



## **FACULTY OF MANAGEMENT AND ADMINISTRATION**

**COURSE TITLE: MEC 303 – ECONOMETRICS**

**SEMESTER 1: FINAL EXAMINATION – NOV, 2013**

**LECTURER: MR G. MANDEWO**

**TIME: 3 HOURS**

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### ***INSTRUCTIONS***

Answer **all** questions in section A and **two** questions in Section B.  
Total possible mark is **60**.

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Start **each** question on a new page in your answer  
Booklet.

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The marks allocated to **each** question are shown at the end of the section.

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**Show all your workings.**

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Credit will be awarded for logical, systematic and neat presentations.

**SECTION A (Answer All questions in this Section)**

1. A data set contains data on the years of formal training, training qualifications, years of work experience, and hourly earnings in rupees in 2010 for a sample of 29 refrigeration mechanics in Bulawayo. Most refrigeration mechanics acquire their skills through informal apprenticeships and have no formal training. Some have one year of formal training at a training institute and earn the Refrigeration Mechanic Certificate if they pass the test at the end. Some take a second year of training and earn the Refrigeration Mechanic Diploma if they pass the test at the end. Trainees may continue to the second year of training only if they have passed the test at the end of the first year. Dummy variables *RMC* and *RMD* are defined as follows:

*RMC* = 1 for those who have had at least one year of formal training and have passed the test for the Refrigeration Mechanic Certificate, but have not passed the test for the Refrigeration Mechanic Diploma. *RMC* = 0 for all others.

*RMD* = 1 for those who have had two years of formal training and have passed the test for the Refrigeration Mechanic Diploma. *RMD* = 0 for all others.

Three regressions are performed:

A. Hourly earnings on *EXP*, number of years of work experience, and *TRAINING*, number of years of formal training at a training institute.

B. Hourly earnings on *EXP*, *RMC*, and *RMD*.

C. Hourly earnings on *EXP*, *TRAINING*, *RMC*, and *RMD*.

The regression results are shown in the table (standard errors in parentheses)

	(1)	(2)	(3)
<i>EXP</i>	0.030 (0.005)	0.028 (0.005)	0.029 (0.005)
<i>TRAINING</i>	0.200 (0.020)	—	0.100 (0.045)
<i>RMC</i>	—	0.18 (0.04)	0.10 (0.05)
<i>RMD</i>	—	0.30 (0.06)	0.20 (0.08)
constant	2.00 (0.60)	2.24 (0.61)	2.10 (0.70)
$R^2$	0.35	0.40	0.42

- (a) What are dummy variables? **(5 marks)**
- (b) With reference to the coefficients of determination choose the best model. **(5 marks)**
- (c) What are the likely reasons why a model with a low coefficient of determination maybe a preferred model. **(5 marks)**
- (d) If the sample size is 29 observations determine the degrees of freedom for each model. **(5 marks)**
- (e) Set the above regression models in standard notation. **(5 marks)**
- (f) If you were asked to screen the above models explain procedures you would undertake to validate your ultimate choice. **(5 marks)**

2. (a) Consider a population regression function of the form

$$Q = \alpha + \beta P + \mu$$

Where Q is the quantity demanded which is a dependent variable and P is the price level which is an independent variable

- i. Deduce the first and second normal equations in the context of price (P) and quantity (Q) **(5 marks)**
- ii. Using the first and second normal equations, determine the formula for estimator of  $\beta$  &  $\alpha$  **(5 marks)**
- iii. If you assume that

$$q = Q - \bar{Q}$$

$$p = P - \bar{P}$$

Where P is the price level and Q is the output

Deduce the formula for  $\hat{\beta}$  in deviations **(5 marks)**

(b) In the context of a Simple Linear Regression Model prove that the estimated  $\hat{\beta}$  is unbiased. **(5 marks)**

(c) Sometimes Econometricians are required to determine the variance of a coefficient. Of what relevance is this statistic to econometrics? **(5 marks)**

(d) What are the major subtle differences between Simple Linear Regression Model and Multiple Linear Regression Model? **(5 marks)**

(e) State the two assumptions of Multiple Linear Regression Model from where the econometrics problems are based. **(5 marks)**

(f) Conceptually demonstrate an understanding of the problem of Multicollinearity. **(5 marks)**

### SECTION B (Answer two questions in this Section)

3. For a sample of 27 students, they have the examination mark,  $M$ , total hours spent studying,  $H$ , hours on primary study,  $P$ , and hours spent on revision,  $R$

$$\hat{M} = 45.6 + 0.15 P + 0.21 R - 0.5 H$$

$$(2.8) \quad (0.03) \quad (0.14) \quad (3.486)$$

$$R^2 = 0.99 \quad \text{D.W} = 2.00$$

- (a) What conclusions can you draw from this model about the relationship between final mark (M), and the explanatory variables (**H**) Hours spent studying hours, (P) Hours of primary study, (R) hours spent on revision? (justify your response quantitatively) **[6 marks]**
- (b) How would you use the goodness of fit to support or refute your conclusions in item (a)? **[3 marks]**
- (c) If this model suffers from heteroscedasticity, demonstrate various ways you may employ to solve this problem? **[3 marks]**
- (d) An economic commentator, suggested that it is possible to test for autocorrelation using the Durbin Watson test. Demonstrate. **[3 marks]**

4 (a) Explain the rationale behind Ordinary Least Squares methodology used in the derivation of estimators. [3 marks]

(b) Consider a Population Regression Function of the form

$$Y = \alpha + \beta X + \mu$$

If Y is the explained variable, and X is the explanatory variable and  $\beta$  &  $\alpha$  are parameters to be estimated, what is the justification of including the random disturbance term  $\mu$ ? [3 marks]

(c) What do you understand by asymptotic properties of estimators? [3 marks]

(d) '*Econometrics is concerned with the empirical determination of economic laws*'.

Explain what you understand by this statement. [3 marks]

(e) Consider a population regression function of the form

$$Q = \alpha + \beta P + \mu$$

Where Q is the quantity demanded which is a dependent variable and P is the price level which is an independent variable

iv. Deduce the first and second normal equations in the context of price (P) and quantity (Q) [3 marks]

5. Agricultural production in Zimbabwe has been studied by experts from 2010 (1) to 2013 (2). The method of analysis which the Canadian firm employed is regression analysis. The following results were then presented for analysis:

$$AGOUT_t = 1201 + 0.712AGOUT_{t-1} - 0.25R_t + 3.3INPUT_t$$

(1000) (211)

(1.3) (0.5)

$R^2 = 0.987$

DW = 2

Where

AGOUT<sub>t</sub> is agricultural output this season

AGOUT<sub>t-1</sub> is the agricultural produce the previous season

R<sub>t</sub> Represent the borrowing rate in this period

INPUT<sub>t</sub> show inputs in the current period.

(a) If it is common knowledge that  $AGOUT_{t-1} = 0.75 INPUT_t$ . What is the apparent econometric problem that exists? [3]

(b) Demonstrate the effects of such a problem. [3]

(c) Suppose the problem has been solved, interpret the model, giving economic intuition. [3]

(d) Calculate the adjusted  $R^2$ . [3]

(e) Evaluate the significance of the whole model. [3]

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