BUEC 333-D100, Test 2

July 26, 2016, 11:30-14:20

Caution

- Allowed on desk: pen, SFU ID, water bottle without a label
- Not allowed: **anything** else. For example, no pencil cases, erasers, pencils, non-graphical calculator, phone, ruler, food, bottles with labels
- No bathroom breaks after the first person has handed in this test.
- No student will be permitted to leave during the last 15 minutes.
- Once you **finish** this exam, **signal** it to us, and we will come to pick up your exam. Stay seated until somebody comes to collect your exam.

Instructions

- On the front page of **your answer sheet**, write (i) your name; (ii) your student ID.
- On the front page of **this document**, write: (i) your name; and (ii) your student ID.
- No explanation = no points. A correct answer **with correct explanation** earns 1 point for each subquestion.
- For a "compute" question, an explanation can consist of starting from **an appropriate formula**, and working towards the correct numerical answer.

Cheat sheet

1. Critical values:
   (a) 5%: 1.96
   (b) 1%: 2.58
2. Adjusted R-squared:
$$\begin{aligned}\bar{R}^2 &= 1-\frac{n-1}{n-k-1}\frac{SSR}{TSS}\\ &= 1-\frac{n-1}{n-k-1}\left(1-R^2\right).\end{aligned}$$
3. Two stage least squares estimator with a single regressor and a single instrument
$$\hat{\beta}_1^{TSLS}=\frac{s_{ZY}}{s_{ZX}}.$$

1 Chapter 6

Using data on the SAT scores, personal and high school characteristic of 4000 U.S. students, we estimate the following regression:

$$\begin{gathered}\widehat{SAT}=1028-2.19Hsize-45.09Female\\ (2.06)\qquad(3.37)\end{gathered}$$

where SAT is the student's SAT score, $Hsize$ is the number of students in their high school graduating class (in hundreds), $Female$ is a gender dummy (1 if student is female, 0 otherwise).

1. Interpret the coefficient estimate of -2.19 on $Hsize$.
2. Is there sufficient statistical evidence that the size of your high school graduating class has an effect on your SAT score?
3. Interpret the coefficient estimate of -45.09 on $Female$.

Next, we control for whether the student is part of a visible minority. Let $VisMin$ is a dummy variable that is 1 if the student is part of a visible minority, and 0 otherwise.

$$\widehat{SAT} = \underset{(2.13)}{748} - \underset{(4.12)}{1.68Hsize} - \underset{(10.87)}{14.09Female} - 69.17VisMin$$

where

4. Is there any evidence of omitted variable bias? Explain!
5. What can you say about the relationship between $Female$ and $Vismin$ based on the two regression results?
6. Interpret your result in 5.

2 Chapter 5+8

Suppose that we have data on BUEC 333 test scores (Y_i), duration for which student i studies for exam (X_i), and the major of the student, call it D_i, where

$$D_i = \begin{cases} 1, \text{ if economics major} \\ 0, \text{ if non economics major} \end{cases}$$

Consider the following model:

$$Y_i = \beta_0 + \beta_1 X_i + \beta_2 D_i + \beta_3 D_i X_i + u_i \tag{1}$$

where Assumption 1 holds:

$$E\left(u_i | X_i, D_i\right) = 0. \tag{2}$$

Y_i is the score between 0 and 100. X_i is the duration studied in hours, between 1 and 100.

1. What is the intercept for econ-majors?
2. What is the slope for econ-majors?
3. What is the interpretation (in words) of β_1?
4. What is the interpretation (in words) for β_3?

Now suppose that the OLS estimate for β_1 is 0.60, and its standard error is 0.2.

5. Test whether $\beta_1 = 0$, at the 5% and 1% significance level.

Finally, we try a different model:

$$\ln\left(Y_i\right) = \beta_0 + \beta_1 \ln\left(X_i\right) + \beta_2 D_i + \beta_3 D_i \ln\left(X_i\right) + u_i \tag{3}$$

6. What is the interpretation of β_1 in this model?

3 Chapter 9

1. What is the difference between internal and external validity?
2. List the five threats to internal validity.
3. Explain in your own words one of the five threats mentioned under (2).

4 Chapter 12

Your textbook's Section 12.4 and 12.5 mentions a few situations which require IV techniques. Some of those are:

- the effect of class size on test scores
- the effect of an increase in the prison population on crime rates
- the aggressive treatment of heart attacks and the potential for saving lives
- the demand elasticity for cigarettes

1. Pick one of these examples and explain what each variable in the model below represents:

$$Y_i = \beta_0 + \beta_1 X_i + u_i$$

   That is, in the example you choose, what is Y_i and X_i?

2. The solution to the issue in (1) is to find an instrumental variable Z_i. What is an example of an IV that the book mentions?

3. What are the two conditions that this instrumental variable must satisfy?