savings for one million randomly chosen South African households for the year 2021

2.1.3 Weekly Johannesburg Stock Exchange All Share price index

2.1.4 Unemployment rates for each South African province since 1994

2.1.5 Daily ZAR/USA exchange rate

2.2. What is the relationship between the following? **[6 marks]**

2.2.1 β_0 and $\hat{\beta}_0$

2.2.2 $\hat{\beta}_2$ and β_2

2.2.3 ε_i and e_i

2.3 What are the consequences of near multicollinearity in a regression model? **[5 marks]**

2.4 Explain the meaning of the BLUE is econometrics **[4 marks]**

QUESTION 3 **[25 MARKS]**

3.1 What is the importance of a stochastic error term in a regression model? ***[4 marks]***

3.2 Interpret the results given in the table below. ***[6 marks]***

	Test	Test statistic	p-value
a)	Ramsey Reset	0.1089	0.0001
b)	Jarque-Bera	JB=2.5643	0.1010
c)	Ljung-Box	Q=0.412	0.0001

3.3 Explain what is meant by 'specification error'. ***[5 marks]***

3.4 Suppose you have annual time series data from 1990 through 2018, and you treat GDP as a function of aggregate Consumption. Interpret the results of the linear regression given below. ***[10 marks]***

Dependent Variable: GDP
Method: Least Squares
Date: 02/26/20 Time: 11:31
Sample: 1990 2018
Included observations: 29

Variable	Coefficient	Std. Error	t-Statistic	Prob.
CONSUMPTION	4.738116	0.049050	96.59801	0.0000
C	107566.9	24032.35	4.475921	0.0001
R-squared	0.997115	Mean dependent var		1939391.
Adjusted R-squared	0.997008	S.D. dependent var		1453411.
S.E. of regression	79500.85	Akaike info criterion		25.47140
Sum squared resid	1.71E+11	Schwarz criterion		25.56569
Log likelihood	-367.3352	Hannan-Quinn criter.		25.50093
F-statistic	9331.175	Durbin-Watson stat		0.447176
Prob(F-statistic)	0.000000			

QUESTION 4 [25 MARKS]

You have data for 44 sub-Saharan African counties on 7 variables:

- Mortality of children under 5 years old relative to 1000 live births ('Mort')
- GDP per capita in constant $US ('GPC'), and
- Literacy rate, adult total (% of people aged 15 and above) ('Lit')
- Whether the country is in West Africa ('West'), 1 if yes and 0 otherwise
- Whether the country is in Central Africa ('Central'), 1 if yes and 0 otherwise
- Whether the country is in Southern Africa ('Southern'), 1 if yes and 0 otherwise
- Whether the country is in East Africa ('East'), 1 if yes and 0 otherwise

You treat mortality as your dependent variable, which is a linear function of the other variables. Your results are shown below:

OLS, using observations 1-44
Dependent variable: Mort

	Coefficient	*Std. Error*	*t-ratio*	*p-value*	
const	156.801	16.9663	9.242	<0.0001	***
GPC	−0.001196	0.0006336	−1.888	0.0666	*
Lit	−1.01741	0.197861	−5.142	<0.0001	***
West	−16.3999	10.9725	−1.495	0.1433	
Central	−2.49571	10.6799	−0.2337	0.8165	
East	−21.2909	9.55096	−2.229	0.0318	**

Mean dependent var	70.93659	S.D. dependent var	29.35611
Sum squared resid	11776.61	S.E. of regression	17.60428
R-squared	0.682199	Adjusted R-squared	0.640383
F(5, 38)	16.31436	P-value(F)	1.39e-08
Log-likelihood	−185.4063	Akaike criterion	382.8125
Schwarz criterion	393.5177	Hannan-Quinn	386.7825

4.1 Interpret the estimated slope coefficient on the Lit variable. [4]

4.2 Interpret the estimated slope coefficient on the West variable. [6]

4.3 Explain why the 'Southern' variable was omitted from the model. [5]

4.4 Suppose from the regression indicated above you save the residuals and square them; this is called 'sq_uhat'. You then run a second regression in which sq_uhat is the dependent variable and the explanatory variables are the same as above. The results are shown below:

OLS, using observations 1-44
Dependent variable: sq_uhat

	Coefficient	*Std. Error*	*t-ratio*	*p-value*	
const	−577.417	496.212	−1.164	0.2518	
GPC	−0.0168962	0.0185315	−0.9118	0.3676	
Lit	9.51413	5.78684	1.644	0.1084	
West	605.338	320.912	1.886	0.0669	*
Central	285.068	312.356	0.9126	0.3672	
East	102.089	279.337	0.3655	0.7168	

Mean dependent var	267.6502	S.D. dependent var	524.5774
Sum squared resid	10073550	S.E. of regression	514.8722
R-squared	0.148676	Adjusted R-squared	0.036659
F(5, 38)	1.327269	P-value(F)	0.273529
Log-likelihood	−333.9404	Akaike criterion	679.8809
Schwarz criterion	690.5860	Hannan-Quinn	683.8509

4.4.1 What is the name of the test you conducted and what is it testing for? [4]

4.4.2 What do you conclude from this test? Explain how your arrived at your conclusion. [6]

QUESTION 5 **[25 MARKS]**

5.1 What are the consequences of omitting one or more relevant variables from a model? ***[5 marks]***

5.2 Write out a sample regression model based on cross-sectional data consisting of a sample size of 752 and involving three explanatory variables. Now explain or identify each and every term in the model. ***[10 marks]***

5.3 The following table gives pairs of dependent and explanatory variables. In each case state whether you would expect the relationship between the two variables to be positive, negative, uncertain, or non-existent (i.e. no relationship). Give a brief justification in each case. ***[10 marks]***

Dependent Variable	**Explanatory**
Personal savings	Rate of interest
Demand for rice	Price of maize meal
Student's mark on Test 2	Student's mark on Test 1
Demand for cigarettes	Tax rate on cigarettes
Wages	Age

QUESTION 6 **[25 MARKS]**

6.1 State with reasons whether the following statements **are true (T) or false (F):**

a) For the double-log model, the slope coefficients can be interpreted as elasticities. **(1)**

b) The R^2 of a log-log (double-log) model can be compared with that of a log-lin model but not with that of a lin-log model. **(1)**

c) The R^2 of a lin-log model can be compared with that of a linear (in variables) model but not with that of a double-log or log-lin model. **(1)**

d) If you regress a residual on its lag value and the slope coefficient is statistically significant, you have evidence of autocorrelation (**1**)

6.2 Briefly explain the meaning of:

6.2.1 Categorical variables. ***[2 marks]***

6.2.2 Type II error ***[2 marks]***

6.2.3 Adjusted R-squared ***[2 marks]***

6.2.4 Joint hypothesis test. ***[2 marks]***

6.3 What are the main types of specification error? ***[4 marks]***

6.4 Name the problems you foresee in estimating the following models: ***[4 marks]***

Model 1 –

$$Y_t = \beta_0 + \beta_1 D_{1t} + \beta_2 D_{2t} + \beta_3 D_{3t} + \beta_4 D_{4t} + u_t$$

where = 1 for observation in quarter 1 and 0 otherwise,
= 1 for observation in quarter 2 and 0 otherwise,
= 1 for observation in quarter 3 and 0 otherwise,
= 1 for observation in quarter 4 and 0 otherwise.

Model 2 –

$$GNP_t = \beta_0 + \beta_1 M_t + \beta_2 M_{t-1} + \beta_3 (M_t - M_{t-1}) + u_t$$

where GNP_t = gross national product (GNP) at time t, M_t = the money supply at time t, M_{t-1} = the money supply at time (t - 1).

6.5 What is heteroscedasticity and how can it be detected? ***[5 marks]***

END