PhD Econometrics II: ECO-6425/7425
Fall 2024
Syllabus

1 General Information

Instructor: Tobias Pfutze

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Office hours: Tue 9:30-10:45am or by appointment.

Time: Tue, Thu 11:00am-12:15pm

Location: SIPA 335

Changes to class schedule:

- The class on *Tuesday, November 26* may be changed.

Course Objectives: The course aims to provide the student with a solid knowledge of the most commonly used econometric estimation techniques beyond basic OLS. It focuses exclusively on methods appropriate to conduct empirical microeconomic research. It consists of two parts: The first one focuses on endogeneity problems and the identification of causal effects in linear models. Topics covered are panel data methods, instrumental variables, simultaneous equations models, regression discontinuity designs, and

matching methods. The second part provides an introduction to Maximum Likelihood Estimation (MLE) and to an introduction to machine learning (ML), and develops estimators for some its most common applications: Binary and multinomial dependent variable models, sample selection, censoring and truncation, and survival analysis. Over half of the course will be allocated on the first part, which will have a strong focus on how the techniques covered can be applied to real world problems. Parts two, comprising the last third, will be much more theoretical in nature.

Course requirements and grading schemes: Class attendance is expected. There will be four problem sets, one presentation of existing research, followed by discussion, and a final exam. For the presentations, all of you are expected to read the assigned papers. The principal deliverable is your own piece of empirical research in which you are expected to employ at least one of the methods covered in a non-trivial (!!!) application. For this, you should think ahead about a possible third year paper and/or dissertation topic. The paper will allow you to take a first stab at your idea. It is important that you meet with me in order to discuss your idea, data sources, and the appropriate estimation method. Failure to do so will be reflected in your grade on that assignment. Part of the research paper is your research proposal. This is due before our week 10 classes at the very latest. The proposal should include i) a clear statement of the research question and hypothesis, ii) a discussion of the data that you plan to use (and possibly descriptive statistics), and iii) a discussion of the method that you plan to employ. You will also need to present your research proposal and final paper in class. The quality of your proposal and the two presentations will be reflected in the grade you receive for your research paper. Your final grade will be derived as follows:

20% Problem Sets

20% Presentation

20% Exam

40% Final paper

If you are a PhD student, all your problem sets, presentations, and your final paper will need to be written in LaTeX, and handed

in a pdf documents! For the problem sets, you are also required to hand in your Stata log files or Matlab code (depending on the problem set). LaTeXis a free software and won't cost you a dime. You can find information on LaTeX, including documentation, books and how to download, here:

The LaTeX Project

Your *presentation* should be 15-20 minutes long, followed by in-class discussion. The focus of your presentation should be on the econometric methods employed and whether you think the results are convincing (and why or why not!). Make sure to read the paper carefully, as you will be expected to answer questions that may arise. The most common LaTeXformat for slide shows is **Beamer**. More information can be found here:

Link to Beamer

Textbook & Readings: This course does not follow any particular textbook. However, as aspiring applied microeconomists, you should consider an investment in the following two titles:

> *Econometric Analysis of Cross Section and Panel Data* by Jeffrey M. Wooldridge, South MIT Press, 2010, 2nd Edition. **(W)**
>
> *Microeconometrics: Methods and Applications* by A Colin Cameron and Pravin K. Trivedi, Cambridge University Press 2005 **(CT)**
>
> *Econometrics with Machine Learning* by Felix Chan and László Mátyás, Springer Nature 2022 **(CL)**

In addition, we will go over a number of theory and empirical papers that develop and/or employ the methods discussed in class. Most of the latter will be presented by you or your peers and you are expected to read them ahead of class to be prepared for their discussion. In order of appearance:

> Pritchett, Lant; *"Where Has All the Education Gone?"* Policy Research Working Paper #1581, The World Bank 1996
>
> Acemoglu, Daron; Johnson, Simon; Robinson, James A.; *"The Colonial Origins of Comparative Development: An Empirical Investigation"*; AER 2001 (AJR 01)

