Introduction to econometrics
Sogang University

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Home Assignment 1

Due: March 30, 2017

1. (10 points) Using the data caschool.xls, regress log(testscr) on log(str).

   (a) Using the t-test based on the small sample approach, test the significance of the coefficient of log(str) at the 5% level.

   (b) Does the result in part (a) change when the large sample approach is used?

   (c) Construct the 95% small-sample confidence interval for the coefficient of log(str).

   (d) When student-teacher ratio increases by 1%, how much does test score increase?

2. (10 points) Consider the linear regression model

$$y_t = \alpha + \beta t + u_t,\ u_t \sim iid(0, \sigma^2), (t = 1, ..., T).$$

   An estimator of β is

$$b = \frac{y_T - y_1}{T - 1}.$$

   (a) Is estimator b linear and unbiased?

   (b) Calculate the variance of b. Is the variance of estimator b shrink to zeros as T gets larger?

   (c) Which estimator should be preferred between b and the corresponding OLS estimator?

3. (10 points) We are interested in estimating the simple regression model

$$y_i = \beta_1 + \beta_2 x_i + \varepsilon_i.$$

   Assume the classical assumptions of linear regression for this model. To estimate parameter β_2, the data were divided into two groups $(x_i, y_i)_{i=1}^{n_1}$ and $(x_i, y_i)_{i=n_i+1}^{n}$, where the values of x_i in the first group is smaaler than those of the second group (i.e., $\max_{1 \le i \le n_1} x_i \le \min_{n_1+1 \le i \le n} x_i$). Denoting the sample means of these two groups as $(\bar{x}_1, \bar{y}_1)$ and $(\bar{x}_2, \bar{y}_2)$, a researcher wants to estimate the parameter by

$$\bar{\beta}_2 = \frac{\bar{y}_2 - \bar{y}_1}{\bar{x}_2 - \bar{x}_1}.$$

(a) Is $\bar{\beta}_2$ unbiased?

(b) Is $\bar{\beta}_2$ more efficient that the OLS estimator?

4. (5 points) Consider the regression model

$$y_t = \mu + u_t.$$

What is the normal equation for the OLS estimation of this model? What is the OLS estimator of μ?

5. (5 points) Consider the linear regression model

$$y_t = \alpha_t + \beta x_t + u_t, \alpha_t \sim iid(\alpha, \sigma_\alpha^2),\ u_t \sim iid(0, \sigma_u^2), (t = 1, ..., T),$$

where $\{x_t\}$ is a sequence of constants. Is the OLS estimator of β unbiased?