

**L32 5024 “Causal Inference”**  
**Fall 2013**  
**Professor Betsy Sinclair**  
**Department of Political Science**  
**Washington University in St Louis**  
**Email: [bsinclair@wustl.edu](mailto:bsinclair@wustl.edu)**  
**Course Meets Thursdays from 1:00-3:00 PM**  
**Office Hours: Monday 3:00-4:30 PM**

**Course Description:**

This course serves as an introduction to the tools by which political scientists draw causal inferences using quantitative data. There are two main goals of this course: to teach students to read, understand and criticize quantitative analysis in published and unpublished work and to provide them with the skills necessary to begin conducting their own analyses.

We will cover the fundamentals of how political scientists are able to draw causal inferences. To do so, we will review basic statistical inference. We will then discuss the types of inferences possible with different data-generating processes, including running laboratory experiments, running randomized field experiments, and collecting observational data.

There are no prerequisites for this class beyond approaching the material with an open and curious mind. Much of the material in this course is technical and a successful student in this course will spend a significant amount of time outside of class working through problem sets and becoming familiar with the necessary statistical software.

This syllabus is designed to provide an overview to the course. It is subject to change throughout the course, and students should consult the course website on a regular basis for updates.

**Course Readings:**

**Required Texts:**

- (1) Alan S. Gerber and Donald P. Green. 2012. *Field Experiments*. New York, Norton.
- (2) Betsy Sinclair. 2012. *The Social Citizen*. Chicago, Chicago University Press.
- (3) Paul R. Rosenbaum. 2010. *Design of Observational Studies*. New York, Springer.

**Optional Text:**

Morgan, Stephen L. and Christopher Winshop. 2007. *Counterfactuals and Causal Inference*. New York, Cambridge University Press.

Additional readings as necessary, all of which will be available on the Blackboard website and/or through JSTOR. The amount of reading varies dramatically from week to week, but you should plan on spending a minimum of five hours each week completing the reading alone, with additional time scheduled to complete your problem sets.

### **Strongly Recommended**

Either:

Verzani, John. 2005. *Using R for Introductory Statistics*. Boca Raton, FL: Chapman & Hall.

Or:

Acock, Alan C. 2008. *A Gentle Introduction to Stata*, 2<sup>nd</sup> Ed. Stata Press.

### **Grading:**

Grading will be based on eight homework exercises (50 points each), a daily quiz (5 points each) and a final prospectus/paper/poster presentation (50 points/500 points/50 points). Exercises will be due one week from being assigned (that is, they will be assigned on Thursday and due the following Thursday). Homework exercises will generally involve mathematical problems as well as analysis and discussion/interpretation of actual data, using statistical computer software (see below). Feel free to work on the assignments in groups, but you must write up all assignments individually.

Your 10-page final paper will provide you with an opportunity to analyze and interpret data on a topic of your choosing. You will prepare a prospectus for this project and present it verbally to your classmates to receive feedback. On the last day of the course, you will present a poster with your findings consistent with general conference standards. Details for the final project will be announced in class.

All homework exercises and the final paper must be submitted as hard (paper) copies. In the exceptional circumstance that you need to submit something electronically, **only PDF files will be accepted**, without exception. If you do not know how to make a PDF file, now is the time to learn.

Assignments are due on the dates indicated in the timetable below, at the **beginning** of class. Late assignments will be penalized grade-wise as described in the next section.

**NOTE THAT YOUR FINAL PAPER AND YOUR FINAL POSTER MUST BE TURNED IN AT THE BEGINNING OF THE LAST CLASS MEETING.**

If there is a dispute with respect to your grade, you will need to submit your complaint in writing, with the original assignment attached, to my mailbox. I will respond in writing. If you disagree with my comments, please come to see me in office hours. No

discussions of grades will be conducted during, before or after class periods whatsoever, no exceptions.

Late assignments and final papers will be penalized a half-grade for every day of lateness. In the case of a last-minute emergency, grades may be calculated on the basis of the remaining assignments at the discretion of the professor.

### **Software:**

You are welcome to make use of whatever statistical software to choose to complete the homework exercises, so long as the manner by which your results are generated and conclusions reached are transparent. However, due to the limits of instructor time and patience, I will support only two software packages. These two packages are Stata and R. Stata is probably the most widely used statistical package in the social sciences. Stata is commercial software, while R is free and open source. Unlike Stata, R is an object-orientated language. Your instructor does not have a formally stated preference for either Stata or R. Stata has a far flatter learning curve than R, but R is far more flexible and powerful and will likely be more useful to you in the long run.