Clemens, Michael; *"Do visas kill? Health effects of African health professional emigration"*; CGD Working Paper #114, 2007

Shea, John; *"Instrument Relevance in Multivariate Linear Models: A Simple Measure"*; REStat 1997

Stock, James H.; Yogo, Motohiro; *"Testing for Weak Instruments in Linear IV Regression"*; NBER Technical Working Paper No. 284, 2002

Clarke, Damian; Matta ,Benjamin; *"Practical Considerations for Questionable IVs"*; MPRA Paper 79991, 2017

Nevo, Aviv; Rosen, Adam M.; *"Identification with Imperfect Instruments"*; REStat 2012

Conley, Timothy G.; Hansen, Christian B., Rossi, Peter E.; *"Plausibly Exogenous"*; REStat 2012

Goodman-Bacon, Andrew; *"Difference-in-Differences with variation in Treatment Timing"*; Journal of Econometrics 225, 2021

Callaway, Brantly; Goodman-Bacon, Andrew; Sant'Anna, Pedro H.C.; *"Difference-in-Differences with a Continuous Treatment*; working paper

Callaway, Brantly; Sant'Anna, Pedro H.C.; *"Difference-in-Differences with Multiple Time-periods"*; Journal of Econometrics 225, 2021

Wooldridge, Jeffrey M.; *"Two-Way Fixed Effects, the Two-Way Mundlak Regression, and Difference-in-Differences Estimators"*; working paper

Roth, Jonathan; Sant'Anna, Pedro; Bilinski, Alyssa; Poe, John; "What's Trending in Difference-in-Differences? A Synthesis of the Recent Econometrics Literature"; Journal of Econometrics 2023

Borusyak, Kirill; Jaravel, Javier; Spiess, Jan; "Revisiting Event Study Design: Robust and Efficient Estimation"; working paper

de Chaisemartin, Clement; D'Haultfoeuille, Xavier; "Two-way Fixed Effects Estimators with Heterogenuous Treatment Effects", AER, 2020

de Chaisemartin, Clement; D'Haultfoeuille, Xavier; "Difference-in-Differences Estimators of Intertemporal Treatment Effects", working paper

de Chaisemartin, Clement; D'Haultfoeuille, Xavier; "Fuzzy Difference-in-Differences"; Review of Economic Studies; 85; pgs. 999-1028, 2018

Arkhangelsky, Dimitry; Imbens, Guido; "Causal Models for Longitudinal and Panel Data: A Survey"; working paper

Sun, Liyang; Abraham, Sarah; "Estimating Dynamic Treatment Effects in Event Studies with Heterogeneous Treatment Effects"; Journal of Econometrics 2021

Yang, Dean; *"International Migration, Remittances and Household Investment: Evidence From Philippine Migrants' Exchange Rate Shocks"*; EJ 2008

Duflo, Esther; *"Schooling and Labor Market Consequences of School Construction in Indonesia: Evidence From an Unusual Policy Experiment"*; AER 2001

Albouy, David: *"The Colonial Origins of Comparative Development: An Investigation of the Settler Mortality Data"*, NBER Working Paper #W14130, 2008

Iyer, Lakshmi; *"Direct vs. Indirect Colonial Rule in India: Long-Term Consequences"*; REStat 2010

Jha, Saumitra; *"Trade, Institutions, and Ethnic Tolerance: Evidence from South Asia"*; APSR, 2013

Alberto Alesina, Paola Guiliano, Nathan Nunn; *"On the Origins of Gender Roles: Women and the Plough"*; QJE, 2013

Stock, James H.; Watson, Mark W.; *"Introduction to Econometrics"*; Chaper 11; Pearson, 3ed, 2015

Calonico, Sebastian; Cattaneo, Matias D.; Titiunik, RocÃo; *"Robust Data-Driven Inference in the Regression Discontinuity Design"*, The Sata Journal 2014

Duflo, Esther; Kremer, Michael; *"Use of Randomization in the Evaluation of Development Effectiveness."*; unpublished mimeo; 2003

