Causal Inference: Methods for Program Evaluation and Policy Research
APSTA-GE 2012.1.001
Fall 2015

Course Time and Location:
Friday 9:30-12:15
Meyer 122
Instructor: Jennifer Hill
804 Kimball Hall (246 Greene St)
Office Hours: Wednesday 3:00-4:00

Course Description and Prerequisites:
This goal of this course is to provide students with a basic knowledge of how to perform some more advanced statistical methods useful in answering policy questions using observational or experimental data. It will also allow them to more critically review research published that claims to answer causal policy questions. The primary focus is the challenge of answering causal questions, that is, those that take the form "Did A cause B?" using data that do not conform to a perfectly controlled randomized study. Examples from real public policy studies will be used throughout the course to illustrate key ideas and methods. First, we will explore how best to design a study to answer causal questions given the logistical and ethical constraints that exist. We then discuss several approaches to drawing causal inferences from observational studies including propensity score methods, instrumental variables, regression discontinuity, difference in differences, and fixed effects models. If time allows we will also discuss some simple forms of sensitivity analysis.

Pre-requisites:
The prerequisite for the course is two semesters of quantitative methods at the level of RESCH-GE.2003, RESCH-GE.2004 (or the equivalent as approved by the instructor). Students should understand the properties of regression including use of indicator (dummy) variables, interactions, and transformation. Exposure to logistic regression is also required. Experience with Stata is extremely helpful though not formally required.

Grading:
Grading will be based on approximately 7 graded assignments (totaling 70%) and one final project or final exam (30%) that will involve both data analysis and a thoughtful description of both the analysis and the findings. A description of the final exam and final project as well as detailed guidelines for the project will be provided in a document posted on the Classes website.

Class meeting times, organization, deadlines
Each class is scheduled to run for 2 hours and 45 minutes. Technically, we are required to meet only 2 hours each week. 10-15 minutes of the extra time will go towards making up for a class that we will have to miss in December (see below). The rest of the time will be used for additional Stata instruction, help with homework, or more general questions/office hours as the need arises. Therefore you should plan on being in the classroom each week until 11:45. Typically, the remaining time (from 11:45-12:15) will be optional.
The class will meet every Friday that the university is open during the semester (that is, all but the day after Thanksgiving) with the exception of Friday October 9th. The last day of class will be Friday December 11th. The final project/final exam will be due on Friday December 18th at noon. A hardcopy of your final must be handed in to my office or mailbox; electronic copies will not be accepted.

Reading materials
There is no required textbook for the course:

The required readings are either available through e-journals through the library or will be posted on the Classes website. In addition, however, the following books are recommended:


Outline of course Lessons and readings:
The following outline describes the Lessons that will be covered along with anticipated associated readings. It corresponds roughly to the course weeks though we may end up adjusting time spent on each Lesson as we go. Readings highlighted with an * are recommended, not required. All readings not available on the web will be put on electronic reserve through Bobst library (BL). Web addresses for the others are provided.

1)  Motivation: What's all the observational vs. randomized fuss about?
    Simple randomized experiments (theory and practice) and the Rubin Causal Model

*Winship & Morgan, Chapter 2 (posted on Classes under Lesson 1)


2) Randomized experiments (including Randomized Block and Matched Pairs Designs) and complications that make them look like observational studies


Guo and Fraser, Chapter 2, pp 21-36 available on Classes under Lesson 2


3) Observational Studies and simple ways of adjusting for covariates


### 4) Propensity Score Approaches – Introduction


available as gelman.hill.reiter.draft.ObservationalStudies2.pdf on Classes


Rosenbaum, PR and D B. Rubin (1985) "Constructing a control group using multivariate matched sampling methods that incorporate the propensity score", *The American Statistician, 39*: 33-38 [Available at www.jstor.org]


### 5) Propensity Score Approaches – Practice (Stata)

Guo and Fraser, Chapter 5, pp 127-149, 154-158, 161-162, 167-186  
Chapter 5 available on Classes under Lesson 4


[Available through e-journals]


6) Instrumental Variables Models – Introduction and Theory

Gelman, A., Hill, J. and Reiter, J. (2013) Draft Chapter “Observational Studies that Relax or Extend the Ignorability Assumption” for *Regression and Other Stories*, to be published by Cambridge University Press in 2014, section on instrumental variables available as gelman.hill.reiter.draft.ObservationalStudies2.pdf on Classes


7) Instrumental Variables Models – Practice (Stata)


*E. Michael Foster. (2000) “Is more better than less? An analysis of children’s mental health services” *Health Services Research*. Chicago: Vol. 35, Iss. 5; p. 1135

8) Regression Discontinuity


9) Difference in Differences/ Fixed Effects models


[available through e-journals]