

BINDURA UNIVERSITY OF SCIENCE EDUCATION

FACULTY OF COMMERCE

DEPARTMENT OF ECONOMICS

PROGRAMMES: BSc HONOURS DEGREE IN ECONOMICS

EC 206: INTRODUCTION TO ECONOMETRICS

DURATION: 3 HOURS

INSTRUCTIONS:

1. Answer all questions
2. NO CELLPHONES ALLOWED IN THE EXAMINATION ROOM.

NOV 2024

Question 1

Consider the standard simple regression model; $Y = \alpha + \beta X + \mu$ under the Classical Linear Regression Model Assumptions. Let $\hat{\beta}$ be the estimator of β .

- i. Show that $\hat{\beta}$ is an unbiased estimator of β (5 marks)
- ii. Derive the variance of $\hat{\beta}$ (5 marks)
- iii. Prove that the variance of OLS estimator for β is efficient (6 marks)
- iv. Explain any five assumptions upon which the CLRM rest highlighting challenges that may arise if the assumptions are not met. (10 marks)

Question 2

- a. Explain the conventional methodology of econometrics highlighting the importance of each of stages and also the challenges that a researcher might face at each of the stages.

(10 marks)

- b. A labor economist seeking to establish the effect of education (*edu*) on earnings (*Pay*) and specified a simple earnings as:

$$Pay = \alpha + \beta edu + \eta$$

where η is the stochastic error term.

- i. What does α show in the model? (2 marks)
- ii. State any two more variables that can be included in this model. (3 marks)
- iii. Suppose you decide to use gender as one of the regressors, briefly explain how this variable could be incorporated in this model and the major precautions that the researcher should take. (10 marks)

Question 3

- a. A joint log-linear model is given as:

$$\log L = -n \log \delta_\mu^2 - \frac{n}{2} \log 2\Pi - \frac{1}{2\delta_\mu^2} \sum (Y - \alpha - \beta X)^2$$

- i. Derive the normal equations under the maximum likelihood estimation. (5 marks)
 - ii. Derive the variance of the residuals under MLE and show that it is biased for small samples. (10 marks)
- b. Briefly explain each of the following terms as they relate to econometrics:
- i. Coefficient of determination
 - ii. Autocorrelation
 - iii. Dummy variable trap. (10 marks)

Question 4

A researcher is using data for a sample of 3240 female employees 25 years of age and over to investigate the relationship between employees' hourly wage rates Y (measured in *dollars per hour*) and their age X (measured in *years*). The population regression equation takes the form of equation $Y = \alpha + \beta X + \mu$:

Preliminary analysis of the sample data produces the following sample information:

$$\sum X^2 = 2872451 \qquad \sum Y^2 = 443227 \qquad \sum XY = 1023825$$

$$\sum y^2 = 78435 \qquad \sum x^2 = 25526.2 \qquad \sum xy = 3666.41$$

$$\sum Y = 34379 \qquad \sum X = 96143 \qquad n = 3240$$

$$\sum \hat{\mu}^2 = 77908.4$$

where $x = (X - \bar{X})$ and $y = (Y - \bar{Y})$

- Use the above information to calculate OLS estimates for the intercept and slope coefficients $\hat{\alpha}$ and $\hat{\beta}$. (5 marks)
- Calculate an estimate of the error variance σ_μ^2 . (4 marks)
- Compute the value of R , the coefficient of determination for the estimated OLS sample regression equation. Briefly explain what the value you have calculated for R means. (5 marks)
- Calculate the sample value of the t -statistic for testing the null hypothesis H against the alternative hypothesis. (5 marks)
- Suppose you decide to use gender as one of the regressors, briefly explain how this variable could be incorporated in this model and explain the major precautions that the researcher should take. (6 marks)

END OF PAPER