

# ESTIMATE: The Reduced Form

## Difference-in-Differences with Panel Data

**Instructor:** Jeffrey M. Wooldridge (Michigan State University)

**Dates:** December 14-15, 2021

**Description:** This course covers difference-in-differences (DiD) estimators for policy analysis with panel data. The focus is on using and combining built-in Stata commands, along with recent user-written commands, to allow simple estimation methods, robust inference, and flexibility in the pattern of treatment effects. We will see how the usual two-way fixed effects approach can be extended in the staggered intervention case to allow for heterogeneous treatment effects across cohort and time. In addition, we will see how to incorporate covariates into the analysis in all settings. Simple solutions to violations of the parallel trends assumption also will be covered. Problems and approaches with unbalanced panels and issues of statistical inference with few treated or control groups will also be covered. The course ends with a discussion of my recent research on staggered designs with nonlinear models, with focus on binary, fractional, and nonnegative responses.

Participants should have good working knowledge of ordinary least squares estimation, fixed effects estimation, and basic nonlinear models such as logit, probit, and exponential conditional means. Sufficient background is provided by my introductory econometrics book, *Introductory Econometrics: A Modern Approach*, 7e, Cengage, 2020. My book *Econometric Analysis of Cross Section and Panel Data*, 2e, MIT Press, 2010, covers the background material at a higher level. An optional video of approximately 90 minutes will provide background on potential outcomes and treatment effects estimators. This material will be applied in DiD contexts.

For much of the material I will rely on my recent working paper, “Two-Way Fixed Effects, the Two-Way Mundlak Regression, and Event Study Estimators.” I will also draw on preliminary research on nonlinear DiD estimation. All material is available here:

[https://www.dropbox.com/sh/zi91darudf2fica/AADj\\_jaf5ZuS1muobgsnxS6Za?dl=0](https://www.dropbox.com/sh/zi91darudf2fica/AADj_jaf5ZuS1muobgsnxS6Za?dl=0)

The lectures and the Q&A sessions will be recorded and the recordings will be made available to participants.

## **Course Timetable (Times are EST)**

### **DAY 1**

#### **Session 1: 10:00-11:30**

Introduction; Two-Period Difference-in-Differences; Common Trends; Controlling for Covariates via Regression Adjustment and Propensity Score Methods

#### **Q&A/Break: 11:30-12:00**

#### **Session 2: 12:00-13:30**

More than Two Time Periods; Two-Way Fixed Effects; Heterogeneous Treatment Effects; Controlling for Covariates

#### **Q&A/Break: 13:30-14:00**

#### **Session 3: 14:00-15:30**

Staggered Interventions, I. Heterogeneous Effects. Pooled OLS and Extended TWFE.

#### **Q&A/Summary: 15:30-16:00**

### **DAY 2**

#### **Session 4: 10:00-11:30**

Staggered Interventions, II. Propensity Score and Imputation Methods. Testing and Correcting for Violation of Common Trends

#### **Q&A/Break: 11:30-12:00**

#### **Session 5: 12:00-13:30**

Unbalanced Panels. Standard Errors and Inference in Nonstandard Settings

#### **Q&A/Break: 13:30-14:00**

#### **Session 6: 14:00-15:30**

Nonlinear DiD. Binary, Fractional, and Nonnegative Responses. Pooled Quasi-Maximum Likelihood Estimation. Poisson Fixed Effects

#### **Q&A/Summary: 15:30-16:00**