UNIVERSITY OF JOHANNESBURG

COLLEGE OF BUSINESS AND ECONOMICS

SCHOOL OF ECONOMICS

UNIVERSITY OF JOHANNESBURG

ECM03B3 / EKM3B01 Examination 1

Course : Econometrics 3B
Examiners : Dr M Pretorius and Ms B Thobejane
Internal Moderator : Dr MK Wilson
External Moderator : Prof A Pretorius (North-West University)
Time : 180 minutes
Marks : 150

Instructions:

1. Answer all the questions.
2. This paper consists of 6 pages.

SECTION	TOTAL
A	55
B	25
C	25
D	31
E	14
TOTAL	150

Section A **[55]**

1. Are the following statements true or false? If a statement is **false**, explain why this is the case: (10)
   a. Statistical inference in Non-Linear Least Squares (NLLS) regression cannot be made on the basis of the usual t, F and χ^2 tests even if the error term is assumed to be normally distributed.
   b. The fundamental weakness of the linear probability model is that it assumes that the probability of something happening increases linearly with the level of the regressors.
   c. In the logit model the dependent variable is the log of the odds ratio, which is a linear function of the regressors.
   d. The following equation is an example of an intrinsically linear regression model: $Y_i = e^{\beta_1+\beta_2 X_i+u_i}$.
   e. After applying the Koyck transformation to a distributed lag model, the model becomes an autoregressive model.

2. Show that the logit model is linear in the parameters and the variables by deriving the necessary formulas. (8)

3. Name the three approaches that are considered in the estimation of a non-linear regression model. (3)

4. Distinguish between the following econometric terms:
   a. Distributed lag and autoregressive models (4)
   b. Simultaneous and reduced-form equations (4)

5. Define the following terms:

   a. Identification (problem experienced in simultaneous equation modelling) (3)
   b. Unit root (2)
   c. Spurious regression (2)
   d. Weak stationarity (2)
   e. Error correction mechanism (3)

6. Define and explain the estimation procedure of the Indirect Least Square (ILS) method. (8)

7. Explain why the Full Information Maximum Likelihood Method (FIMLM) is not commonly used for estimating simultaneous equations. (6)

Section B **[25]**

Consider the data provided in the Excel Worksheet Exam 1 Data – Section B. In order to investigate the factors that determine the happiness of first-year students at the University of Johannesburg, data was obtained of 1200 students and the following model was considered:

$$Y_i = \beta_1 + \beta_2 X_{2i} + \beta_3 X_{3i} + \beta_4 X_{4i} + u_i$$

Where:

$Y = 1$ when a student considered herself/himself to be happy, 0 otherwise [Happiness];

$X_2 =$ age of the student during the time of the survey in years [Age];

$X_3 = 1$ if the student has made friends at the university, 0 otherwise [Friends];

$X_4 = 1$ if the student lives on campus in a student residence, 0 otherwise [Live].

1. Estimate the logit model and write down your regression results. (2)

2. Interpret the coefficients of the logit model by making use of the odds ratio. (6)

3. Do your interpretations in (2) make economic sense? Explain for each variable. (6)

4. Is the logit model overall statistically significant? Explain. (3)

5. Interpret the goodness of fit of the logit model by making use of the count R^2. Show your calculations. (3)

6. What is the probability of student number 100 considering herself/himself to be happy? Show your calculations and compare the result with the actual data given for student number 100. (5)

Section C **[25]**

Consider the data provided in the Excel Worksheet Section C. The table gives data on inventories (Y) and sales (X) for the United States for the period 1954-1999.

Make use of the Almon approach and assume that inventories depend on sales in the current year and in the preceding 4 years. Furthermore, assume that β_i can be approximated by a third-degree polynomial.

1. Specify the distributed lag model. (2)
2. Specify the necessary Z variables and construct them in Excel. Report the Z formulas. (5)
3. Estimate the Z variable equation in EViews and report your results. (2)
4. Specify the formulas for the β variables. (5)
5. Calculate the values for the β variables by making use of your answers in (3). (5)
6. State the final equation for the distributed lag model. (2)
7. Comment on the Granger causality between inventories and sales by making use of two lags. (4)

Section D **[31]**

1. Consider the following two equations that represent a simple macroeconomic model:

$$M_t = \alpha_0 + \alpha_1 Y_t + u_{1t}$$
$$Y_t = b_0 + b_1 M_t + b_2 I_t + u_{2t}$$

Where M_t , Y_t and I_t is money supply, income and investment, respectively.

   a. Explain why the above equations illustrate a simultaneous equation model. (2)
   b. Determine the endogenous and exogenous variables. (2)
   c. Obtain the reduced form equations. (8)
   d. Calculate the structural parameters of the exactly identified money supply equation from the reduced form equation. (5)

2. The income equation, a hybrid of quantity-theory-Keynesian approach to income determination, states that income is determined by money supply, investment expenditure and government expenditure. In addition, money supply is determined by income as follows:

Income function:	$Y_{1t}= \beta_{10}+\beta_{11}Y_{2t}+\gamma_{11}X_{1t}+\gamma_{12}X_{2t}+ u_{1t}$
Money supply function:	$Y_{2t}= \beta_{20} + \beta_{21}Y_{1t}+u_{2t}$

Where Y_{1t} , Y_{2t}, X_{1t} and X_{2t} are income, money supply, investment and government expenditure, respectively.

   a. Determine the endogenous and exogenous variables (2)
   b. Using the order condition, determine which equation is exactly identified, overidentified or underidentified. (4)
   c. Using the data in worksheet Section D, estimate the overidentified equation by making use of the Two Stage Least Squares method. Report the two step results and the correct standard errors. (8)

Section E **[14]**

1. Using the Engle-Granger method, determine if a long-run relationship exists between real personal consumption expenditure (PCE) and real disposable income (DPI). Use the data given in worksheet Section E (show all your steps and estimations). (6)

2. Given the outcome in (1) above, estimate and report the Error Correction Model and interpret the results. (8)

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