One final recommendation is that you learn to use LATEX now, while you have the time. You will be glad you did.

### **Daily Class Structure:**

This course meets on Thursdays from 1:00 PM until 3:00 PM. It is essential that you attend all class meetings as the material is cumulative.

The structure of our weekly meeting will be the same for each individual class period. Each class meeting will focus on active, serious learning. This means that you will need to stand up in front of your classmates and work through problems or respond to questions. You will sometimes make mistakes. These mistakes are a key component of the learning process.

Readings should be completed prior to coming to class on the assigned day. Some of this material will include sample problems or exercises in the text. These you should work through as you read the material and not skip. Also, you should make sure to commit the definitions to memory. At first these definitions may seem obvious, but you want to be assured that you understand their exact statement. This is because future definitions will make very small adjustments in their statements but have very large implications (for example, the population mean vs the sample mean).

Turn in your weekly homework at the beginning of class. You will spend the first ten minutes of each class period taking a quiz on the assigned readings.

We will then spend some fraction of the class period in lecture on the particular topic of the day. All slides presented in class will also be posted on the chalk website. We will

spend the remaining class time doing something interactive. This will often consist of playing a game or having a discussion. These games are designed to allow you to engage deeper with the material and hopefully to feel more comfortable using the techniques we study each week. You should also begin to think about your final projects; ideally these are a component of your larger research agenda.

### **A Few Other Notes:**

Extra credit can be earned via successful completion of the pre-test and post-test administered on the first and last days of the course. Please take this exam seriously.

The homework will take several hours to complete each week. **Start early.** If you have a question, ask your classmates for help. It is important that you struggle with this material. Those struggles will help you remember and understand these concepts.

### **On Academic Integrity:**

Academic honesty is at the very core of a university's mission of research, teaching, and learning. We cannot grow and develop as scholars and citizens of this community without honoring a commitment to generate original work and to appropriately cite the work of others. Any case of academic dishonesty in this course will be referred to the University Judicial Board. All violations of academic integrity will be treated extremely seriously.

### **Course Website**

The syllabus, readings, and requirements will be adjusted as the course progresses. Throughout the course I will periodically add journal articles to each week's reading. Each of these articles I will post on our course website.

**\*\*\* Every student is required to check the course website for updates to this syllabus before doing any reading or assignment \*\*\***

### **Course Timetable**

All the readings listed below are required unless otherwise noted.

Date	Topic	Readings	Assignments & Notes
Week One (August 29)	No Class (APSA)	None	None
Week Two (Sept 5)	Introduction to Causal Inference	None	Pre-test
Week Three (Sept 12)	Cause and Effect	Gerber and Green, pg 1-46. Rosenbaum pg 3-18. Sinclair pg 1-43.	Last day to drop this course is September 11 <sup>th</sup> . Quiz 1. HW1 due.

			September 11 <sup>th</sup> .
Week Four (Sept 19)	Field Experiments and Hypothesis Testing	Rosenbaum pg 21-61. Gerber and Green pg 51-94. Sinclair pg 43-76.	Last day to change a grade to P/F is September 16 <sup>th</sup> . Quiz 2. HW2 due.
Week Five (Sept 26)	Noncompliance and Covariates	Gerber and Green, Chapter 4 and 5.	Quiz 3. HW 3 due.
Week Six (Oct 3)	Field Experiment Problems	Gerber and Green, Chapters 6-8	Quiz 4. HW 4 due.
Week Seven (Oct 10)	Observational Studies and Their Problems	Rosenbaum Chapter 3	Mid-term course evaluations (optional). Quiz 5. HW 5 due.
Week Eight (Oct 17)	Instrumental Variables and Other Options	Rosenbaum Chapters 4-6	Quiz 6. HW 6 due.
Week Nine (Oct 24)	Matching, Part I	Rosenbaum Chapters 7, 8, 9 and 13. Sinclair pg 77-114.	Quiz 7. HW 7 due.
Week Ten (Oct 31)	Matching, Part II	Rosenbaum Chapter 14	Quiz 8. HW 8 due.
Week Eleven (Nov 7)	Survey experiments	TBA	Quiz 9. Prospectus due.
Week Twelve (Nov 14)	Laboratory experiments	TBA	Last day to change back to a letter grade from P/F is November 15 <sup>th</sup> . Quiz 10.
Week Thirteen (Nov 21)	Overview: Causal Inference	None	Post-test
Week Fourteen (Nov 28)	No class	None	None
Week Fifteen (Dec 5)	Poster presentation	None	Posters and final papers due