90-906: Introduction to Econometric Theory

Professor Edson Severnini
Carnegie Mellon University
Spring 2017, Heinz College
MW, 4:30-5:50pm, HBH 1006

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HBH 2212
412-268-2329
Teaching Assistant: Britta Glennon (bglennon@andrew.cmu.edu)

Email Policy and Office Hours
Please email me only if my answer is expected to be a few words or sentences, and include “Econometrics - Spring 2017” on the subject. I will get back to you within 24 hours on weekdays, and 48 hours on weekends. That said, I prefer talking to you in person during my office hours, which will be held on Wednesdays, 2:50-4:20pm. The TA’s office hours will be posted on Blackboard. You may also ask questions in the TA’s recitations, which you are required to attend.

Course Description
Empirical research is most valuable when it uses data to answer specific causal questions, as if in a randomized clinical trial. In the absence of a real experiment, we look for well-controlled comparisons and/or natural quasi-experiments. Some research designs are more convincing than others, but the econometric methods behind them are almost always fairly simple. This course provides an introduction to the most important items in an applied econometrician’s toolkit: (i) regression models designed to control for variables that may mask the causal effects of interest; (ii) instrumental variables methods for the analysis of real and natural experiments; and (iii) difference-in-differences-type strategies that use repeated observations to control for unobserved omitted factors. In this course, emphasis will be given to conceptual issues and simple statistical techniques that turn up in the applied research we read and do. Many empirical examples will illustrate these ideas and techniques.

Prerequisite
90-905: Statistical Theory for Social and Policy Research (or equivalent)
The main prerequisite for this course is basic training in probability and statistics. Students should be comfortable with the elementary tools of statistical inference, such as t-statistics and standard errors. Familiarity with fundamental probability concepts such as mathematical expectation in also helpful, but extraordinary mathematical sophistication is not required.

Course Objectives
Upon successful completion of this course, you should be able to:
1. Understand the key elements of regression analysis.
2. Use the core methods in today’s econometric toolkit in empirical analysis – e.g., linear regression for statistical control, instrumental variable methods for the analysis of real and natural experiments, and difference-and-difference methods that exploit policy changes.
**Student Audience**
Within the Heinz College, 90-906 is appropriate for first-year PhD students plus first and second year Masters students who desire and are prepared for a rigorous course in econometrics as a base for more advanced research methodology. Outside the Heinz school, 90-906 may be of interest to graduate students in Engineering and Public Policy, Social and Decision Science, Software Engineering, Psychology, GSIA, Philosophy, Applied History, or Architecture who need background in econometrics targeted toward social and policy research.

**Course Web Page**
I plan to post slides, readings, homework, and announcements on Blackboard: http://www.cmu.edu/blackboard

**Textbooks**

In case you are not familiar with the software to be used in the course – STATA –, you should acquire a third book that provides detailed instructions on how to work with the software as well as the econometric theory behind the commands. The book is *Microeconometrics Using Stata (Revised Edition)*, by A. Colin Cameron and Pravin K. Trivedi.

**Grading Scheme**
Students are expected to attend and actively participate in class, complete assignments (reading, homework problems, etc.), present a published paper and prepare a problem set based on it, and take examinations. You are all expected to attend recitations, and office hours as needed. There will be bi-weekly assignments, and two mid-term exams.

The final grade will be determined by a formula chosen by each student subject to the following constraints:

<table>
<thead>
<tr>
<th>Grade Components</th>
<th>Range</th>
<th>Default</th>
</tr>
</thead>
<tbody>
<tr>
<td>Class participation</td>
<td>5-10%</td>
<td>5%</td>
</tr>
<tr>
<td>Assignments</td>
<td>15-25%</td>
<td>20%</td>
</tr>
<tr>
<td>Mid-Exam 1</td>
<td>20-30%</td>
<td>25%</td>
</tr>
<tr>
<td>Mid-Exam 2</td>
<td>20-30%</td>
<td>25%</td>
</tr>
<tr>
<td>Presentation</td>
<td>20-30%</td>
<td>25%</td>
</tr>
<tr>
<td>Total</td>
<td>100%</td>
<td>100%</td>
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The total of the percentages allocated by the student must total 100%. This allocation is intended to provide flexibility in the way a student demonstrates mastery of the course material. If no choice is made, grading will be by the default weights.
**Paper Presentation**

During the semester, each group of students is required to present a published paper, and prepare a problem set based on it. The presentation should provide the motivation for the study, data description with background and summary statistics, the econometric model used in the empirical analysis, the main findings, and a critique of the paper. The analytical discussion should focus on identification and causality issues.

The problem set should have at least four questions: two theoretical questions on the method used on the study, a question on the interpretation of the tables and figures in the paper, possibly highlighting identification issues, and a question using data from the study that replicates the main results. You must provide suggested solutions. If you do not find the dataset in the website of the journal where the paper was published, reach out to the authors to get it. The problems at the end of each chapter of the Wooldridge’s book should provide good guidance on formulating these questions. The theoretical questions can be actually extracted from any book or online sources (please cite the source).

The presentation slides and the problem sets should be posted on Blackboard at least three hours before class in the day of the presentation. Please send them to the TA, who will upload them on Blackboard. A week before the presentation, please come to my office hours to show me a draft of the slides and the problem set. I will make comments/suggestions on how to improve them.

**Regrade Policy**

If you feel that a regrade request is justified, please write down the reasons on a separate page, print it and staple it to the front of your exam/assignment, and bring it to me or the TA in class. If you like to use your old exams/assignments to study for the next exam, make a copy for yourself before handing them in. Deadline for regrades is one week after the return of the exams/assignments, unless a different date is announced in class. Late requests will not be considered.

If there was an arithmetic error in adding up points on your exam/assignment, let us know right away, and we will record the correct grade. This doesn't constitute a regrade request. Just write a brief note on the cover sheet and give the exam/assignment to me or the TA.

**Cheating & Plagiarism**

Students are expected to honor the letter and the spirit of the Carnegie Mellon University Policy on Cheating and Plagiarism. All activities cited in that policy will be treated as cheating in this course. Students are expected to familiarize themselves with this policy. Students are also encouraged to review the Carnegie Mellon University Academic Disciplinary Actions Overview for Graduate Students, which details penalties and sanctions, as well as students’ rights. I will take a zero-tolerance policy on cheating and plagiarism and will consult with Departmental leadership on appropriate action for all instances of cheating and plagiarism. As the aforementioned policies indicate, penalties can include course failure, suspension, and dismissal from the program.

-- Carnegie Mellon University Policy on Cheating and Plagiarism
http://www.cmu.edu/policies/documents/Cheating.html

-- Carnegie Mellon University Academic Disciplinary Actions Overview for Graduate Students
http://www.cmu.edu/policies/documents/GradDisc.html

**Personal Accommodations**

Students with disabilities: If you wish to request an accommodation due to a documented disability, please inform me and contact Disability Resources as soon as possible. They can be reached at access@andrew.cmu.edu or (412) 268-2013.
Topics

1. Regression Analysis – Cross Section and Panel Data (5 weeks)

Examples:


Optional additional readings:


2. Randomized Controlled Trial (1 week)

Examples:

Optional additional readings:


3. Difference in Differences (3 weeks)

*Examples:*


Optional additional readings:


4. Instrumental Variables (2 weeks)

*Examples:*


Optional additional reading:


5. Regression Discontinuity Design (3 weeks)

*Examples:*


Optional additional readings:


