Spring 2019: Tuesday and Thursday 9:30 – 10:50 am @Harris 0021

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Course Description

The goal of this course is for students to learn a set of statistical tools and research designs that are useful in conducting high-quality empirical research on topics in applied microeconomics and related fields. Since most applied economic research examines questions with direct policy implications, this course will focus on methods for estimating causal effects. This course differs from many other econometrics courses in that it is oriented towards applied practitioners rather than future econometricians. It therefore emphasizes research design (relative to statistical technique) and applications (relative to theoretical proofs), though it covers some of each.

Prerequisites

- PPHA420 (Applied Econometrics I) is the prerequisite for this course. Students should be familiar with PhD-level probability and statistics, matrix algebra, and the classical linear regression model at the level of PPHA420. In the Economics department, the equivalent level of preparation would be the 1st year Ph.D. econometrics coursework.

- In general, I do not recommend taking this course if you have not taken PPHA420 or a Ph.D. level econometrics coursework. This course is a core course for Ph.D. students and MACRM students at Harris School. Therefore, although the course name
is Applied Econometrics, we'll cover a lot of theoretical econometrics with intensive math. Your problem sets and exams will be based on these materials.

- Because this is a core course for PhD students, all students including master's students and undergraduates will be graded in the same way as PhD students

- In the past, many non-PhD students who did not have the prerequisite took my course anyway and ended up dropping out or getting low grades. So, please carefully read this syllabus before you take this course

**No electric device policy:**

I ask you not to use electric devices, including laptops, phones, and smart pads in class. Please seek permission from the instructor if you need to use an electric device for a special reason (e.g. a medical reason).

**Assignments and Grading**

There will be four problem sets during the course.

- Students can work as a group
- However, each student must submit his/her problem set individually
- Answers have to be typed (handwriting will not be accepted)
- Please submit 1) the main part of your answers including properly formatted tables and figures supporting your answers and 2) an appendix that includes program files and log files from your statistical programs
- Re-grading policy: Instructor (not TAs) will handle re-grading. Note that when I re-grade, I do that for your entire problem set so that there is a chance that your total grade gets lower compared to the grading done by TAs.
- Problem sets are due in class as specified in the schedule below. Late problem sets will incur a penalty of 50% of the total points per day except for medical reasons (with a doctor’s official note submitted to instructor).

There will be a final exam (in-class, closed book, one-page cheat sheet). There will be no make-up exams. Course grades will be based on the problem sets (40%) and a final exam (60%).

**Statistical Software**

You may use any software that you wish, but solutions for problem sets will be handed out in Stata. Demonstrations during lectures will also be conducted in Stata.
Course Schedule (subject to change)

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<th>Date</th>
<th>Topic</th>
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<td>4/2</td>
<td>Randomized Controlled Trials</td>
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<td>Randomized Controlled Trials</td>
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<td>Regression Discontinuity Design</td>
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<td>4/11</td>
<td>Regression Discontinuity Design</td>
<td>Problem Set #1 due</td>
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<td>4/16</td>
<td>Advanced Topics in IV, LATE, MTE</td>
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<td>4/18</td>
<td>Advanced Topics in IV, LATE, MTE</td>
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<td>4/23</td>
<td>Selection on Observables and Lalonde’s Critique</td>
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<td>4/25</td>
<td>Matching</td>
<td>Problem Set #2 due</td>
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<td>4/30</td>
<td>Matching</td>
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<tr>
<td>5/2</td>
<td>DID, Fixed Effects, Synthetic Controls</td>
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<td>5/7</td>
<td>DID, Fixed Effects, Synthetic Controls</td>
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<td>5/9</td>
<td>Clustering and Bootstrapping Standard Errors</td>
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<td>Introduction to Maximum Likelihood Estimation</td>
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<td>5/16</td>
<td>Limited Dependent Variables</td>
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<td>Discrete Choice Methods with Individual Data</td>
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<td>5/23</td>
<td>Introduction to GMM</td>
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<td>Discrete Choice with Aggregated Data (BLP)</td>
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<tr>
<td>5/30</td>
<td>Discrete Choice with Aggregated Data (BLP)</td>
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<td>6/4</td>
<td>Numerical Optimization Methods</td>
<td>Problem Set #5 due</td>
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<td>6/13</td>
<td><strong>Final exam</strong> (3 hours), 11 am -2 pm, Keller 0021</td>
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Textbooks and Notes

The main materials for this course will be my lecture slides, two textbooks: 1) the econometrics notes at NBER econometrics courses written by Imbens and Wooldridg [WNE] and 2) the econometrics textbook by Cameron and Trivedi [CT], and several academic papers listed below.

In addition, Angrist and Pischke [AP] provide intuitive, practical, and less mathematical explanations for some topics. Woodridge [JW] is at the same level of WNE and CT. For each topic, I reference chapters from these sources.

For discrete choice methods with individual data, the best textbook is Kenneth Train [KT]. We use its relevant chapters later in the course.

• [WNE] Imbens, Guido and Jeffrejy Wooldridge (2007). What’s New In Econometrics, NBER Summer Course.


References to each topic

Econometrics is hard, but I personally found that repeated learning is very helpful. For this reason, please do required readings before you come to class. Ask your questions in class. Then, read the relevant chapters and papers again after class. This process helps you to master the knowledge.

** The main textbook-style materials for each topic (required readings)
* Other references that I use for the topic
# Further readings for the topic, including more theoretical materials

1. Causality

** WNE Lecture 1, Section 2.

** AP Chapters 1 - 2.

# CT Chapter 2.


2. RCT

** Sections 1,2,4,5,6 in:


3. Regression Discontinuity Designs


** WNE Lecture 3.

CT Chapter 25.6.

* AP Chapter 6.


4. Advanced Topics in Instrumental Variables
A. The IV Estimator

** CT Chapter 4.8.

** AP Chapter 4.1 - 4.3.

JW Chapter 5.


B. Heterogeneous Treatment Effects

** CT Chapter 25.7. ** AP Chapter 4.4 - 4.5.

** WNE Lecture 5.

JW Chapter18.4.


C. 2SLS and Weak Instruments

** CT Chapter 4.9.

**AP Chapter 4.6.

* WNE Lecture 13.


D. Marginal Treatment Effects (MTE)


5. Selection on Observables, Lalonde’s Critique, Matching, Propensity Score Matching

** CT Chapter 25.

** AP Chapter 3.

** WNE Lecture 1.


5. DID, Fixed Effects, Synthetic Controls

** WNE Lecture 10.

** CT Chapter 25.

** AP Chapter 5.


6. Clustering and Bootstrapping Standard Errors

** CT Chapter 24.5.

** AP Chapter 8.2.


** CT Chapter 11.


7. Maximum likelihood Estimation

A. Introduction to Maximum likelihood Estimation

** CT Chapters 5.1 - 5.3, 5.6, 5.7

JW Chapter 13.

B. Limited Dependent Variables Models

** CT Chapters 14.1 - 14.5, 16

JW Chapter 15, 16.


C. Multinomial Discrete Choice (Discrete Choice with Individual Data)

** CT Chapter 15.

** WNE Lecture 11.

JW Chapter 15.9.

** KT Chapters 1, 2, 3, 5

8. Generalized Method of Moments

** CT Chapter 6.

** WNE Lecture 15.

9. Numerical Optimization Methods

** CT Chapter 10

** KT Chapter 8