

# Topics in Econometrics\*

José-Luis Montiel-Olea

NYU-Spring 2015

**Course Description:** This course will provide a 12-week to introduction to *causal* analysis in *modern* econometrics. The course will focus on five econometric methods: random assignment, linear regression, instrumental variables, regression discontinuity designs, and differences-in-differences.

**Prerequisite:** ECON-UA 18 or (STAT-UB 103 and ECON-UA 10) or ECON-UB 10 or (ECON-UB 1 and ECON-UA 12) or ECON-UA 12 or (ECON-UB 11 and ECON-UB 9010 and ECON-UA 9012). All with a minimum grade of C.

**Background:** I will try to make the course self-contained. You should be familiar with basic concepts in probability theory and statistical inference.

**Textbook:** “*Mastering ‘Metrics, the Path from Cause to Effect*”, by Joshua D. Angrist and Jörn Steffen Pischke, 1st Edition.

- I will prepare slides for each lecture. The slides will make reference to the book, but sometimes I will introduce my own notation/motivation for each topic discussed. During the first 4 weeks of the course I will do a review on probability and statistics based on my own materials.

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\*First version: January 27th, 2015. This version: January 27, 2015

**Laboratory Sessions:** There will be weekly “lab” sessions. You must register for lecture and for the lab session separately.

**Problem Sets:** You will receive a problem set each Thursday due at the end of class on Tuesday of the following week. All late homework will be assigned a grade of 0/10.

**Grading:** Your grade will be based upon participation in lecture (20%), the weekly problem sets (20%), a midterm (40%) and a final paper with a 10 page limit (20%). Your two lowest grades in the problem sets will not count towards the final grade of the course.

**Grading Policy in the Econ Department:** The Economics Department has agreed to coordinate grading practices in the interest of fairness to students and to avoid non-intellectual incentives to take or avoid courses. We have asked all teachers of courses to conform approximately to the following distribution. Deviation of plus or minus five percentage points is considered within the normal bounds:

A 29%  
B 40%  
C 22%  
D 5%  
F 5%

Whatever the marking procedure, the distribution of final grades for large classes should fall reasonably closely to the curve described above, unless you can justify the difference.

All other instructors should recognize that with smaller class sizes, and especially because of self-selection, the distribution of grades within a particular small elective class can differ widely from the above recommendations. You will have to use your judgment. If in doubt, discuss the matter with the Director of Undergraduate Students.

**Out of class collaboration:** You are encouraged to work in groups for all the problem sets, but each student must turn in an individual problem set with his/her own solutions.

**Midterm Exam and Final Presentation:** The midterm examination will be held on Thursday, March 24th (after spring break). The final paper is due on Tuesday, May 5th.<sup>1</sup> I will only consider out-of-schedule examinations under the following cases:

- a) A documented medical excuse.
- b) A university sponsored event such as an athletic tournament, a play, or a musical performance. In this case, please have your coach, conductor, or other faculty adviser contact the teacher assistant (TA) of this course. Athletic practices and rehearsals do not fall into this category.
- c) A religious holiday.
- d) Extreme hardship as a family emergency.

If you require additional accommodations as determined by the Center for Student Disabilities, please let the TA of the course know as soon as possible.

**E-mail Policy:** I will only read your e-mails on Tuesday and Thursday from 630pm to 730pm, and I commit to reply between 630pm to 830pm. You should send e-mails to the TAs before contacting me.

**Office hours:** I will hold office hours only by appointment. You should contact the TAs before contacting me.

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<sup>1</sup>Time permitting, I will ask some students to give a 10 minute presentation of their papers.

## Course Outline for the First Eight Weeks (Tentative)

### 1. PROBABILITY THEORY (4 lectures/2 weeks)

- *Lecture 1-2:*

- 1) Basic Definitions: Real-Valued Random Variables, Probability Space, Sample Space, Distribution Function of a Real-valued Random Variable.
- 2) Real-valued Random Variables with Discrete Distributions and the Probability Mass Function (p.m.f.).

- *Lecture 3-4:*

- 1) Multivariate Distributions: Bivariate Bernoulli Distribution as a simple example. Vector of Means and Covariance Matrix. Bivariate Normal Distribution.
- 2) Independence of Random Variables. Useful characterizations of Independence.
- 3) Transformations of Random Variables.
  
- 4) Expectation, Conditional Expectation and the Law of Iterated Expectations.

### 2. MATHEMATICAL STATISTICS (4 lectures/2 weeks)

- *Lecture 5-6:* Elements of a finite-sample statistical inference problem.
- *Lecture 7-8:* Testing Statistical Hypothesis.

### 3. ANGRIST AND PISCHKE'S FURIOUS FIVE:

- 1) Random Assignment ( 4 lectures/2 weeks)
- 2) Regression ( 4 lectures/2 weeks)
- 3) Instrumental Variables ( 2 lectures/1 week)
- 4) Regression Discontinuity ( 4 lectures/2 weeks)
- 5) Difference-in-Differences ( 2 lectures/1 week)

**Class Schedule:** We will meet Tuesday and Thursday from 4.55 PM - 6.10 PM at MEYR 121. Our last lecture will be on May 5th.