

ØAMET4100 · Spring 2019

Worksheet 8

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1 Experiments and Quasi-Experiments

Exercise 1.1 (Stock & Watson, Review the Concepts 13.1) A researcher studying the effects of a new fertilizer on crop yields plans to carry out an experiment in which different amounts of fertilizer are applied to 100 different 1-acre parcels of land. There will be four treatment levels. Treatment level 1 has no fertilizer, treatment level 2 is 50% of the manufacturer's recommended amount of fertilizer, treatment level 3 is 100%, and treatment level 4 is 150%. The researcher plans to apply treatment 1 to the first 25 parcels of land, treatment level 2 to the second 25 parcels, and so forth. Can you suggest a better way to assign treatment levels? Why is your proposal better than the researcher's method?

Exercise 1.2 (Stock & Watson, Review the Concepts 13.2) A clinical trial is carried out for new cholesterol-lowering drug. The drug is given to 500 patients, and a placebo is given to another 500 patients, using random assignment of the patients.

- (a) How would you estimate the treatment effect of the drug?
- (b) Suppose that you had data on the weight, age and gender of each patient. Could you use these data to improve your estimate? Explain.
- (c) Suppose that you had data on the cholesterol levels of each patient before he or she entered the experiment. Could you use these data to improve your estimate? Explain.

Exercise 1.3 (Adapted from Stock & Watson, Review the Concepts 13.3) Project STAR (Student-Teacher Achievement Ratio) was an experiment in Tennessee that was designed to evaluate the effect on learning of small classes. As part of this study, students were randomly assigned to a small class size (with 13-27 students per teacher) or a regular class size (with 22-25 students per teacher). Researchers studying the STAR data report anecdotal evidence that school principals were pressured by some parents to place their children in the small classes.

- (a) Suppose that some principals succumbed to this pressure and transferred some children into the small classes. How would such transfers compromise the internal validity of the study?
- (b) Suppose that you had data on the original random assignment of each student before the principal's intervention. How could you use this information to restore the internal validity of the study?

Exercise 1.4 What are experimental effects? How can they create biased treatment effects and what can a researcher do to reduce the bias?

Exercise 1.5 (Adapted from Stock & Watson, Exercise 13.4) Going back to the Card and Krueger (1994) example discussed in lecture, consider the difference-in-difference regression:

$$emp_{it} = \beta_0 + \beta_1 NJ_i + \beta_2 POST_t + \beta_3 NJ_i * POST_t + u_{it}$$

- (a) In terms of coefficients $\beta_0, \beta_1, \beta_2, \beta_3$, what is the expected number of employees in:
 - (i) A New Jersey restaurant in 1991?
 - (ii) A New Jersey restaurant in 1993?
 - (iii) A Pennsylvania restaurant in 1991?
 - (iv) A Pennsylvania restaurant in 1993?
- (b) In terms of the coefficients $\beta_0, \beta_1, \beta_2, \beta_3$, what is the average causal effect of the minimum wage on employment?
- (c) Explain why Card and Krueger used the difference-in-difference estimator of the causal effect instead of the “New Jersey after – New Jersey before” or the “1993 New Jersey – 1993 Pennsylvania” differences estimator.

Exercise 1.6 (Adapted from Stock & Watson, Exercise 13.3) Suppose that, in a randomized controlled experiment of the effect of tutoring on test scores, the following results are reported:

	Treatment Group	Control Group
Average Test Score (\bar{X})	1395	1348
Standard deviation of test score (S_X)	87.3	82.1
Number of women	60	40
Number of men	40	60

- (a) Estimate the average treatment effect of tutoring on test scores.
- (b) Is there evidence of non-random assignment? Explain.

Exercise 1.7 (Stock & Watson, Exercise 13.5) Consider a study to evaluate the effect on college student grades of dorm room Internet connections. In a large dorm, half the rooms are randomly wired for high-speed Internet connections (the treatment group), and final course grades are collected for all residents. Which of the following pose threats to internal validity, and why?

- (a) Midway through the year, all the male athletes move into a fraternity house and drop out of the study. (Their final grades are not observed.)
- (b) Engineering students assigned to the control group put together a local area network so that they can share a private wireless Internet connection that they pay for jointly.
- (c) The art majors in the treatment group never learn how to access their internet accounts.
- (d) The economics majors in the treatment group provide access to their internet connection to those in the control group, for a fee.