

Causal Inference for the Social Sciences II

2026 ICPSR Summer Program

Ann Arbor, Michigan

1 Basic Information

Instructors:	Sebastian Calonico Assistant Professor UC Davis scalonico@ucdavis.edu	Nicolás Idrobo Postdoctoral Research Associate Princeton University idrobo@princeton.edu
Teaching Assistants:	Jefferson Lecio Leal University of Rochester leal.lecio@gmail.com	Seongyoon Kim University of Michigan syoonkim@umich.edu
Office hours:	By appointment for Nicolás and Sebastian Jefferson: Monday–Friday, 12–1pm, in person in ISR Room 1450, with a Zoom option . Seongyoon: Monday–Friday, 1–2pm, fully hybrid on Zoom .	
Lecture schedule:	Monday July 13 through Thursday July 30, 2026 Main lecture: 2:30 – 5:30pm every day	
Lecture location:	North University Building (NUB), Room 1567	

2 Overview

The goal of this class is to provide a thorough introduction to recent methodological developments to study causal inference in non-experimental settings, including reweighting methods, regression discontinuity designs, difference-in-differences, synthetic controls and causal machine learning. The main focus will be on methodology and empirical practice, with an emphasis of the key steps to follow when implementing the methods.

It is assumed that participants have elementary working knowledge of statistics, econometrics and policy evaluation. It would be useful, but not required, if participants were familiar with basic results from the literature on program evaluation and treatment effects at the level of [Wooldridge \(2010\)](#). This course is nonetheless meant to be self-contained and hence most underlying statistical concepts and results are introduced and explained in class.

3 Reading Materials

We will not follow any specific books. For general background, we recommend [Imbens and Rubin \(2015\)](#), [Angrist and Pischke \(2009\)](#), [Rosenbaum \(2023\)](#), and [Hernán MA \(2020\)](#). We also provide specific background references under each topic below.

4 Assignments

Assignments are due each Monday, before 2:30pm.

5 Computing and Software

To participate in the hands-on exercises, you are strongly encouraged to bring a laptop computer with the most recent version of **Stata** or **R/RStudio** installed, as we will use them to analyze several empirical illustrations. Please make sure you have **Stata** (or **R**) and the modules/commands listed below installed and fully functional in your personal computer before the course begins. Datasets, do-files and **R** files will be provided in advance.

The following **Stata**/**R** packages will be used:

RDD

- **rdrobust**: RD inference employing local polynomial and partitioning methods. [Calonico, Cattaneo and Titiunik \(2014, 2015b\)](#).
- **rddensity**: Manipulation testing for RD designs. [Cattaneo, Jansson and Ma \(2018\)](#).
- **rdlocrand**: RD inference employing randomization inference methods. [Cattaneo, Titiunik and Vazquez-Bare \(2016\)](#).
- **rdmulti**: Analysis of RD designs with multiple cutoffs or scores. [Cattaneo, Titiunik and Vazquez-Bare \(2020\)](#).

DiD

- **R**: `dplyr`, `fixest`, `did`, `drdid`, `bacondecomp`.
- **Stata**: `csdid`, `drdid`, `reghdfe`, `bacondecomp`, `eventstudyinteract`, `did_multiplegt`, `did_imputation`.

Machine Learning

- **R**: `ISLR2`
- **Stata**:

5.1 Software installation instructions

If you will be using **R**, we recommend also installing **RStudio**. To install these programs, follow the instructions below:

1. Download the most recent version of **R** and install it in your computer. **R** is free and available for Windows, Mac, and Linux operating systems. Download the version of **R** compatible with your operating system from [CRAN](#). If you are running Windows or MacOS, you should choose one of the precompiled binary distributions (i.e., ready-to-run applications) that are linked at the top of the page, *not* the source codes.

2. Download and install [R Studio](#). This is an integrated development environment (IDE) that includes a console, a syntax-highlighting editor, and other tools for plotting, history, debugging and workspace management for R use. RStudio is free and available for Windows, Mac, and Linux platforms.

If you are using **Stata**, you will have to obtain a license from [here](#). **Stata** is licensed through **StataCorp** and is frequently offered at a significant discount through academic institutions to their employees and students. Seminar participants who are not yet ready to purchase Stata could take advantage of StataCorp's 30-day software return policy and obtain Stata 19 on a trial basis in the weeks immediately preceding this course. Use this link for 30-day trial copy: <http://www.stata.com/customer-service/evaluate-stata/>

6 Outline, Schedule & Background References

This section gives an overview of the topics covered and optional readings.

