[SI] [Yoke Hong] - ECO372 Assignment 2
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a.
The pre-experiment observable characteristics include age, education, black, hispanic, married and nodegree. The t-statistic obtained from the regression of these pre-experiment observable characteristics apart from nodegree on treatment is found to be within the interval of [-1.96, 1.96] that corresponds to a significance level of 0.05. Therefore, the difference in these characteristics is not statistically significant between the treatment (individuals who were assigned into training) and the control group. Hence, in our sample, the difference in characteristics between the treatment and control group is not sufficient to conclude a difference at the population level. Thus, we fail to reject the null hypothesis. Given this result, the training group and control group does not differ to a significant extent between these aforementioned observable characteristics.

The t-statistic obtained from the regression of nodegree on treatment does not fall within the interval of [-1.96, 1.96] that corresponds to a significance level of 0.05. Therefore, we can infer that there is a statistically significant difference in the number of individuals with degrees between the treatment and control. It can be inferred that the participants under the treatment have 0.0834779 (0.7306397 - 0.8141176) lesser individuals with “nodegree” than participants under the control. Thus, we reject the null hypothesis. Given this result, we observe that the individuals under the treatment group are more likely to have a degree when compared to the control group. Hence, when estimating the growth in revenue due to the training program, revenue growth in the individuals of the treatment group may be overestimated when compared to the control group since we would expect a positive correlation between having a degree and attaining higher earnings.

This is important as we would like to prevent any omitted variable bias to be present in our model. Since there is a statistical significance in the number of individuals with degrees between the treatment and control group, it is important to control for this “nodegree” variable. If the variable is not controlled, it would underspecify the model and affect the results when estimating the treatment effect on earnings growth.

b.
The regression model ran to re-obtain $886 is “reg re78 treat, robust”. The result I obtained from STATA is $886.3037 which is very close to the $886 value from the data in the LaLonde paper.

c.
The regression model ran to re-obtain $798 is as follows.
“gen age_squared = age^2”
“reg re78 treat age age_squared education black hispanic nodegree, robust”
The result I obtained from STATA is $798.3512 which is also very close to the $798 value from the data in the LaLonde paper.

d.
The robust standard error obtained is 486.85 whereas the classic standard error obtained is 471.7456. Thus, the LaLonde paper used classic standard errors since the classic standard error obtained from STATA (471.7456) is closer to the standard error in the paper (472).

e.
An assumption that the experiment undergoes a random sampling process is crucial in determining the causal effect of the NSW training program. Random sampling would satisfy the backdoor criterion and conditional independence assumption, preventing any confounders from affecting the results of the experiment, therefore eliminating any selection bias.

This assumption is likely to be satisfied in the NSW program since the participants of the experiment were assigned randomly to treatment and control groups. Therefore, this allows LaLonde to identify a causal effect of the NSW training program on revenue growth.

f.
The t-statistic gives a value of -1.8154 which falls within the interval of [-1.96, 1.96] that corresponds to a significance level of 0.05. Therefore, the difference in 1978 revenues is not statistically significant between the treatment (NSW program) and the control group.

Hence, in our sample, the 1978 revenue is $886.304 (5976.352 - 5090.048) greater in the treatment group than the control group, but the difference is not sufficient to conclude a difference at the population level. Thus, we fail to reject the null hypothesis. Given this result, the training program is effective at increasing revenue but only to a small insignificant extent due to the results of our hypothesis test.

g.
The PSID-3 control group is defined as all-male household heads continuously from 1975 through 1978, who were less than 55-years-old and did not classify themselves as retired in 1975, that were also not working when surveyed in either spring of 1975 or 1976.

h.
The observable characteristics include age, education, black, hispanic, married and nodegree. The t-statistic obtained from the regression of these characteristics, apart from the education and hispanic variables, on treatment does not fall within the interval of [-1.96, 1.96] that corresponds to a significance level of 0.05. Therefore, we can infer that there is a statistically significant difference in these observable characteristics between the treatment (individuals who were assigned into training) and PSID-3 comparison group. Thus, we reject the null hypothesis. Given this result, we can conclude that there is a significantly large difference in age, black individuals, married individuals and individuals with degrees between the treatment and PSID-3 comparison group. Due to the significant correlation between these variables and revenue growth, estimating the revenue growth in the individuals of the treatment group may be overestimated or underestimated due to bias when compared to the PSID-3 comparison group.

