

Fall 2009: Econometrics I

Homework Assignment #2 (Due Wednesday, 10/07, in class)

1. Consider a true model,

$$y = X\beta + \gamma Z^* + u,$$

where Z^* is not observable. The observed Z can be represented as:

$$Z = Z^* + \varepsilon_z,$$

where $Cov(Z^*, \varepsilon_z) = 0$, $Cov(Z, \varepsilon_z) \neq 0$

(a) Show $\hat{\gamma}_{OLS}$ is biased. How do you characterize the bias?

(b) Is $\hat{\beta}_{OLS}$ bias?

(c) If we also observe W , such that

$$W = Z^* + \varepsilon_w$$

Can you consistently estimate the model and under what conditions if you can?

(Hint: use partitioned regression)

2. Consider a linear regression model,

$$y = x_1\beta_1 + x_2\beta_2 + u, \text{ with } E(x_1) = 0, E(x_2) = 0, \text{ and } E(u) = 0.$$

Let $Cov(x_1, u) = \theta$, and $Cov(x_1, x_2) = \rho$, and $Cov(x_2, u) = 0$

Show whether OLS estimates of $\hat{\beta}_{1OLS}$ and $\hat{\beta}_{2OLS}$ are consistent if:

(a) $\theta \neq 0$ and $\rho = 0$

(b) $\theta \neq 0$ and $\rho \neq 0$

(c) if $\theta > 0$ and $\rho > 0$, will $\text{plim } \hat{\beta}_{1OLS} > \beta_1$ and $\text{plim } \hat{\beta}_{2OLS} > \beta_2$?

(Hint: use portioned regression)

3. The Body Mass Index (*BMI*) measures obesity. Assume that we have a sample of individuals' *BMI* and other information that is collected from various cities in the China. Consider a model of *BMI*:

$$BMI_{ic} = \beta_0 + \beta_1 * age_{ic} + \beta_2 * age_{ic}^2 + \beta_3 * male_{ic} + \beta_4 * exercise-time_{ic} + u_{ic}$$

where subscript *ic* indicates individual *i* at city *c*.

(a) Why might you concern about *exercise-time_{ic}* be correlated with the error term *u_{ic}*? Discuss within the framework of (i) omitted variables (ii) measurement error, and (iii) simultaneity. How would the OLS estimate of β_4 be biased?

(b) Suppose you can collect information on $income_{ic}$, age of kid, $kidage_{ic}$, and city-wide average commuting time cmt_c . Discuss if these variables are likely to be valid *IV*.

4. Wooldridge, page 80, #4.14

5. Wooldridge, page 109, #5.4