WEEK 1

Day 1: Introduction to Causal Inference

Potential outcomes framework. Randomized experiments: identification, estimation and inference. Non-experimental approaches to causal evidence. Instrumental Variables.

Assigned Reading: [Abadie and Cattaneo \(2018\)](#) (Ch. 1-3), [Hernán MA \(2020\)](#) (Ch. 1-2, 6).

Background References: [Imbens and Rubin \(2015\)](#), [Holland \(1986\)](#), [Rosenbaum \(2010\)](#), [Rosenbaum \(2023\)](#).

Day 2: Unconfoundedness

Identification of causal effects by Conditional Independence. Regression Adjustments. Matching Estimators. Doubly robust approaches.

Assigned Reading: [Abadie and Cattaneo \(2018\)](#) (Ch. 4), [Hernán MA \(2020\)](#) (Ch. 3).

Background References: [Imbens and Rubin \(2015\)](#), [Holland \(1986\)](#), [Rosenbaum \(2010\)](#).

Days 3-4: RD Designs - Foundations

Introduction to RD designs. Graphical presentation of RD results. Conventional continuity-based estimation and inference methods based on local polynomials. Bandwidth selection. Falsification methods. The role of covariates.

Assigned Reading: [Cattaneo, Idrobo and Titiunik \(2020\)](#), Sections 1 and 2.

Background References: [Hahn, Todd and van der Klaauw \(2001\)](#), [Lee and Lemieux \(2010\)](#), [Lee \(2008\)](#), [Thistlethwaite and Campbell \(1960\)](#). [Calonico, Cattaneo, Farrell and Titiunik \(2019\)](#), [Cattaneo, Jansson and Ma \(2020, 2018\)](#), [McCrary \(2008\)](#).

Robust bias-corrected local polynomial methods for continuity-based analysis.

Assigned Reading: [Cattaneo, Idrobo and Titiunik \(2020\)](#), Sections 1-4.

Background References: [Calonico, Cattaneo and Titiunik \(2015a\)](#), [Card et al. \(2015\)](#), [Keele and Titiunik \(2015\)](#).

WEEK 2

Day 5: RD Designs - Extensions

Fuzzy RDD. Local randomization. Discrete running variables. Multicutoff and multiscore RDD.

Assigned Readings: [Cattaneo, Idrobo and Titiunik \(2023\)](#), Sections 2 to 5.

Background references: [Keele and Titiunik \(2015\)](#), [Cattaneo, Titiunik and Vazquez-Bare \(2017\)](#), [Cattaneo, Keele, Titiunik and Vazquez-Bare \(2016\)](#), [Cattaneo, Keele, Titiunik and Vazquez-Bare \(2021\)](#).

Days 6-9: Difference-in-Differences

Classical two-periods/two-groups DiD setup with heterogeneous treatment effects. The parallel trends assumptions. DiD with multiple periods and simultaneous treatment adoption. Sensitivity analysis and robustness checks. Staggered treatment adoption designs: problems with two-way fixed effects estimators and possible solutions. Synthetic controls.

Assigned Reading: [Abadie and Cattaneo \(2018\)](#), [de Chaisemartin and D'Haultfoeulle \(2022\)](#), [Roth et al. \(2023\)](#), [Steigerwald, Vazquez-Bare and Maier \(2021\)](#).

Background References: [Abadie and Gardeazabal \(2003\)](#), [Abadie, Diamond and Hainmueller \(2010\)](#), [Athey and Imbens \(2017\)](#), [Sun and Abraham \(2021\)](#), [de Chaisemartin and D'Haultfoeulle \(2020\)](#), [Tazhitdinova and Vazquez-Bare \(2023\)](#), [Abadie \(2021\)](#).

WEEK 3

Days 10-14: Machine Learning Methods for Causal Inference

Supervised and unsupervised approaches. Average and heterogeneous causal effects. Regression trees and random forest. Double Selection to Double ML. Average treatment effect estimation: AIPW-Double ML. Heterogeneous effects with inference. Policy learning.

Assigned Reading: [James et al. \(2023\)](#), [Mullainathan and Spiess \(2017\)](#), [Athey and Imbens \(2017\)](#), [Athey and Imbens \(2019\)](#), [Colin Cameron's notes \(UC Davis\)](#).

Background References: [Hastie, Tibshirani and Friedman \(2009\)](#), [James et al. \(2014\)](#).

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