ECON 272 - 01, 02

Homework 4

Due Date: Februrary 27

Q.1. Consider the population regression testing the relationship whether college GPA is affected by hours of studying. $GPA_i = \beta_0 + \beta_1 Study_i + \delta\mathbf{X}_i + \epsilon_i$. $\mathbf{X}$ refers to other controls in the regression (the bold typeface refers to a "vector" of controls, or multiple control variables). Upon estimation in the data, the 95% confidence interval corresponding to β_1 is (0.012, 0.024). Assume you have 200 degrees of freedom ($(n - k - 1) = 200$).

a) Can you reject the null hypothesis of $\beta_1 = 0$ at the 5% level of significance in a 2-sided test? What about the null hypothesis $\beta_1 = 0.02$ in a 2-sided test? Justify your reasoning.

b) Can you reject the null hypothesis of $\beta_1 = 0$ at the 1% level significance in a 2-sided test? What about the null hypothesis of $\beta_1 = 0$ at the 10% level of significance in a 1-sided test? Justify your reasoning and show any steps.

Q.2. Consider the population regression testing the relationship whether college GPA is affected by hours of studying. $GPA_i = \beta_0 + \beta_1 Study_i + \delta\mathbf{X}_i + \epsilon_i$. $\mathbf{X}$ refers to other controls in the regression. Upon estimation in the data, $\hat{\beta_1} = 0.025$ and the accompanying standard error – $s.e.(\hat{\beta_1}) = .013$. Assume you have 200 degrees of freedom ($(n - k - 1) = 200$).

a) Can you reject the null hypothesis of $\beta_1 = 0$ in a two-sided test at the 10 percent level of significance?

b) Given the estimated coefficient and standard error, what is the minimum level of Type-I error with which you can reject the null of $\beta_1 = 0$ in a two-sided test? What would be your answer if you were considering a one-sided test (alternate hypothesis being $\beta_1 > 0$). Your answer in both instances should be a probability.

c) Can you reject the null hypothesis of $\beta_1 = 0.04$ at the 10 percent level in a two-sided test? What about a one-sided test? Show your steps.

Q.3. Use *hw4data* for the following question. The data refers to manufacturing firms. A list of variable definitions are provided at the end of the problem set. Consider the population regression function

$$\ln(Output_i) = \beta_0 + \beta_1 \ln(Wages_i) + \beta_2 \ln(Capital_i) + \beta_3 \ln(Materials_i) + \beta_4 Importer_i + \beta_5 Rural_i + \beta_6 Listed_i + \beta_7 Age_i + \beta_8 Age_i^2 + \epsilon_i$$

a) How much additional output can a firm currently aged 5 years expect when it reaches the age of 10 years? How much additional output can a firm currently aged 50 years expect when it reaches the age 55 years?
(*Note: you will first need to compute the natural log of output, wages paid, capital and materials, and also generate the squared age variable.*)?

b) Based on your regression estimates, from point can firm owners expect output to display an increasing relationship with age?

c) Based on your regression estimates, what will be the minimum type-I error you would need to tolerate to reject the null of $\beta_2 = 0.3$ using a 2-sided test.

d) Based on your regression estimates, can you reject the null of $\beta_6 = -0.1$ at the 5% level using a 2-sided test.

Note: you can use the ***test*** *command in Stata for this*

e) Based on your regression estimates, test the null hypothesis of $\beta_1 + \beta_2 + \beta_3 = 1$. Can you reject the null hypothesis at the 5% level of significance using a 2-sided test? What about the 1% level of significance?

Note: use the ***test*** *command in Stata for this.*

f) Use an F-test to argue whether Age and Age^2 should be a part of the population regression function.

Variable Definitions

Variable names in the Stata dataset are in parentheses

State (state): state in which the firm is located.
District (dist01): district in which the firm is located.
Rural (rural): binary variable equaling 1 if the firm is located in a rural area.
Total workers (nototalworker): number of workers hired by the firm.
Total output (total_output): total output produced by the firm in the year (in USD).
Total wages (tot_wage_final): total wages paid by firm to workers (in USD).
Capital (avg_nfa): total capital stock of the firm (in USD).
Importer (importer): binary variable equaling 1 if the firm imported any input during the year.
Raw Materials (avg_raw_mat): value of raw materials used by the firm during the year (in USD).
Listing status (listed): binary variable equaling 1 if the firm was publicly listed in the stock market.
State-owned firm (psu): binary variable equaling 1 if the firm was owned by the government.
Age (age): age of the firm in years.