Public Policy 621: Advanced Quantitative Methods

Professor: Todd Pugatch

Class meetings: Monday 10-11:50am GILK 100
Wednesday 10-11am MCC 130 (lab session)
Wednesday 11-11:50am GILK 100

Prerequisites: ECON 524 (Econometrics) or equivalent

Course Credits: 4 credits. This course combines approximately 30 hours of lecture and 10 hours of laboratory for 4 credits.

Grading Mode: A-F

Campus Location: Corvallis, OR

Office: BALE 311

Email: todd.pugatch@oregonstate.edu

Phone: (541) 737-6628

Office hours: M 12-1:30pm
W 4-5pm
Th 4-5pm (virtual office hours on Canvas Chat and Skype [tpugatch])

Textbooks: Required
Verbeek, Marno. A Guide to Modern Econometrics (4th Edition). Wiley, 2012. (Earlier editions are permissible for use in the class, but I will not provide support to translate page or problem numbers or substantive differences between editions.)

The software program STATA (Version 10 or later) is also required, but available for free use through RemoteApps or on the Economics Lab computers.

Optional but recommended


Additional readings will be provided as necessary.

**Course Description**

This is a Ph.D.-level course in Advanced Quantitative Methods used in research in the social sciences. The focus of the course is the theory and application of methods for causal inference in public policy contexts. We will explore the causes and consequences of selection on observable and unobservable characteristics in quantitative analysis, including how such selection can impede attempts to infer causality. We will learn several methods used at the frontier of research to estimate the causal effect of policies on outcomes, including instrumental variables, regression discontinuity, and difference-in-differences estimation. We will also learn methods for conducting statistical inference when using these techniques and how to assess the appropriateness of their underlying assumptions in specific scenarios.

**Student Learning Outcomes**

By the end of the course, students should be able to:

- Explain the statistical properties of linear regression estimators.
- Recognize and interpret the conditions under which linear regression estimators possess desirable properties.
- Explain the consequences of the violation of assumptions underlying the statistical properties of linear regression estimators.
- Explain and interpret the concepts of selection on observables and selection on unobservables.
- Apply leading quantitative methods for causal inference in the presence of selection on observables or unobservables.
- Recognize and apply appropriate estimators for causal inference based on a variety of data structures and data-generating processes.
- Compare the advantages and disadvantages of alternative estimation techniques in particular research contexts.

**Course Requirements**

Requirements for PPOL 621 include a midterm exam, a comprehensive final exam, and 6 homework/lab assignments. A seventh homework will be assigned but not graded; it will serve as useful preparation for the final exam. Among the six graded homework assignments, the lowest score will not count towards the final grade. Final grades will be assigned according to a curve of the total points. There is no extra credit work available. The course requirements and weights for each requirement as a component in the total score are listed below.
### Exams

Exams will consist of short essay questions requiring verbal answers, graphs, and numerical derivations. Computer programming will not be tested, but you are expected to be able to explain and interpret computer output. Make-up exams will be given only with the instructor’s permission. If you miss the midterm, the final will count double. In compliance with university policy, if you miss the final without my approval, you will receive a score of zero on the final.

### Homework and Lab Assignments

Homework assignments will have analytical problems, computer work, and questions related to the results of the computer work. You will be using the software package Stata to obtain estimates. Please submit the output with each assignment. Due dates will be announced in class. Late assignments will be penalized at a rate of 50% of available points per calendar day late (i.e., the max score on an assignment submitted one day late is 50%, and assignments two or more days late receive no points).

### Additional Readings

In addition to the textbook, you will be responsible for additional readings from the academic literature which illustrate the quantitative techniques learned in class. These readings will be assigned weekly and posted on Blackboard. We will discuss the readings during a portion of the weekly lab session. Concepts introduced in the readings are fair game for problem set and exam questions.

### Note on textbooks

There are many introductory graduate texts in quantitative methods that cover the same material we will learn in this class. Among the most relevant are Greene, *Econometric Analysis*; Cameron and Trivedi, *Microeconometrics*; and Wooldridge, *Econometric Analysis of Cross Section and Panel Data*. Undergraduate texts like Wooldridge, *Introductory Econometrics* and Stock and Watson, *Introduction to Econometrics* can also be useful resources. Angrist and Pischke’s *Mastering ‘Metrics* is useful for understanding the more sophisticated analysis of *Mostly Harmless Econometrics*. Simon and Blume’s *Mathematics for Economists* is an excellent treatment of some of the mathematical concepts required for success in the course, and there are of course many resources to brush up on basic mathematics and statistics. You are encouraged to use other texts as supplements to the listed texts, as you may find that reading the material from other authors can help clarify difficult concepts. In addition to the textbook treatments, you may find Kennedy, *A Guide to Econometrics* useful, because it discusses quantitative methods in largely non-technical fashion and is intended as a supplement to traditional textbooks.
Learning Stata