Duflo, Esther; Glennester, Rachel; Kremer, Michael; *"Using Randomization in Development Economics Research: A Toolkit Handbook of Development Economics"*; 2007

Clemens, Michael; Demombynes, Gabriel; *"When Does Rigorous Impact Evaluation Make a Difference? The Case of the Millenium Villages."*; Journal of Developement Effectiveness, 2010

Miguel, Edward; Kremer, Michael; *"Worms: Identifying Impacts on Education and Health in the Presence of Treatment Externalities"*, Econometrica 2004

Bertrand, Marianne; Mullainathan, Sendhil; *"Are Emily and Greg More Employable than Lakisha and Jamal? A Field Experiment on Labor Market Discrimination"*; AER; 2004

Bertrand, Marianne; Djankov, Simeon; Hanna, Rema; Mullainathan, Sendhil; *"Obtaining a Driving License in India: An Experimental Approach to Studying Corruption"*; QJE 2007 (BDHM 07)

Jones, Benjamin F.; Olken, Benjamin A. *Hit or Miss? The Effect of Assassinations on Institutions and War"*; AEJ: Macro, 2009

Lee, David S.; Lemieux, Thomas; *"Regression Discontinuity Designs in Economics"*, Journal of Economic Literature, Vol.48, June 2010

Heckman, James J.; Ichimura, Hidehiko; Todd Petra E.; *"Matching as an Econometric Evaluation Estimator: Evidence From Evaluating a Job Training Program"*, REStud 1997, No. 64

Smith Jeffrey A.; Todd Petra E.; *"Does Matching Overcome LaLonde's Critique of Non-experimental Estimators?"*, Journal of Econometrics 2005, No. 125.

Diamond, Alexis; Sekhon, Jasjeet S.; *"Genetic Matching for Estimating Causal Effects: A General Multivariate Matching Method for Achieving Balance in Observational Studies"*; REStat 2013

Brollo, Fernanda; Nannicini, Tommaso; Perotti, Roberto; Tabellini, Guido; *"The Political Resource Curse"*, AER 2013, 103(5) (BNPT13)

Dell, Melissa; *"The persistent Effects of Peru's Mining Mita"*; Econometrica, Vol.78(6), 2010

Abadie, Alberto; Diamond, Alexis; Hainmueller, Jens; *"Synthetic Control Methods for Comparative Case Studies: Estimating the Effect of California's Tobacco Control Program"*, Journal of the American Statistical Association 2010, Vol.105, Issue 490

Abadie, Alberto; Gardezabal, Javier; *"The Economic Costs of Conflict: A Case Study of the Basque Country"*, AER March 2003

Athey, Susan; Imbens, Guido W.; *"Machine Learning Methods for Estimating Heterogeneous Causal Effects"*, Unpublished Working Paper 2015

Athey, Susan; Imbens, Guido W.; *"Machine Learning Methods Economists Should Know About"*, Unpublished Working Paper 2019

Abadie, Alberto; Kasy, Maximilian; *"The Risk of Machine Learning"*, Unpublished Working Paper 2017

Stock, James H.; Watson, Mark W.; *"Generalized Shrinkage Methods for Forecasting Using Many Predictors"*, Journal of Business and Economic Statistics, Vol. 30(4), 481-93, 2012

Varian, Hal R.; *"Big Data: New Tricks for Econometrics"*; Journal of Economic Perspectives; Vol.28(2), 3-28, 2014

Hastie, Trevor; Tibshirani, Robert; Friedman, Jerome; *"The Elements of Statistical Learning: Data Mining, Inference, and Prediction"*, Springer 2009

2 Course Outline

2.1 Reduced Form Estimation

Week 1: Introduction, Causes of Endogeneity, Stata Syntax

- W: Ch. 4, Ch. 19.3-19.4
- CT: Ch. 2.4, Ch. 4.7, Ch. 16.5, Ch. 26.1-26.2

Week 2: IV Estimation & Simultaneous Equation Models

- W: Ch. 5, Ch. 6.3,Ch.9, Ch. 11.2, Ch. 11.4, Ch. 11.6
- CT: Ch. 4.8-4.8, Ch. 22.5
- Shea 1997
- Stock, Yogo 2002
- Clarke, Matta 2017
- Nevo, Rosen 2012
- Conley, Hansen & Rossi 2012

Week 3: Panel Data Methods

- W: Ch. 10, Ch. 6.5
- CT: Ch. 21, Ch. 22.6-22.7

Week 4: Panel Data Methods cont.

