

BINDURA UNIVERSITY OF SCIENCE EDUCATION

SFM 422: Econometric Modelling

Time: 3 hours

 MAR 2023

Candidates may attempt ALL questions in Section A and at most two questions in Section B.
Each question should start on a fresh page.

Section A (40 marks)

Candidates may attempt ALL questions being careful to number them A1 to A5.

- A1. Determine if experimental evidence is always more credible than that of studies using observational data [10]
- A2. a) Identify possible problems of ordinary least squares regression. [6]
b) Why does the simple regression model $y = \beta_0 + \beta_1 x + u$ typically fail to uncover the ceteris paribus effect of x on y ? [2]
- A3. Suppose you want to estimate the following model
$$y = \beta_0 + \beta_1 x_1 + \beta_2 x_2 + \beta_3 x_3 + u$$

Describe how you would test for heteroskedasticity using the special case of the White test? [5]
- A4. a) What are the threats to internal and external validity? [7]
b) Determine the conditions for a valid instrumental variable. [6]
- A5. a) What is the consequence of specifying a model with a variable in log form, if in the population model, the variable is in level form? [2]
b) What is the effect of increasing the sample size on $se(\beta_j)$? [2]

Section B (60 marks)

Candidates may attempt two questions being careful to number them B6 to B8.

- B6.** a) Consider the following simultaneous equation model:

$$Y_{1t} = A_1 + A_2 Y_{2t} + A_3 X_{1t} + u_{1t} \quad (1)$$

$$Y_{2t} = B_1 + B_2 Y_{1t} + B_3 X_{2t} + u_{2t} \quad (2)$$

In this model the Y s are the endogenous variables and the X s are the exogenous variables and the u 's are stochastic error terms.

- (i) Obtain the reduced form regressions. [8]
- (ii) Which of the above equations is identified? [2]
- (iii) For the identified equation, which method will you use to obtain the structural coefficients? [4]
- b) Explain the consequences of multicollinearity in a regression model. [10]
- c) determine any three criteria used for model selection in econometrics. [6]

- B7.** The following table gives the amount of additive (x) and the reduction in nitrogen oxides (y) in 7 cars.

Amount of additive (x)	1	2	3	4	5	6	7
Reduction in nitrogen oxide (y)	2.5	3.1	3.8	3.2	3.9	4.4	4.8

- a) Find the least squares regression line. [17]
- b) Test at $\alpha = 0.05$ whether there is a significant linear relationship between these two variables. [10]
- c) What percentage of variation in nitrogen oxide is explained by the amount of additive? [3]

- B8.** a) Using a company's earnings data, E_t ; and the dividends paid out to shareholders, D_t ; $t=1872-1986$ the following results were obtained (standard errors in parentheses):

$$D_t = 0.011 + 0.088E_t + 0.863D_{t-1} + \hat{u}_{1t}$$

(0.009) (0.008) (0.019)

$$R^2 = 0.998; \text{SER} = 0.074;$$

$$\ln D_t = -0.136 + 0.312 \ln E_t + 0.656 \ln D_{t-1} + \hat{u}_{2t}$$

(0.015) (0.025) (0.029)

$$R^2 = 0.993; \text{SER} = 0.085;$$

where SER is the standard error of regression.

- (i) Test whether the intercepts in each equation are significantly different from zero at the 5% level and interpret them. Do they have sensible values? [6]
- (ii) 1) It is suggested that the linear equation is a better equation than the logarithmic because it has a higher R^2 . Do you agree with this? [2]
- 2) Interpret the role of the lagged dependent variable and calculate the long-run effect of earnings on dividends in each case. [7]
- (iii) A test for second order serial correlation had a p value of 0.008 in the linear model and 0.161 in the logarithmic model.
- 1) Explain what second order serial correlation is and why it is a problem. [2]
- 2) Is it a problem in either of these models? [4]
- b) Using a sample of 1801 black individuals, the following earnings equation has been estimated:

$$\ln(\text{earnings}) = 7.059 + 0.147\text{educ} + 0.049\text{experience} + 0.201\text{female}$$

(0.135) (0.008) (0.007) (0.036)

$$R_2 = 0.179; n = 1801$$

where the standard errors are reported in parenthesis.

- (i) Interpret the coefficient estimate on female. [2]
- (ii) Dropping experience and female from the equation gives:

$$\ln(\text{earnings}) = 6.703 + 0.151\text{educ}$$

(0.182) (0.012)

$$R_2 = 0.153; n = 1801$$

Are experience and female jointly significant in the original equation at the 5% significance level?

[7]