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Lab 3: The Moving to Opportunity Experiment

In a randomized experiment with non-compliance, we use the following terminology:

1. **Intent-to-Treat (ITT) Effect on an Outcome**. We estimate a simple regression of the outcome Y_i on an intercept and the randomly assigned treatment group indicator, which in the Moving to Opportunity Experiment is $voucher_i$:

   $$\widehat{Y_i} = \alpha_0 + \alpha_1 \cdot voucher_i$$

   The coefficient α_1 measures the difference in means of the outcome Y_i between the group with $voucher_i = 1$ and the group with $voucher_i = 0$. It is the intent-to-treat (ITT) parameter. The coefficient on the intercept α_0 measures the mean of the outcome Y_i for the group with $voucher_i = 0$.

2. **Intent-to-Treat (ITT) Effect on Treatment**. We estimate a simple regression of the treatment, which was $Moved_i$ in the Moving to Opportunity Experiment, on the intercept and $voucher_i$:

   $$\widehat{Moved}_i = \pi_0 + \pi_1 \cdot voucher_i$$

   The coefficient π_1 measures the difference in means of $Moved_i$ between the group with $voucher_i = 1$ and the group with $voucher_i = 0$. It measures the compliance rate or take-up rate in an experiment with one sided non-compliance.[1] In an experiment with perfect compliance, $\pi_1 = 1$. When there is non-compliance, $\pi_1 < 1$. The coefficient on the intercept π_0 measures the mean of $Moved_i$ for the group with $voucher_i = 0$.

3. **Treatment-on-the-treated (TOT) effect.** In an experiment with one sided non-compliance, the treatment-on-the-treated (TOT) effect is the ratio between the ITT and the compliance rate:

   $$\begin{aligned} TOT &= \frac{\text{Intent-to-Treat Effect on an Outcome}}{\text{Intent-to-Treat Effect on Treatment}} \\ &= \frac{\alpha_1}{\pi_1} \end{aligned}$$

   The TOT is the average treatment effect among those who actually receive the treatment. This distinction matters if there is treatment effect heterogeneity, meaning that the treatment has a different impact on different people.

[1] π_1 measures the *difference* in compliance rates between the treatment and control groups in an experiment with two sided non-compliance.

4. **Local Average Treatment Effect (LATE) effect.** In an experiment with two sided non-compliance, the local average treatment effect is the ratio between the ITT α_1 and the compliance rate π_1 (Imbens and Angrist 1994):[2]

$$\begin{aligned} LATE &= \frac{\text{Intent-to-Treat Effect on an Outcome}}{\text{Intent-to-Treat Effect on Treatment}} \\ &= \frac{\alpha_1}{\pi_1} \end{aligned}$$

The LATE is the average treatment effect for those whose treatment status *changes* because of the random assignment. These people are called compliers. We also have non-compliers. The experiment is simply not informative about the treatment effect for non-compliers.

To see why dividing the ITT by the compliance rate identifies the effect of the treatment $Moved_i$ on the outcome Y_i, make the assumption the the only reason that $voucher_i$ could affect Y_i is by encouraging people to move, which then goes on to affect Y_i. If that is the case, then the effect of $voucher_i$ on Y_i must equal the effect of $voucher_i$ on $Moved_i$ times the effect of moving on Y_i:

$$\text{Effect of } voucher_i \text{ on } Y_i \; = \; \text{Effect of } voucher_i \text{ on } Moved_i \; \times \; \text{Effect of } Moved_i \text{ on } Y_i$$

Rearranging:

$$\text{Effect of } Moved_i \text{ on } Y_i = \frac{\text{Effect of } voucher_i \text{ on } Y_i}{\text{Effect of } voucher_i \text{ on } Moved_i}$$

The numerator is the Intent-to-Treat Effect on an Outcome and the denominator is the Intent-to-Treat Effect on Treatment:

$$\text{Effect of } Moved_i \text{ on } Y_i = \frac{\text{Intent-to-Treat Effect on an Outcome}}{\text{Intent-to-Treat Effect on Treatment}}$$

[2] Joshua Angrist and Guido Imbens won the 2021 Nobel Prize in Economics for introducing the idea of Local Average Treatment Effects. This is the modern interpretation of *instrumental variables regression* from econometrics.