THE UNIVERSITY OF CHICAGO

THE HARRIS SCHOOL OF PUBLIC POLICY

PPHA 42100:
APPLIED ECONOMETRICS II

Spring 2018: Mondays and Wednesdays 1:30 – 2:50 pm @Harris 289A

Instructor: Professor Koichiro Ito
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Office hours: Monday 11-noon

TA: Valerie Michelman: vmichelman@uchicago.edu
Office hours: Friday 9:30-10:30am (room 171)

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

PPHA42000 (Applied Econometrics I) is the prerequisite for this course. Students should be familiar with graduate school 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. Those who are not in the Harris Ph.D. program, the MACRM program, or the economics Ph.D. program need permission from the instructor to take the 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

I will assign 4 problem sets during the course. I highly encourage you to work as a group up of up to 4 students. You can work as a group, but each student must submit his/her problem set individually.

To make our TA's life easier, I also ask everyone to type answers (except for math equations if you prefer handwriting, but please write very clearly otherwise the TA may not be able to grade your math equations).

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) and family emergencies (contact instructor).

There will also a final exam (in-class, closed book, one-page cheat sheet). There will be no make-up exams.

Grades will be based on performance on problem sets (40%), final exam (50%), and class participation (10%).

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)

Date	Topic	Deadline
3/26	Causality	
3/28	Randomized Controlled Trials	
4/2	Randomized Controlled Trials	
4/4	Regression Discontinuity Design	
4/9	Regression Discontinuity Design	
4/11	Advanced Topics in IV, LATE, MTE	
4/16	Advanced Topics in IV, LATE, MTE	Problem Set #1 due
4/18	Selection on Observables and Lalonde's Critique	
4/23	Matching	
4/25	Matching	
4/30	DID, Fixed Effects, Synthetic Controls	
5/2	DID, Fixed Effects, Synthetic Controls	Problem Set #2 due
5/7	Clustering and Bootstrapping Standard Errors	
5/9	Introduction to Maximum Likelihood Estimation	
5/14	Limited dependent variables	
5/16	Discrete Choice Methods with Individual Data	Problem Set #3 due
5/21	Introduction to GMM	
5/23	BLP: Discrete Choice with Aggregated Data	
5/28	**Memorial day – No class**	
5/30	Numerical Optimization Methods	Problem Set #4 due
TBA	**Final exam** (3 hours)	

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 Woodridg [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 Jeffrey Wooldridge (2007). *What's New In Econometrics*, NBER Summer Course.

• [*CT*] Cameron, A. Colin and Pravin Trivedi (2005). *Micreconometrics: Methods and Applications*. Cambridge University Press.

• [J*W*] Wooldridge, Jeffrey (2002). *Econometric Analysis of Cross Section and Panel*
Data. MIT Press.

• [*AP*] Angrist, Joshua and Jorn-Steffen Pischke (2009). *Mostly Harmless Econometrics*. Princeton University Press.

• [*KT*] Train, Kenneth (2002). *Discrete Choice Model with Simulation.* Cambridge University Press. A copy is also available at: eml.berkeley.edu/books/**train**1201.pdf

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.

*Holland, Paul "Statistics and Causal Inference." *Journal of the American Statistical Association*, 1986, 81, 945–960.

*Rubin, Donald "Statistics and Causal Inference: Comment: Which Ifs Have Causal Answers?" *Journal of the American Statistical Association*, 1986, 81, 961–962.

Causal Inference for Statistics, Social, and Biomedical Sciences: An Introduction 1st Edition, by Guido W. Imbens, Donald B. Rubin (2015)

2. RCT

** Sections 1,2,4,5,6 in:
E. Duflo, R. Glennerster, and M. Kremer. Chapter 61 using randomization in development economics research: A toolkit. In T. Paul Schultz and John A. Strauss, editor, Handbook of Development Economics, volume Volume 4, pages 3895–3962. Elsevier, 2007.

* Julian Cristia, Ana Santiago, Santiago Cueto, Pablo Ibarraran, and Eugenio Severio "Technology and Child Development: Evidence from the One Laptop per Child Program" (February, 2012) IDB Working Paper Series 304

Koichiro Ito, Takanori Ida, and Makoto Tanaka, "Moral Suasion and Economic Incentives: Experimental Evidence from Energy Demand," NBER Working Paper 20910

Koichiro Ito, Takanori Ida, and Makoto Tanaka, "Information Frictions, Switching Costs, and Selection on Elasticity: A Field Experiment on Electricity Tariff Choice," Working Paper

* Esther Duflo and Emmanuel Saez, "The Role of Information and Social Interactions in Retirement Plan Decisions: Evidence from a Randomized Experiment," QJE (2003)

Causal Inference for Statistics, Social, and Biomedical Sciences: An Introduction 1st Edition, by Guido W. Imbens, Donald B. Rubin (2015)

3. Regression Discontinuity Designs

** Imbens, Guido and Thomas Lemieux. "Regression Discontinuity Designs: A Guide to Practice." *Journal of Econometrics*, 2008, 142, 615–635.

