The University of Texas at Austin
ECO 348K (Advanced Econometrics)
Prof. Sukjin Han

Assignment 2

Due: Sep. 20th 11:00am

- In answering questions, if any math derivations are involved, state them explicitly. In computer exercises, report all the codes and the outputs.

1. Consider the example in Section 3.2 and Table 3.3 in MM.

   (a) Based on Table 3.3, can you conclude that the officers have fully complied to the random assignments? Explain.

   (b) Explain how

   $$E[D_i|Z_i = 1] - E[D_i|Z_i = 0] = .797 - .011$$

   is derived given the table.

   (c) Suppose Y_i indicates any post-treatment recidivism. Write down the math formula for the intention-to-treat (ITT), i.e., the causal effect of being assigned to treatment on the likelihood of recidivism.

   (d) Suppose $ITT = .15$. Based on the values in (b), calculate the local average treatment effect (LATE) and carefully interpret the estimated parameter using the language of the example in this section.

   (e) Suppose that the treatment effect is constant for all batterers. What is the averge treatment effect (ATE) in this example? What is the average treatment effect on the treated (TOT), and how do you interpret the estimated parameter?

2. [Computer exercise] Write a full code that demonstrate the Law of Large Numbers. To be specific, let Y_i be the face of a dice. Rolling it N times would generate a sample $(Y_1, Y_2, ..., Y_N)$. Demonstrate the LLN with the sample mean $\bar{Y}_N$ of this experiment. Consider yourself as a statistics instructor and think about what the most effective way would be to demonstrate this law.

3. [Computer exercise] Take the CARD.csv file on Canvas. Card (1995) used this wage and education data for a sample of men in 1976 to estimate the return to education.

   (a) As a preliminary analysis, run a OLS regression of $\log(wage)$ on $educ$. In doing so, include the following controls as well: $exper, exper^2, fathedu, mothedu, black, smsa, south$. They are to contol for experience, parents education, race, and regions. Report the estimate of the effect of $educ$ on $\log(wage)$ and its s.e. Determine whether it is significant.

(b) What is the problem in giving causal interpretation on the estimate in (a)? Discuss.

(c) We turn to the IV estimation. Card used a dummy variable for whether someone grew up near a four year college ($nearc4$) as an instrumental variable (IV) for education.

i. Discuss how $nearc4$ would meet the second and third requirements for IV (i.e., randomness and exculsion restriction).

ii. Run the first stage OLS regression, by determining the dependent and the set of independent variables. Discuss whether the first requirement for IV (i.e., the existence of first-stage effect) meets.

iii. Based on the fitted values obtained in (ii), run the second stage OLS regression, by determinig the dependent and the set of independent variables. Report the 2SLS estimate of the effect of $educ$ on $\log(wage)$.

iv. [Hard] Calculate the s.e. of the 2SLS estimate on $educ$, by using the formula $SE(\hat{\lambda}_{2SLS})$ in the Appendix of Chapter 3 in MM. In doing so, you need to be able to caculate the sample standard deviation of η_i (recall how to estimate the standard deviation of the error term of a regression in the intro class) as well as the sample standard deviation of $\hat{D}_i$.

v. Based on the answers in (iii) and (iv), determine whether the causal effect is significant.