ECON 3161 Final Exam Example

Instruction:

- There are 100 points in total. You can either type or handwrite your answer.
- Please clearly number your answers. To receive full credits, your answers should be legible and include all the necessary steps unless otherwise specified. Incomplete or non-legible answers will only receive partial or no credits.

Good Luck!

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1. (40 points) Consider the following regression function:

$$log(wage) = \beta_0 + \beta_1 exper + \beta_2 age + \beta_3 educ + \beta_4 female + \beta_5 black + \epsilon, \tag{1}$$

where *exper* denotes a person's working experience (number of working years), *educ* denotes a person's years of formal school education, $female$ is a dummy equal to 1 if the person is a female, and black is also a dummy equal to 1 if the person's race is black. Answer the following questions:

(1) What are the other factors that could be in the error term ϵ? (4 points)

(2) Based on your answer in part (1), do you expect that the error term and the regressors will be correlated? (4 points)

(3) Suppose that one student collects a dataset of 100 workers' wage, exper, age and educ, and it turns out that in the dataset *age* is two times of *exper* for every individual, i.e., $age_i = 2exper_i$ for $i = 1, 2, \cdots 100$. Would you be able to estimate model (1)? What will you do if your answer is no? Explain your answer. (4 points)

(4) In labor economics people usually believe ability will affect a person's wage, and education is correlated with a person's ability. In this case, if one estimates model (1), would the OLS estimator $\hat{\beta}_3$ be biased? If it is biased, would it bias upward or downward? (i.e., is the bias positive or negative?) Explain your answer. (8 points)

(5) Under some conditions, the OLS estimators $\hat{\beta}_j$, $j = 0, 1, \cdots, 5$ are BLUE. What does BLUE stand for? (4 pts)

(6) List those necessary conditions for BLUE. (6 pts)

(7) Discuss in detail how the violation of each condition would affect the BLUE. (10 pts)

2. (40 points) Consider a model that explains salaries of CEOs in terms of annual firm sales, return on equity (roe, in percentage form), and return on the firm's stock (ros, in percentage form):

$$log(salary) = \beta_0 + \beta_1 log(sales) + \beta_2 roe + \beta_3 ros + u. \tag{2}$$

Answer the following questions:

(1) What is the interpretation of β_2? (3 points)

(2) In terms of the model parameters, state the null hypothesis that, after controlling for $sales$ and roe, ros has no effect on CEO salary. State the alternative that stock market performance affects a CEO's salary. (4 points)

(3) If you use t-test for the hypothesis testing in part (2), write down your test statistic. What is the distribution of the test statistic? (4 points)

(4) When you derive the distribution of the test statistic in part (3), What model assumptions are needed? (6 points)

(5) If you use F-test for the hypothesis testing in part (2), write down your test statistic. What is the distribution of the test statistic? What is the relationship between the F-test statistic and the t-test statistic in part (3)? (8 points)

(6) In terms of the model parameters, state the null hypothesis that a 1% increase in roe is offset by a 1% decrease in ros. (3 points)

(7) What test will you use for the hypothesis testing in part (6)? Write down your test statistic. (6 points)

(8) Now suppose that you add one more variable $male$ into the model (2), and you consider the following richer model

$$log(salary) = \beta_0 + \beta_1 log(sales) + \beta_2 roe + \beta_3 ros + \beta_4 male + \beta_5 male * log(sales) + u. \tag{3}$$

where $male$ is a dummy variable which takes value 1 if the CEO is a male, 0 if the CEO is a female. How would you interpret the coefficients β_4 and β_5? (6 points)

3. (20 points) Answer the following questions:

(1) What is the significance level? (4 points)

(2) What is the p-value? (5 points)

(3) In hypothesis testing, what's the rejection rule based on p-value and significance level? (5 points)

(4) In hypothesis testing, if a researcher rejects the null hypothesis at 5% significance level, does this imply that the researcher will reject the null hypothesis at both 10% and 1% significance level? Explain your answer. (6 points)

Have a great rest of summer and best wishes in your future endeavors!