**DIFFERENCE IN DIFFERENCES ACTIVITY GUIDANCE**

**Activity learning goals:**

* Estimate causal effects by applying difference-in-differences (DD) estimation to aggregate level data.
* Understand and evaluate the parallel trends assumption of DD in different empirical contexts.

**Introducing the activity:**

Do free laptop computers improve student outcomes? Suppose São Paulo, the capitol of Brazil, instituted a free laptop program in all of its elementary schools in 2009. Suppose also that Rio de Janeiro, another large city a few hundred miles up the coast, did NOT implement the program. While this scenario is hypothetical, the government of Uruguay implemented a One-Laptop-Per-Child program across their country in 2009, and many schools in the US have also distributed free computers to their students. These programs are expensive, and it is important to have good estimates of their benefits.

**Guiding students during the activity:**

1. *You have average elementary school test scores in São Paulo and Rio de Janeiro for the end of the 2009 school year. Why is the difference between them a poor measure of the effect of the program?*   
   When students are having trouble getting started, we ask more pointed questions: What does this difference capture above and beyond the effect of the program? Are there other differences between São Paolo and Rio de Janeiro that could explain some of the observed differences in test scores?
2. *You get the average test score for São Paulo students in 2008. Why is the difference between this and the average São Paulo score in 2009 a poor estimate of the effect of the program?*We hope that students will recognize that there may be other changes that occurred between these two years that could explain the difference in test scores.
3. *Suppose you have the average test scores for both São Paulo and Rio in 2008 and 2009. Can you use these together to improve upon the estimate suggested in Q1? How about Q2? Hint: Think about the Q1 and Q2 differences in terms of Treatment on the Treated and Selection Bias.*Ideally you have introduced the vocabulary of treatment effects earlier in the semester, and can encourage students to think about the difference between the outcomes of two groups in a non-experimental context as the sum of the Treatment on the Treated and Selection Bias. If these terms are not familiar to your students, you can instead suggest that the simple differences presented in Q1 and Q2 are sums of the causal effect of the treatment and another part that represents pre-existing differences. The key is to encourage students to look for a new difference that can be used as an estimate of the second part and then subtracted from the combined effects to isolate the effect of the program*.*

**Wrapping up the activity:**

Many students are able to discover the method of difference-in-differences through the activity. This allows you to give a very concise lecture summarizing the method and explaining how the parallel trends assumption relies on the difference across time in the control group being a good approximation of what would have happened in the treatment group in the absence of the treatment. Equivalently, you can explain that the difference between the control group and treatment group in the pre-treatment period must approximate the difference that would exist between the two groups in the post-treatment period if the treatment had never been applied.

After this activity, you may want to use a traditional lecture to show how difference-in-differences estimates can be computed using regression models that contain an interaction of a dummy variables representing the treatment group and post-treatment period.