- De Chaisemartin, D'Haultfoeuille 2020
- Goodman-Bacon 2021
- Callaway, Sant'Anna 2021

- Wooldridge 2021
- Roth, Sant'Anna, Bilinski & Poe 2023
- CT: Ch. 21, Ch. 22.6-22.7
  Additional Readings not covered in class:
- Callaway, Goodman-Bacon, Sant'Anna 2021
- Borusyak, Jaravel, Spiess, 2022
- de Chaisemartin, D'Haultfoeullie, 2023
- de Chaisemartin, D'Haultfoeullie, 2018
- Arkhangelsky & Imbens 2023
- Sun & Abraham 2021

Problem Set 1

Week 5: Presentations

- Pritchett 1996:
- AJR 01 & Albouy 2008:
- Clemens 2007:
- Yang 2008
- Duflo 2001:
- Iyer 2010:
- Jha 2013:
- Alesina, Guiliano, Nunn 2013:

Week 6: Experimental vs. Non-Experimental Approaches

- W: Ch. 21.1-21.2
- CT: Ch. 25.1-25.3
- Stock & Watson, Ch. 11
- Duflo, Kremer 2003
- Duflo, Glennester, Kremer 2007
- Clemens, Demombynes 2011

Week 7: Regression Discontinuity Models

- W: 21.5
- CT: Ch. 9.1-9.6 & 25.6
- Lee, Lemieux 2010
- Calonico, Cattaneo, Titiunik 2014

Problem Set 2

Week 8: Matching Methods

- W: Ch. 21.3
- CT: Ch. 25.4
- Heckman, Ichimura, Todd 1997
- Smith, Todd 2005
- Diamond, Sekhon 2013

Week 9: Synthetic Control Methods & Presentations

- Abadie, Diamond, Hainmueller 2010

Presentations:

- Miguel, Kremer 2004:
- Bertrand, Djankov, Hanna, Mullainathan 2007:
- Bertrand, Mullainathan 2003:
- Jones, Olken 2009:
- Brollo, Nannicini, Perotti, Tabellini 2013:
- Dell 2010:
- Abadie & Gardezabal 2003:

Problem Set 3

DUE: Research Proposal

2.2 Non-Linear Models, Maximum Likelihood Estimation & Recent Developments

Week 10: Research Proposal Presentations

Week 11: Introduction to MLE, Binary Dependent Variable Models (Probit & Logit) & MATLAB

- W: Ch. 12.7, 15
- CT: Ch. 10, 14.1-14.3

Week 12: Multinomial & Ordered Response Models; Truncation & Censoring: Tobit and Selection Models

- W: Chapter 16
- SW: Chapter 15.1-15.10
- W: Ch. 17.1-17.4, 17.6, 18.2, 19.1-19.6
- CT: Ch. 16.1-16.7

Week 12: Survival Analysis

- W: Ch. 22
- CT: Ch. 17

Week 13: Machine Learning

- Athey & Imbens 2015
- Athey & Imbens 2019
- Abadie & Kasy 2017
- Stock & Watson 2012
- Varian 2014
- Hastie, Tibshirani, Friedman 2009: Ch. 2, 3.4, 9.2 & 11.1-11.5

Problem Set 4

Week 14: Machine Learning cont. & Thanksgiving

- CL: Ch.1-3

Week 15: Final Paper Presentations

DUE: Final Paperl, Thu Dec. 12

FINAL EXAM: THU DEC. 12, 9:45-11:45am, SIPA 335