** *WNE* Lecture 3.

CT Chapter 25.6.

* *AP* Chapter 6.

** "A credible approach for measuring inframarginal participation in energy efficiency programs" by Judson Boomhower and Lucas W. Davis, Journal of Public Economics 113 (2014) 67-79

Gelman, Andrew and Guido Imbens. "Why High-order Polynomials Should not be Used in Regression Discontinuity Designs." 2014, *NBER Working Paper* No. 20405.

Lee, David and Thomas Lemieux. "Regression Discontinuity Designs in Economics." *Journal of Economic Literature*, 2010, 48, 281–355.

McCrary, Justin. "Manipulation of the Running Variable In the Regression Discontinuity Design: A Density Test." *Journal of Econometrics*, 2008, 142, 698–714.

* Angrist, Joshua and Victor Lavy. "Using Maimonides' Rule To Estimate The Effect Of Class Size On Scholastic Achievement." *Quarterly Journal of Economics*, 1999, 114, 533–575.

4. Advanced Topics in Instrumental Variables

A. The IV Estimator

** *CT* Chapter 4.8.

** *AP* Chapter 4.1 - 4.3.

JW Chapter 5.

*Angrist, Joshua. "Lifetime Earnings and the Vietnam Era Draft Lottery: Evidence from Social Security Administrative Records." *American Economic Review*, 1990, 80, 313–336.

*Angrist, Joshua and Alan Krueger, "Instrumental Variables and the Search for Identification: From Supply and Demand to Natural Experiments." *Journal of Economic Perspectives*, 2001, 15, 69–86.

B. Heterogeneous Treatment Effects

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

** *WNE* Lecture 5.

JW
Chapter18.4.

*Angrist, Joshua, Guido Imbens, and Donald Rubin. "Identification of Causal Effects Using Instrumental Variables." *Journal of the American Statistical Association*, 1996, 91, 444–455.

C. 2SLS and Weak Instruments

** *CT* Chapter 4.9.

**AP* Chapter 4.6.

* *WNE* Lecture 13.

*Angrist, Joshua and Alan Krueger. "Does Compulsory School Attendance
Affect Schooling and Earnings?" *Quarterly Journal of Economics*, 1991,

106, 979–1014.

Bound, John, David Jaeger, and Regina Baker. "Problems With Instrumental Variables Estimation When the Correlation Between the Instruments and the Endogenous Explanatory Variable Is Weak." *Journal of the American Statistical Association*, 1995, 90, 443–450.

Small, Dylan and Paul Rosenbaum. "War and Wages: The Strength of Instrumental Variables and Their Sensitivity to Unobserved Biases." *Journal of the American Statistical Association*, 2008, 103, 924–933.

D. Marginal Treatment Effects (MTE)

** Heckman, James J. 2010. "Building Bridges between Structural and Program Evaluation Approaches to Evaluating Policy." Journal of Economic Literature, 48(2): 356–398.

* Brinch, Christian N., Magne Mogstad, and Matthew Wiswall. 2017. "Beyond LATE with a discrete instrument. Heterogeneity in the quantity-quality interaction of children." Journal of Political Economy, 125(4): 985–1039.

Carneiro, Pedro, James J. Heckman, and Edward J. Vytlacil. 2011. "Estimating Marginal Returns to Education." American Economic Review, 101(6): 2754–2781.

Carneiro, Pedro, James J. Heckman, and Edward Vytlacil. 2010. "Evaluating Marginal Policy Changes and the Average Effect of Treatment for Individuals at the Margin." Econo met- rica, 78(1): 377–394.

Eisenhauer, Philipp, James J. Heckman, and Edward Vytlacil. 2015. "The Generalized Roy Model and the Cost-Benefit Analysis of Social Programs." The journal of political economy, 123(2): 413–443.

Heckman, James J., and Edward J. Vytlacil. 2007. "Using the Marginal Treatment Effect to Organize Alternative Econometric Estimators to Evaluate Social Programs, and to Forecast their Effects in New Environments." Handbook of Econometrics, 6: 4875–5143. DOI: 10.1016/S1573- 4412(07)06071-0.

Heckman, James J., and Edward Vytlacil. 2001. "Policy-Relevant Treatment Effects." The American Economic Review, 91(2): 107–111.

Heckman, James J., and Edward Vytlacil. 2005. "Structural equations, treatment effects, and econometric policy evaluation." Econometrica, 73(3): 669–738.

