*"Investing in Africa's future"*

# COLLEGE OF HEALTH AGRICULTURE AND NATURAL SCIENCES

**MAG5102: APPLIED ECONOMETRICS**
**END OF FIRST SEMESTER EXAMINATION**
**NOVEMBER 2025**
**LECTURER: PROF L. DUBE**
**DURATION: 3 HRS**

## INSTRUCTIONS

Answer all questions in Section A and any **three** from Section B

Section A carries **40 marks** and each question in

Section B carries **20 marks**.

**Materials: Calculator**

   **Statistical tables and formulae**

## SECTION A: ANSWER ALL QUESTIONS [40 MARKS]

### Question 1

The Chairperson of the Parliamentary Portfolio Committee on Agriculture wishes to investigate the determinants of productivity amongst commercial orange growers in Zimbabwe.

Using the regression tool in SPSS, a student on industrial attachment with the Ministry of Agriculture, Mechanization and Irrigation Development has produced the results shown below. A simple linear multiple regression model was assumed, where Y (YIELD) = orange yield in tonnes per hectare; $X_1$ (EXPN) = number of years of farmer in producing organges; $X_2$ (TENURE) = tenure status of farmer (1 = for farmers with title deeds, and 0 = otherwise); $X_3$ (TREES) = number of orange trees per hectare; and $u$ is an unobservable disturbance term

$$Y = \alpha + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + u$$

OLS Estimates of the Determinants of Orange Farming Productivity

| Variable | Coefficient | Std. Error | T | Sig. |
|---|---|---|---|---|
| CONSTANT | 11.930 | 7.235 | 1.649 | 0.105 |
| EXPN | 0.404 | 0.163 | 2.488 | 0.016 |
| TENURE | 15.217 | 6.206 | 2.452 | 0.017 |
| TREES | 0.019 | 0.006 | 3.172 | 0.002 |
|  |  |  |  |  |
| $R^2$ | 0.301 |  |  |  |
| Adj. $R^2$ | 0.265 |  |  |  |

| ANOVA | | | | | |
|---|---|---|---|---|---|
| Model | Sum of Squares | df | Mean Square | F | Sig. |
| Regression | 6514.380 | 3 | 2171.460 | 8.321 | 0.000 |
| Residual | 15135.921 | 58 | 260.964 |  |  |
| Total | 21650.301 | 61 |  |  |  |
| a. Dependent Variable: Yield per hectare | | | | | |

The Chairperson of Committee asks you to help the Committee to understand what the results mean.

a) Write a short report on the economic meaning of these results.　　　　[25]

b) What advice would you provide to both policy makers and farmers on measures to improving orange farming productivity in Zimbabwe? [15]

## SECTION B: ANSWER ANY THREE QUESTIONS [60 MARKS]

### Question 2

Applied econometrics has become an essential tool for analyzing real-world economic and agricultural problems. Critically examine the benefits of studying applied econometrics for students, researchers, and policymakers in the field of agricultural and development economics. [20]

### Question 3

Ordinary Least Squares (OLS) is widely used in econometrics to estimate regression models. Its usefulness, however, depends on a set of assumptions that ensure the estimators are **Best Linear Unbiased Estimators (BLUE)**.

(a) Identify and explain the key assumptions underlying OLS estimation. [15]

(b) Discuss the consequences of violating any two of these assumptions in applied econometric analysis. [5]

### Question 4

A researcher wants to examine the relationship between fertilizer use (X), measured in kilogrammes per hectare) and maize yield (Y), measured in tonnes per hectare) among smallholder farmers. A simple linear regression model is specified as:

$$Y_i = \alpha + \beta X_i + \mu_i$$

a) Explain the meaning of the coefficients $\alpha$ and $\beta$ in this model. (4 marks)

b) Suppose the estimated regression equation is:

$$\hat{Y} = 1.5 + 0.8X$$

Interpret the coefficients in the context of maize production. [6]

c) If a farmer applies 10 kg/ha of fertilizer, what is the predicted maize yield?      [4]

d) Discuss two limitations of using a simple linear regression model in this context. [6]


## Question 5

Based on 76 observations, the following regression to explain personal consumption expenditure (PCE) in Zimbabwe is obtained.

$$Y = -10.96 + 0.93X_1 - 2.09X_2$$
$$t = (-3.33) \quad (1249.06) \quad (-3.09)$$

$Y$ = PCE ($ in billions)
$X_1$ = disposable income ($ in billions)
$X_2$ = prime lending rate (%) charged by banks

a) What is the Marginal Propensity to Consume (MPC)?      [4]

b) Is the MPC statistically different from 1?      [6]

c) What is the rational for inclusion of the prime lending rate variable in the model?
   *A priori* would you expect a negative sign for this variable?      [6]

d) Is the coefficient of $X_2$ significantly different from zero?      [4]

### *END OF EXAMINATION PAPER*