Lecture 10 - Economics 113

Professor Spearot

- Agenda
  1. Bias Examples
  2. Other Examples
- Exam Reminders
  1. No graphing calculators or notes
  2. Be on time!!!

Multivariate Regression

Omitted variable bias

- What happens when we omit an important variable?
- Need to conjecture regarding the relationship between the omitted variable and included x and y variables
- The Table

		Corr(omitted variable,x)	
		positive	negative
Corr(omitted variable,y)	positive	upward bias	downward bias
	negative	downward bias	upward bias

- Upward bias:
  - Estimate is *higher* than the true parameter: $\beta < \widehat{\beta}$
- Downward bias:
  - Estimate is *lower* than the true parameter: $\widehat{\beta} < \beta$

Multivariate Regression

Omitted variable bias - Examples

- Example: Effect of class attendance on grades
- Population follows:

$$final = \beta_0 + \beta_1 attend + \beta_2 study + u$$

- We instead forget about *study* and estimate:

$$\widehat{final} = \widehat{\beta}_0 + \widehat{\beta}_1 attend$$

- Suppose we estimate $\widehat{\beta}_1 > 0$, and conclude that attendance increases your grade ($\beta_1 > 0$). Is this right?
- Positive correlation between *study* and *final*
- Positive correlation between *study* and *attend*
- $\widehat{\beta}_1$suffers from an upward bias. $\beta_1 < \widehat{\beta}_1$

Multivariate Regression

Omitted variable bias - Examples

- Intuition
  - $\widehat{\beta}_1 > 0$ suggests that higher attendance improves your grade
  - However, students who attend class often tend to study more
  - Thus, *attend* may actually be accounting for the effects of studying, and not attendance.
- Overall, given $\beta_1 < \widehat{\beta}_1$, the result $\widehat{\beta}_1 > 0$ is *insufficient* to guarantee that $\beta_1 > 0$.

Multivariate Regression

Omitted variable bias - Examples

- Example: Effect of drugs on crime
- Population follows:

$$crime = \beta_0 + \beta_1 educ + \beta_2 drugs + u$$

- We instead forget about *drugs* and estimate:

$$\widehat{crime} = \widehat{\beta}_0 + \widehat{\beta}_1 educ$$

- Suppose we estimate $\widehat{\beta}_1 < 0$, and conclude education reduces your likelihood of committing a crime ($\beta_1 < 0$)
- Positive correlation between *drugs* and *crime*
- Negative correlation between *drugs* and *educ*
- $\widehat{\beta}_1$suffers from an downward bias. $\widehat{\beta}_1 < \beta_1$

Multivariate Regression

Omitted variable bias - Examples

- Intuition
  - $\widehat{\beta}_1 < 0$ suggests that education reduces your likelihood of committing a crime
  - However, people who go to school are less likely to abuse drugs
  - Thus, *educ* may actually be accounting for the propensity of drug use, not the effects of education
- Overall, given $\widehat{\beta}_1 < \beta_1$, the result $\widehat{\beta}_1 < 0$ is *insufficient* to guarantee that $\beta_1 < 0$.

Multivariate Regression

Omitted variable bias - Examples

- Example: Effect of graduate education on wages
- Population follows:

$$\log(wage) = \beta_0 + \beta_1 geduc + \beta_2 Exper + u$$

- We instead forget about *Exper* and estimate:

$$\widehat{\log(wage)} = \widehat{\beta}_0 + \widehat{\beta}_1 \log(geduc)$$

- Suppose we estimate $\widehat{\beta}_1 > 0$, and conclude that graduate education increases your wage ($\beta_1 > 0$)
- Positive correlation between *Exper* and $\log(wage)$
- Negative correlation between *Exper* and *geduc* (by construction)
- $\widehat{\beta}_1$suffers from an downward bias. $\widehat{\beta}_1 < \beta_1$

Multivariate Regression

Omitted variable bias - Examples

- Intuition
  - $\widehat{\beta}_1 > 0$ suggests that graduate education of some sort increases your wage
  - However, people who pursue graduate education have lower levels of experience
  - Thus, people with no graduate education may earn relatively high wages since they have lots of experience.
- Overall, given $\widehat{\beta}_1 < \beta_1$, the result $\widehat{\beta}_1 > 0$ is *sufficient* to guarantee that $\beta_1 > 0$.