

**Humboldt University**  
**Short Course**  
**Topics in Estimating Treatment Effects**  
**February 25-26, 2019**

Jeffrey M. Wooldridge  
Michigan State University

**Overview:** This course covers selected topics in estimating treatment (causal) effects in several settings. We will study methods that have become recently more popular but are not as commonly used as other approaches, including doubly robust estimators when assignment is either randomized or unconfounded conditional on covariates, and control function methods when an instrumental variable is available. Also, we will study both linear and nonlinear difference-in-differences estimators, and discuss some recent work on properly computing standard errors to account for sampling uncertainty and assignment uncertainty. We will also discuss the issue of clustering standard errors for treatment effect estimation.

Some of the topics are covered in Imbens and Wooldridge (2009) and Wooldridge (2010). Others are covered in recent journal articles or working papers. The reading list is given below.

The format is two 90 minute lectures per day, with a 15 minute break between lectures.

**Background:** I will assume you have had a course in econometrics that covers a modern approach to linear regression and instrumental variables for cross-sectional data, including the notion of a linear projection. Background reading is in Wooldridge (2010, Chapters 2, 3, and 4). In addition, you should feel comfortable with basic limited dependent variable models, such as probit, logit, and Poisson regression. The lectures focus on the practical meaning of the assumptions underlying each method and the consequences of relaxing those assumptions.

**Monday, February 25, 9:15-12:30**

Methods Assuming Random Assignment and Unconfoundedness

- Quick Review of Setup
- Regression Adjustment with Random Assignment
- Doubly Robust Estimators

Methods with Confounded Assignment

- Review of Linear Instrumental Variables
- Control Function Methods

**Tuesday, February 26, 9:15-12:30**

Difference-in-Differences

- Linear Methods with Pooled Cross Sections
- Group-Specific Trends
- Nonlinear Difference-in-Differences

Issues in Computing Standard Errors

- Finite Population Standard Errors
- When Should One Cluster Standard Errors?

### **Course Material**

I will provide a Dropbox link to lecture slides, Stata data sets, and some simple Stata code. One need not have a Dropbox account to access the material.

### **Readings**

Abadie, A., S. Athey, G.W. Imbens, and J.M. Wooldridge (2017), “Sampling-Based vs. Design-Based Uncertainty in Regression Analysis.” Working paper.  
<https://arxiv.org/abs/1706.01778>

Abadie, A., S. Athey, G.W. Imbens, and J.M. Wooldridge (2017), “When Should You Adjust Standard Errors for Clustering?” NBER Working Paper No. 24003.  
<https://arxiv.org/pdf/1710.02926.pdf>

Imbens, G.W. and J.M. Wooldridge (2009), “Recent Developments in the Econometrics of Program Evaluation,” *Journal of Economic Literature* 47, 5-86.

Puhani, P.A. (2012), “The Treatment Effect, the Cross Difference, and the Interaction Term in Nonlinear ‘Difference-in-Differences’ Models,” *Economics Letters* 115, 85-87.

Wooldridge, J.M. (2010), *Econometric Analysis of Cross Section and Panel Data*, MIT Press, 2<sup>nd</sup> edition, 2010. Chapters 6 and 21.

Wooldridge, J.M. (2015), “Control Function Methods in Applied Econometrics,” *Journal of Human Resources* 50, 420-445.