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

** Robert J. LaLonde. "Evaluating the Econometric Evaluations of Training Programs with Experimental Data," *American Economic Review* 76(4): 604-620.

** *CT* Chapter 25.

** *AP* Chapter 3.

** *WNE* Lecture 1.

* Rosenbaum, Paul and Donald Rubin. "Reducing Bias in Observational Studies Using Subclassification on the Propensity Score." *Journal of the American Statistical Association*, 1984, 79, 516–524.

* Dehejia, Rajeev and Sadek Wahba. "Causal Effects in Non-Experimental Studies: Reevaluating the Evaluation of Training Programs." *Journal of the American Statistical Association*, 94, 1999, 1053–1062.

* Smith, Jeffrey and Petra Todd. "Does Matching Overcome LaLonde's Critique of Non-experimental Methods?" *Journal of Econometrics*, 2005, 125, 305–353.

Arceneaux, Kevin, Alan Gerber, and Donald Green. "Comparing Experimental and Matching Methods Using a Large-Scale Voter Mobilization Experiment." *Political Analysis*, 2006, 14, 37–62.

Shadish, William, M. H. Clark, and Peter Steiner. "Can Nonrandomized Experiments Yield Accurate Answers? A Randomized Experiment Comparing Random and Nonrandom Assignments." *Journal of the American Statistical Association*, 2008, 103, 1334–1356.

Millimet, Daniel and Rusty Tchernis. "On the Specification of Propensity Scores, With Applications to the Analysis of Trade Policies." *Journal of Business and Economic Statistics*, 2009, 27, 397–415.

5. DID, Fixed Effects, Synthetic Controls

** *WNE* Lecture 10.

** *CT* Chapter 25.

** *AP* Chapter 5.

Card, David. "The Impact of the Mariel Boatlift on the Miami Labor Market." *Industrial and Labor Relations Review*, 1990, 43, 245–257.

Card, David and Alan Krueger. "Minimum Wages and Employment: A Case Study of the Fast-food Industry in New Jersey and Pennsylvania." *American Economic Review*, 1994, 84, 487–496.

*Abadie, Alberto, Alexis Diamond and Jens Hainmueller. "Synthetic Control Methods for Comparative Case Studies: Estimating the Effect of California's Tobacco Control Program." *Journal of the American Statistical Association*, 2010, 105, 493–505.

Currie, Janet and Duncan Thomas. "Does Head Start Make a Difference?" *American Economic Review*, 1995, 85, 341–364.

Ashenfelter, Orley, and Michael Greenstone. "Using Mandated Speed Limits to Measure the Value of a Statistical Life." *Journal of Political Economy*, 2004, 112(1), S226–67.

Deschênes, Olivier and Michael Greenstone. "The Economic Impacts of Climate Change: Evidence from Agricultural Output and Random Fluctuations in Weather." *American Economic Review*, 2007, 97, 354–385.

Kellogg, Ryan and Hendrik Wolff. "Daylight Time and Energy: Evidence from an Australian Experiment." *Journal of Environmental Economics and Management*, 2008, 56, 207–220.

6. Clustering and Bootstrapping Standard Errors

** *CT* Chapter 24.5.

** *AP* Chapter 8.2.

** Bertrand, Marianne, Esther Duflo, and Sendhil Mullainathan. "How Much Should We Trust Differences-in-Differences Estimates?" *Quarterly Journal of Economics*, 2004, 119, 249–275.

Cameron, Colin, Jonah Gelbach, and Doug Miller. "Robust Inference with Multi-way Clustering." *Journal of Business and Economic Statistics*, 2011, 29, 238–249.

** *CT* Chapter 11.

Efron, Bradely and Robert Tibshirani. "Bootstrap Methods for Standard Errors, Confidence Intervals, and Other Measures of Statistical Accuracy." *Statistical Science*, 1986, 1, 54–75.

Cameron, Colin, Jonah Gelbach, and Doug Miller. "Bootstrap-Based Improvements for Inference With Clustered Errors." *Review of Economics and Statistics*, 2008, 90, 414–427.

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.

Angrist, Joshua. "Estimation of Limited Dependent Variable Models With Dummy Endogenous Regressors: Simple Strategies for Empirical Practice." *Journal of Business and Economic Statistics,* 2001, 19, 2–16.

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.

** Nevo, Aviv. "A Practitioner's Guide to Estimation of Random-Coefficients Logit Models of Demand," Journal of Economics & Management Strategy (2000), 9, 4, 513-548.

* Koichiro Ito and Shuang Zhang. "Willingness to Pay for Clean Air: Evidence from Air Purifier Markets in China," NBER Working Paper, 22367, June 2016.

9. Numerical Optimization Methods

** *CT* Chapter 10

** *KT* Chapter 8