On the other hand, the t-statistic obtained from the regression of education and hispanic on treatment is found to be within the interval of [-1.96, 1.96] that corresponds to a significance level of 0.05. Therefore, the difference in education and hispanic individuals is not statistically significant between the treatment and the PSID-3 comparison group. Hence, in our sample, the difference in characteristics between the treatment and comparison group is not sufficient to conclude a difference at the population level. Thus, we fail to reject the null hypothesis. Given this result, the training group and control group does not differ to a significant extent in terms of education levels and the number of hispanic individuals in the groups.

The difference in observable characteristics that are statistically significant between treatment and control group must be controlled for as it would lead to omitted variable bias if not. For instance, people with a degree are likely to have higher earnings growth than those without. Omitting a relevant variable would underspecify the model and affect the results when estimating the treatment effect on earnings growth in the labour market. Additionally, it would lead to the violation of the conditional independence assumption leading to bias in the results.

i.

The estimate of the effect of the training program on 1968 revenues controlling for age, age squared, years of schooling, high school dropout status, and race between the treatment and PSID-3 comparison group is determined to be $-509.2156 from STATA. This differs greatly from the estimate drawn from the experimental design of $798 in part (c).

As mentioned in the paper, the estimator for the non-experimental estimates of this effect is “biased since the training dummy variable is correlated with the error in the earnings equation”. Furthermore, the estimates are also sensitive to both the features of the PSID-3 comparison group as well as the econometric procedure. In addition, we can infer that this estimator is not properly controlled for differences between the trainees and comparison group members, causing discrepancies between the non-experimental and experimental estimates. For instance, the paper mentioned that some of the training participants experienced bad luck before the training program. Hence, we would expect the trainees' earnings to grow even without the provision of the treatment.

The bias in the non-experimental estimates is mainly due to the lack of randomisation. Since a randomisation sampling technique is unable to be conducted on the non-experimental estimate (PSID-3), there would be backdoor paths thus, the conditional independence assumption will not hold. Therefore, selection bias would be present in the experiment, underestimating the effect of the training program on 1978 revenues (-509) in comparison to the control group (798).

j.

Based on question h., I would expect the comparison groups with younger aged individuals to experience the strongest wage change in the absence of a treatment effect. From the regression of earnings growth on all the observable characteristics variables when treatment = 0, I found the age variable to have a t-statistic of -3.25 which is the greatest amongst all the other variables. The t-statistic of -3.25 also implies that age is statistically significant at the 0.02% level.

Hence, the age variable is the most statistically significant in affecting the change of wages which implies that individuals of different ages will lead to a significant difference in their wage levels. In our particular scenario, younger individuals tend to have higher positive earnings growth than older individuals due to the negative coefficient of age as determined in STATA.

k.
The regression model ran to re-obtain the estimate from column (7) is as follows.
“gen earningsgrowth = re78 - re75”
“reg earningsgrowth treat age age_squared, robust”

l.
The estimate for the difference in earnings growth between 1975 to 1978 between the treatment and comparison groups for male individuals is determined to be $856 for the Controls and -$1325 for the PSID-3. The control group is comprised of individuals that were not provided with the NSW training program treatment. The PSID-3 comparison group is defined in part g.

Hence, it could be inferred that by providing treatment and comparing to individuals part of the control group, earnings of the control group is $856 less than of the treatment group. On the other hand, the earnings of the PSID-3 comparison group is $1325 greater than the treatment group. Thus, we can conclude that the PSID-3 comparison group has an earnings growth of (856 - (-1325)) $2181 greater than the control group.