

**Qualification Test for Ph.D. Program in Business  
Research Methods**

3/4/2025

**For 1<sup>st</sup> semester:**

1. When using  $N = 50$  observations to estimate the model  $Y_i = \beta_1 + \beta_2 X_i + \beta_3 Z_i + e_i$ , you obtain  $SSE = 2132.65$  and  $s_y = 9.8355$ .
  - (1) Find  $R^2$ . (10%)
  - (2) Find the value of the F-statistic for testing  $H_0 : \beta_2 = 0, \beta_3 = 0$ . Do you reject or fail to reject  $H_0$  at a 5% level of significance? (10%)

2. Suppose from a sample of 60 observations, the least squares estimates and the corresponding estimated covariance matrix are given by

$$\begin{bmatrix} b_1 \\ b_2 \\ b_3 \end{bmatrix} = \begin{bmatrix} 2 \\ 3 \\ -1 \end{bmatrix}, \quad \widehat{\text{cov}}(\mathbf{b}) = \begin{bmatrix} 3 & -2 & 1 \\ -2 & 4 & 0 \\ 1 & 0 & 3 \end{bmatrix}$$

Test each of the following hypotheses and states the conclusion:

- (1)  $\beta_1 + 3\beta_2 = 5$  (5%)
  - (2)  $\beta_1 - \beta_2 + 2\beta_3 = 4$  (5%)
3. Consider the following estimated regression equation (standard errors in parentheses):

$$\hat{y} = 5.83 + 0.869x \quad R^2 = 0.756$$

(se) (1.23) (0.117)

Rewrite the estimated equation that would result if

- (1) All values of  $x$  were divided by 20 before estimation. (5%)
  - (2) All values of  $y$  were divided by 50 before estimation. (5%)
4. A large company is accused of gender discrimination in wages. The following model has been estimated from the company's human resource information

$$\ln(WAGE) = 1.439 + .0834 \text{ EDU} + .0512 \text{ EXPER} + .1932 \text{ MALE}$$

where **WAGE** is hourly wage, **EDU** is years of education, **EXPER** is years of relevant experience, and **MALE** indicates the employee is male.

- (1) What is the marginal effect of experience on wages? (10%)
  - (2) How much more do men at the firm earn, on average? (10%)
  - (3) What hypothesis would you test to determine if the discrimination claim is valid? (5%)