PSC 504 | Prof. Matthew Blackwell | Harkness 307 | m.blackwell@rochester.edu

Homework 4

Hard copy due Monday February 25th, 2013 in Jeff Marshall's mailbox in the PSC lounge (3rd floor Harkness) or by email to jeffrey.marshall@rochester.edu.

1 ATC

Assume that conditional ignorability holds for the treatment, along with positivity:

$$Y_i(1) \perp\!\!\!\perp A_i | X_i$$

$$0 < \Pr(A_i = 1 | X_i) < 1$$

1. Prove that, with a dataset of exact matches, the simple difference in means identifies the average treatment effect on the controls (ATC): $\tau_{ATC} = E[Y_i(1) - Y_i(0)|A_i = 0]$.

2 Matching to recover an experiment

In this problem, you will investigate the effect of the National Supported Work Demonstration, a subsidized work program in the mid-1970's. The federal government instituted a randomized evaluation of this program. Later, statisticians and economists were interested how well they could recover the experimental ideal when the experimental controls are replaced with a set of non-experimental controls from the Population Survey of Income Dynamics (PSID). In these data, the variable `nsw` is the treatment and the `re78` and `u78` are outcomes. The rest of the variables are covariates and their definitions are in Table 1.

1. Use the experimental data, `nsw_exper.dta`, to calculate the effect of the NSW program on 1978 earnings, along with the standard error and a 95% confidence interval.

nsw	=1 for NSW participants, =0 otherwise
age	age in years
educ	years of education
black	=1 if African American, =0 otherwise
hispanic	=1 if Hispanic, =0 otherwise
married	=1 if married, =0 otherwise
re74	real (inflation adjusted) earnings for 1974
re75	real (inflation adjusted) earnings for 1975
re78	real (inflation adjusted) earnings for 1978
u74	=1 if unemployed in 1974, =0 otherwise
u75	=1 if unemployed in 1975, =0 otherwise
u78	=1 if unemployed in 1978, =0 otherwise

Table 1: NSW variable definitions

2. Use the observational data, `nsw_psid_withtreated.dta`, and calculate the balance of this observational counterpart to the experiment. You may find the `imbalance` function from the `cem` library helpful for this.

3. Use a logistic regression to estimate the propensity scores for the non-experimental data. Create a nicely-formatted plot that compares the propensity score distribution for treated and control units. How balanced does the propensity score look?

4. Use the same logistic model to estimate the propensity score in the experimental data and create the same plot as in the last part. Compare the balance of the experimental and non-experimental propensity score.

5. Use `MatchIt` to create a matched sample using the method of your choice. Attempt at least two matching solutions. Provide evidence that your final matching solution improves the balance of the dataset. Did you have to make any tradeoffs, either in terms of sample size or between the balances of the various variables?

6. Take your matching solution and increase the number of matches (using the `ratio` argument). Does this appear to increase or decrease the balance of the data? Why or why not?

7. Calculate the effect of the NSW in the matched dataset, along with a standard error. How does this estimate compare to the experimental benchmark?

8. Take the observational data and their estimated propensity scores, use the subclassification approach from last week's problem set to calculate the average treatment effect with bootstrapped standard errors. How does this estimate compare to the matching estimator and the experimental benchmark?

3 Matching applications

Choose one paper from set of matching applications. Briefly describe the treatment and outcome and the types of variables were used for matching. Identify one potential confounder that you believe went unmatched or unmeasured. What type of influence (positive or negative) would that confounder have on the treatment? What about the influence of the confounder on the outcome? What type of bias might these influences cause? Speculate (perhaps wildly) about whether or not you think that bias would be enough to overturn the results of the paper.