Learning how to use Stata and improving your programming skills will serve you well in this class and beyond. There are a number of guides to using Stata, including Acock, *A Gentle Introduction to Stata* and Baum, *An Introduction to Modern Econometrics Using Stata*, which you might find useful. Cameron and Trivedi, *Microeconometrics Using Stata* covers more advanced topics. The web has many free resources. Among the best are:

http://data.princeton.edu/stata/
http://www.ats.ucla.edu/stat/stata/
http://www.stata.com/links/resources1.html

Academic Dishonesty

Plagiarism, fabrication, cheating, and facilitating the academic dishonesty of others are serious offenses and may be punished by failure on the exam or paper, failure in the course, and/or expulsion from the university. Collaboration is allowed on homework problems and computer work, but homework must be written up independently. Jointly written homework assignments will receive zero points. Refer to the Schedule of Classes and http://oregonstate.edu/studentconduct/http://oregonstate.edu/studentconduct/code/index.php for more information.

Disruptive Behavior

Behaviors that are disruptive to teaching and learning will not be tolerated, and will be referred to the Student Conduct Program for disciplinary action. Behaviors that create a hostile, offensive or intimidating environment based on gender, race, ethnicity, color, religion, age, disability, marital status or sexual orientation will be referred to the Affirmative Action Office.

Disabilities

Accommodations are collaborative efforts between students, faculty and Disability Access Services (DAS). Students with accommodations approved through DAS are responsible for contacting the faculty member in charge of the course prior to or during the first week of the term to discuss accommodations. Students who believe they are eligible for accommodations but who have not yet obtained approval through DAS should contact DAS immediately at (541) 737-4098.
Course Outline

The following outline is tentative and subject to change. Readings are drawn from Verbeek (V), Angrist and Pischke (A&P), Morgan and Winship (M&W), Bazen (B), and Simon & Blume (S&B). Additional readings will be announced in class. Problem set due dates will be announced in class.

<table>
<thead>
<tr>
<th>Week</th>
<th>Date(s)</th>
<th>Topics</th>
<th>Reading</th>
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<tbody>
<tr>
<td>1</td>
<td>January 4-6</td>
<td>Math and Stats Tools</td>
<td>(S&amp;B) 2.2-2.4, 14.1, 3.5, 8.1-8.2, 8.4; (V) Appendix A</td>
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<tr>
<td>2</td>
<td>January 11-13</td>
<td>Treatment Effects and Linear Regression</td>
<td>(A&amp;P) Ch. 2, (V) Ch. 2</td>
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<td></td>
<td>January 18</td>
<td>MLK DAY, NO CLASS</td>
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<td>3</td>
<td>January 20</td>
<td>Linear Regression: Mechanics</td>
<td>(V) Ch. 2-4</td>
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<td>4</td>
<td>January 25-27</td>
<td>Linear Regression: Properties</td>
<td>(V) Ch. 2-4</td>
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<td>5</td>
<td>February 1-3</td>
<td>Linear Regression: Inference</td>
<td>(V) Ch. 2-4</td>
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<td>February 3</td>
<td>MIDTERM</td>
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<td>6</td>
<td>February 8-10</td>
<td>Instrumental Variables</td>
<td>(V) Ch. 5, (A&amp;P) Ch. 4</td>
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<td>7</td>
<td>February 15-17</td>
<td>Instrumental Variables</td>
<td>(V) Ch. 5, (A&amp;P) Ch. 4</td>
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<td>8</td>
<td>February 22-24</td>
<td>Regression Discontinuity</td>
<td>(A&amp;P) Ch. 6</td>
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<td>9</td>
<td>February 29-</td>
<td>Selection Models</td>
<td>(B) Ch. 4</td>
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<td>March 2</td>
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<td>10</td>
<td>March 7-9</td>
<td>Difference in Differences</td>
<td>(A&amp;P) Ch. 5, (V) Ch. 10</td>
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<td>March 15</td>
<td>FINAL EXAM, 9-11:20am</td>
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Supplemental Readings

We will discuss the following supplemental readings in lab during the week we cover each topic.


