

**Public Policy 712**  
**Causal Inference in Education Policy Research: K-12**

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Weill Hall, Room 5132

Course Meeting Time and Location:

M/W: 2:30-3:50pm  
Weill Hall 1220  
Office hours: TBD

**Overview**

This course covers a variety of statistical methods utilized in education policy research. The two primary goals of the course are (1) to provide students with the analytic framework and skills necessary to evaluate education (or other public) policies and (2) to familiarize students with the arguments and evidence relating to important K-12 education policies and/or interventions. The course will cover a variety of methodological techniques including randomized-control trials (RCT), panel data models and regression discontinuity analysis (RD).

**Prerequisites**

A strong foundation in introductory statistics (e.g., Stats 250, PP 529, SOE 793, or equivalent) and regression analysis (e.g., Stats 413, PP 639, SOE 794 or 795, or equivalent) are required for this course. For those students who are interested, a good refresher for statistics and regression analysis can be found in: Stock and Watson, *Introduction to Econometrics* (syllabus references are to 3<sup>rd</sup> edition, but older editions contain virtually identical content).

**PubPol 712 vs. PubPol 571**

There is some overlap between the content of this course and PubPol 571 (Applied Econometrics). Both classes cover applied econometric methods at a level of depth beyond PubPol 639. Both classes require students to do exercises in Stata (or R) using “real” data sets. Both classes focus on the *application* of methods rather than the underlying theory.

However, there are also important differences between the courses. PubPol 571 is designed to be a general course in more advanced statistical methods. It covers a broad set of topics and draws examples from a variety of disciplines and policy domains. PubPol 712 is primarily a course on methods relevant for education policy research. This course covers a much narrower set of methodological techniques, but goes into each technique in greater depth. In addition, PubPol 712 covers a number of practical issues that arise in the context of applied research, including how to conduct power calculations and how to handle missing data.

Finally, PubPol 712 is designed to meet the requirements of the IES-funded pre-doctoral training grant at the University of Michigan. As such, the course will cover several topics that are not typically taught in this type of advanced methods course, including cost analysis, research-practice partnerships, and the role of descriptive analysis in policy research.

Both PubPol 571 and PubPol 712 assume a strong foundation in basic probability and statistics as well as applied regression analysis. As a general rule, we recommend this course for students who received a grade of A- or better in prerequisite courses. Students with less preparation should expect this course to be very challenging.

### **Course Requirements and Grading**

General Class Participation (15%) – Students are expected to attend class regularly and to have read the assigned material prior to class. Because this is a discussion-based course, the quality of the class will depend on whether students are prepared to talk about the readings each week.

Problem Sets (30%) – There will be 3 required problem sets for this course (10% each), each of which will have students using real data to do empirical exercises in Stata. Students are encouraged to work in small groups (max size 3) on the assignments, though each student is required to write up and submit his or her own version of the solutions. Students must indicate the other students with whom they worked at the top of the problem set. Note: Neither Stata nor R will be formally taught as part of this course. I will provide students with general guidance, including a variety of online materials to help them learn the commands necessary to complete the assignments, and will be available to answer questions in office hours. However, students should expect to do some learning of statistical programming languages on their own.

Online quizzes (15%) – There will be 3 short (roughly 30 minutes each) “open note” online quizzes for this course. These quizzes will test basic understanding of course material. Students typically will be given a 24-48 hour window of time to complete the quiz, which they will either complete on CANVAS or complete by hand and then upload to CANVAS.

#### Take-Home Final (40%)

The take-home will be distributed on the last day of class (Wednesday, December 8<sup>th</sup>) and will be due by 5pm on Wednesday, December 15<sup>th</sup>. The exam will resemble problem sets in that students will be provided datasets and will be asked to conduct analyses and interpret the results. On the final exam, however, students will not be told what statistical techniques to use, nor will they be given an existing paper to replicate. Rather, the exam will pose a causal education policy question and ask students to use whatever methods they deem appropriate to find the answer. Students will be required to discuss the method they chose, including any necessary assumptions and/or limitations of the method. They will write code to apply their chosen method, and create tables/figures to display the results. They will then briefly describe their findings, paying careful attention to discussing how one should (and should not) interpret the results, noting limitations and caveats as necessary.

Research Project Proposal (only required for IES pre-doctoral fellows)

Over the course of the year (encompassing both PubPol 712 and 713), students in the IES pre-doc training program are required to start an independent research project. This project can be the same project as the student is pursuing for other requirements of their program (e.g., the 3<sup>rd</sup> year paper that is required of students in the Economics PhD program). In 712, pre-doc students will produce a research project proposal, and start taking steps to begin the project. I will provide students more details during 1-on-1 meetings.

### Course Materials

Book chapters and journal articles, all of which will be available through CANVASS.

### Readings

There is no course packet. All articles are available online or on the CANVAS site. Assignments will be listed under the relevant lecture at least a week in advance. I typically provide links and/or PDFs but students are ultimately responsible for obtaining the readings. If a link is broken or a file corrupted, however, students need to find the article themselves.

The course will draw largely on this textbook, which students can access for free on the UM library.

- Murnane, R., & Willett, J. (2010). *Methods matter: improving causal inference in educational and social science research*. New York, NY: Oxford University Press, USA.

We will also reference several other textbooks, which are available online or we will put on Canvas.

- Imbens, Guido W. & Donald B. Rubin (2015). *Causal Inference for Statistics, Social, and Biomedical Sciences: An Introduction*. Cambridge University Press: New York, NY.
- Morgan, Stephen L. and Christopher Winship (2014). *Counterfactuals and Causal Inference*. Cambridge University Press.
- Stock and Watson, *Introduction to Econometrics*, Third Edition. (This is the textbook used in PubPol 639, and may be a good resource for students who want a refresher on some of this material.)
- Angrist, Joshua and Jorn-Steffen Pischke. *Mostly Harmless Econometrics*. (MHE)
- Angrist and Pischke. *Mastering 'Metrics* (an undergraduate version of MHE).

Please make sure to bring the readings to class, as we will reference them. As for reading strategy, for the more technical papers a good strategy is to read the abstract, intro, results,

conclusions, tables/figures first and see how many of the questions you can answer. Then go back and try to understand it a little bit better.

### **Software**

Students are welcome to use whatever programming language they prefer. Most students will choose Stata or R. Students are strongly encouraged to purchase and/or otherwise obtain whichever software they plan to use. R is free for download, and Stata is available for students very cheaply. Order through the Stata website. It is possible to access Stata from computer labs on campus. It may also be possible to access Stata via Virtual Sites. However, because we will use statistical software during class throughout the semester, it will be much easier for students to have a copy of the software on a computer they bring to class. Note: I will be able to provide instruction and guidance in Stata. However, my knowledge of R is very limited and my guidance for R users mostly will involve pointing them to other resources for assistance.

### **Material to bring to class**

Please bring copies of the readings to class, as well as any notes that are provided ahead of time. If you own a laptop, it would be useful to bring it to class – particularly on days we plan to work with data.

### **Academic Expectations & Resources**

Please read the information at the link below for important information on topics such as academic integrity, accommodations for students with disabilities, inclusivity and others. We expect students to be familiar with all of the expectations and resources described herein:

<http://fordschool.umich.edu/academics/expectations>