UNIVERSITY OF FORT HARE

AGE 507 / AGE 609

DEGREE EXAMINATIONS

NOVEMBER MAIN EXAMINATION

2017

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Time: 3 HOURS

Subject: SPECIAL TOPICS

Marks: 100

This paper consists of 3 pages including the cover page

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INSTRUCTIONS

You MUST answer Question 1, as well as ANY THREE of the other questions.

Question 1 (Mandatory) **[40 Marks]**

Explain under what circumstances you might use each of the following methods or models:

1.1 The Maximum Likelihood Estimator (MLE) (5)

1.2 The Fixed Effects Model (FEM) (5)

1.3 The Ordinary Least Squares (OLS) estimator (5)

1.4 The Feasible Generalized Least Squares (FGLS) estimator (5)

1.5 The Generalized Least Squares (GLS) estimator (5)

1.6 The Error Components Model (ECM) (5)

1.7 The method of instrumental variables (5)

1.8 The Seemingly Unrelated Regression (SUR) model (5)

Question 2 **[20 Marks]**

Recall the expectations and variance operators, E( ) and V( ), respectively, and suppose a random variable X with mean μ and variance σ_x^2. Further, let $\overline{X}$ denote the mean, i.e. $\overline{X} = (1/n) \sum_i^n X_i$, where n represents the number of observations on X.

On the basis of the information given above answer the following:

2.1 What are $E(\overline{X})$? and $V(\overline{X})$? (5)

2.2 What do your answers to 2.1 imply about

2.2.1 The biasedness/unbiasedness of $\overline{X}$ as an estimator of μ? (2.5)

2.2.2 The consistency of $\overline{X}$ as an estimator of μ? (2.5)

2.3 Suppose now that ε_i is the error term from a linear regression model, and that the usual Gauss-Markov assumptions apply, i.e. $E(\varepsilon_i) = 0$, $V(\varepsilon_i) = \sigma^2$ for all i, and $Cov(\varepsilon_i,\varepsilon_j) = 0$ for all $i \neq j$. Consider now the vector $\underline{\varepsilon}$, and the variance-covariance matrix denoted by $V(\underline{\varepsilon})$ or $E(\underline{\varepsilon}\,\underline{\varepsilon}')$. Assuming for simplicity that n = 4, show the actual 4 x 4 matrix for $V(\underline{\varepsilon})$. (10)

Question 3 **[20 Marks]**

Suppose you have a linear regression model but you are concerned about heteroscedasticity, i.e. $V(\varepsilon_i) = \sigma_i^2 \neq \sigma^2$ for all i.

3.1 Let $\underline{\hat{\beta}}$ designate the vector of estimated slope coefficients, therefore $V(\underline{\hat{\beta}})$ designates the variance-covariance matrix of $\underline{\hat{\beta}}$. If $V(\underline{\varepsilon}) = E(\underline{\varepsilon}\,\underline{\varepsilon}')$ is the variance-covariance matrix of the error term, then recall that we can write:

$$V(\hat{\underline{\beta}}) = (X'X)^{-1} X' E(\underline{\varepsilon}\,\underline{\varepsilon}') X (X'X)^{-1}$$

3.1.1 If the Gauss-Markov assumptions hold (i.e. as summarised above in 2.3), then simplify the expression above for $V(\hat{\underline{\beta}})$. (5)

3.1.2 If the Gauss-Markov assumptions do not hold, then what is implied about the usual OLS standard errors? (10)

3.2 There are two main approaches you could consider, namely weighted least squares (WLS) and heteroscedasticity consistent covariance matrix (HCCM). Explain the advantages and disadvantages of each approach. (5)

Question 4 **[20 Marks]**

You wish to understand what influences whether or not maize farmers adopt genetically modified (GM) seed, where the influences could include various demographic factors as well as farming characteristics. If your dependent variable is S (adopt or do not adopt), and X represents your matrix of explanatory variables, then you can write $S = f(X,\underline{\beta})$.

4.1 What is the general name for a dependent variable such as S? (5)

4.2 Why is it undesirable or inappropriate to use OLS to estimate $\underline{\beta}$? (10)

4.3 Name two superior methods you could use to estimate $\underline{\beta}$, and explain or describe how you would implement them. (5)

Question 5 **[20 Marks]**

5.1 Explain what is meant by the 'endogeneity problem' and explain at least two situations in which it might arise. (5)

5.2 Use basic matrix notation to express the OLS estimator for $\underline{\beta}$. Define each of your terms. (5)

5.3 Explain what is the principle underlying the Seemingly Unrelated Regression model. (5)

5.4 In general, what are the properties of the maximum likelihood estimator? (5)