Econometrics Lab 3

Inference on Linear Regression

1. Income Determination. We use cgss05d.csv, the dataset we use in Lab 2 on the question of income determination. In this exercise we conduct hypothesis testing on the regression

(1) Estimate the following model. Read significance tests from the results.

$$\log(income) = \beta_0 + \beta_1 edu + \beta_2 expr + u. \tag{1}$$

(2) Obtain confidence interval for β_1.

(3) Test

$$\mathrm{H}_0: \ \beta_1 = 0 \quad \mathrm{H}_1: \ \beta_1 > 0.$$

(4) An economist claims that the income of a Chinese worker increases 20% with each additional year of schooling. Test his claim use our data. Write down your hypothesis, calculate the statistic, obtain the critical values, obtain the p-value, and discuss your result.

(5) Test whether gender plays any role in labor income in China. Consider the following regression,

$$\log(income) = \beta_0 + \beta_1 edu + \beta_2 expr + \beta_3 female + \beta_4 female \cdot edu + u.$$

2. Testing Cobb-Douglas Production Function In the 1920s, an economist Paul Douglas and a mathematician Charles Cobb proposed a functional form for modeling production,

$$Q = \gamma K^{\alpha_1} L^{\alpha_2}, \tag{2}$$

where K denotes capital, L denotes labor, Q denotes output, and γ, α_1, and α_2 are constants. Any production function should exhibit monotonicity and decreasing marginal returns. So it is required that $0 < \alpha_1 < 1$ and $0 < \alpha_2 < 1$.

In a competitive economy, real factor price should be equal to the marginal product. We have

$$\frac{w}{p} = \frac{\partial Q}{\partial L} = \alpha_2 \frac{Q}{L},$$

where w is wage and p is price of output. Let $V = pQ$ be the value of the output, we have

$$\frac{V}{L} = \frac{1}{\alpha_2} w. \tag{3}$$

Since V, L, and w are all readily available, (3) is a testable implication of our model of competitive economy with Cobb-Douglas production function. In this exercise, we test if (3) is empirically sound. (This is a classic study conducted by Arrow, Chenery, Minhas, and Solow, 1961.)

We use logarithm to obtain an additive regression equation,

$$\log(V/L) = \beta_0 + \beta_1 \log w + u, \tag{4}$$

where $\beta_0 = -\log \alpha_2$ and $\beta_1 = 1$ under assumptions.

We use the dataset dairy.dat, which contains the variable L/V and w for the dairy industry of 16 countries.

(1) Test

$$\mathrm{H}_0: \ \beta_1 = 1 \quad \mathrm{H}_1: \ \beta_1 \neq 1.$$

You are required to calculate the t statistic, obtain the critical values, calculate p-value, and discuss your results.

(2) The dataset basichem.dat contains data for the basic chemicals industry of the same 16 countries. Do the same things as above.

3. Campaign Expenditures (Woodridge C4.1)

Use the data vote1.csv. The following model can be used to study whether campaign expenditures affect election outcomes:

$$voteA = \beta_0 + \beta_1 log(expendA) + \beta_2 log(expendB) + \beta_3 prtystrA + u,$$

where $voteA$ is the percent of the vote received by Candidate A, $expendA$ and $expendB$ are campaign expenditures by Candidates A and B, and $prtystrA$ is a measure of party strength for Candidate A (the percent of the most recent presidential vote that went to As party).

(1) First, estimate the model in the usual way. Conduct the Breusch-Pagan test. What do you conclude?

(2) Estimate the model, checking the option of White heteroscedasticity-robust standard error. Compare the new standard errors with those in part (1).

(3) What is the interpretation of β_1?

(4) In terms of the parameters, state the null hypothesis that a 1% increase in As expenditures is offset by a 1% increase in Bs expenditures.

(5) Do A's expenditures affect the outcome? What about B's expenditures? Can you use these results to test the hypothesis in part (4)?

(6) Estimate a model that directly gives the t statistic for testing the hypothesis in part (4). What do you conclude? (Use a two-sided alternative.)