

Econometrics Qualifying Exam
Department of Agricultural and Applied Economics
May 31, 2013

Please Show work fully and write neatly – unreadable writing could affect your score

1. The following production function was estimated on a cross-sectional sample of firms:

$$\ln(Y_i) = \beta_0 + \beta_1 \ln(L_i) + \beta_2 \ln(K_i) + u_i$$

where Y_i is output, L_i is labor input, and K_i is capital input. Assume that all classical assumptions hold.

Explain two different methods for testing whether there are constant returns to scale. State the adequate null hypotheses and the testing procedures step by step.

2. In deciding the “best” set of explanatory variables for a regression model, some researchers follow the method of stepwise regression. In this method one proceeds either by introducing the X variables one at a time (stepwise forward regression) or by including all the possible X variables in one multiple regression and rejecting them one at a time (stepwise backward regression). The decision to add or drop a variable is usually made on the basis of the contribution of that variable to the explained sum of squares, as judged by the F test. Considering your knowledge of econometrics, would you recommend either procedure? Fully explain with attention to detail why or why not.

3. Consider the model

$$y = X\beta + \varepsilon = X\hat{\beta} + e \quad \text{where} \quad \hat{\beta} = (X'X)^{-1} X'y.$$

Here X is an $n \times k$ matrix of rank k and its first column is the unit vector i , β is a $k \times 1$ vector of unknown parameters, and y , ε , and e are $n \times 1$ vectors. Also define

$$P = X(X'X)^{-1} X'.$$

- a. Show that $e = (I - P)y$ where I is an identity matrix of dimension n .
- b. Show that $e'i = 0$.
- c. Show that $X'e = 0$.
- d. Show that $e'e = y'(I - P)y$.