

Econometrics Lab 3

Inference on Linear Regression

Note: You can do this lab using either Eviews or Matlab. If you use Matlab, you can use `ols.m`, a program for OLS estimation of multiple 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.

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

- (2) Obtain confidence interval for β_1 .
 (3) Test

$$H_0 : \beta_1 = 0 \quad H_1 : \beta_1 > 0.$$

(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,

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

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,

$$Q = \gamma K^{\alpha_1} L^{\alpha_2}, \quad (2)$$

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

$$\frac{V}{L} = \frac{1}{\alpha_2} w. \quad (3)$$

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,

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

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

$$H_0 : \beta_1 = 1 \quad H_1 : \beta_1 \neq 1.$$

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:

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

where $voteA$ is the percent of the vote received by Candidate A, $expendA$ and $expendB$ are campaign expenditures by Candidates A and B, and $prtystA$ 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.)