Agricultural and Applied Economics 637:
Applied Econometric Analysis II

Syllabus Spring 2024

Instructor: Prof. Dustin Frye
E-mail: dustin.frye@wisc.edu
Office: 422 Taylor Hall
Office Hours: Wednesdays 10 am – 12 pm; Thursdays 11:30 am – 12:30 pm; or by appointment. (Zoom or In-Person)
Website: Canvas

Teaching Assistant: Jacob Bills
Office: 522 Taylor Hall
Email: jbbills@wisc.edu
Office Hours: Mondays 2 – 3 pm and Fridays 11 am – 12 pm

Course Description

This course focuses on statistical tools and research designs for empirical research and policy analysis. It extends the standard regression model and covers recent advances for analyzing panel data, implementing instrumental variables, and introduces techniques like nonlinear regression and maximum likelihood estimation. The course provides an overview of these empirical methods while emphasizing practical implementation of research design for estimating causal effects.

Course Structure

This class meets for a total of 4 class period hours (two 75-minute lectures and one 50-minute discussion section) each week over the semester and carries the expectation that students will work on course learning activities (reading, problem sets, studying, etc) for about 2 hours out of the classroom for every class period.

Prerequisite(s): Applied Econometrics I (or equivalent). If you are unsure of whether you meet the necessary prerequisite, you can get in touch with me.
Instruction Mode: In-person instruction
Credits: 4 credits
Location and Schedule: Tuesday/Thursday 9:30 – 10:45 am, 119 Babcock Hall
Discussion Sections: 301: 150 Russell Laboratories, Friday 2:25 – 3:15 pm

Course Learning Outcomes (CLOs)

1. Extend the standard linear regression models to nonlinear regression models, estimate them, and interpret the results.
2. Get familiarized with the latest techniques being developed using panel data and apply these methods in an independent estimation exercise.
3. Select the experimental or quasi-experimental method appropriate for the analysis at hand.
4. Estimate models beyond ordinary least squares (OLS), to include Maximum Likelihood (MLE), analysis of discrete choice and limited dependent variables.

Textbook and Course Materials

Textbook

There are no required textbooks for the course, but there are several recommended books that I incorporate into lectures.

- [MHE] Joshua Angrist and Jörn-Steffen Pischke, *Mostly Harmless Econometrics*
- [CI] Scott Cunningham, *Causal Inference: The Mixtape*, https://mixtape.scunning.com/
- [TE] Nick Huntington Klein, *The Effect*, https://theeffectbook.net/

In addition to the textbooks, most topics include references to academic papers or book chapters that provide more depth or discussion.

Software

We will primarily make use of STATA for work with data (using R or Python will be optional). There are many incredible resources available online, a quick Google Search of: A BRIEF INTRODUCTION TO STATA returned several great tutorials. The TA will focus on getting everyone setup with STATA. You're welcome to use other analysis software, but we won't be covering the particular packages and tools from other software.

Grading

There are two components to your course grade.

1. Problem Sets (70%)
2. Final Exam (30%)

Problem Sets:

The primary component of your grade will be based on assignments. There will be five assignments, which will consist of problems based on topics covered in class. All assignments will involve exercises that will require working heavily with data and code. Each assignment will likely take some time to finish, so I would encourage you to start working on it early. Solutions will be provided after the deadline, and no late submissions will be accepted. If you anticipate needing extra time, you should discuss you circumstances with me, and may have access to the problem set early so that you can submit it before the deadline.

As an urban economist I believe in the importance of creating positive spillover effects through collaboration. You are encouraged to study with other students and to discuss and compare notes with each other when working on problem sets. If you do work with other students, you can submit a single assignment for a group of *up to two* people.

Submitting Problem Sets:

All assignments must be submitted by 5 pm. Submission dates are: *Feb 9th, Mar 1st, Mar 22nd, Apr 12, and Apr 30th.* Written materials being submitted must be typed, and you must use the free online version of Latex on: www.overleaf.com).

• You should submit your Overleaf page to the TA along with any pdf versions.
• You should also submit any code (for example, your do file)

Early in the semester, the TA will help you get familiar with Overleaf and we will share an example template that you can use for the assignments for the course.

Exams:
We will have an in-class final exam on the last scheduled day of class on May 2nd. I will provide more details on the structure of the final exam as we get closer to the exam date.

Grades:
The following outlines the letter grade cutoffs, but I may adjust them downward as needed. I will not adjust them upward.

Percentage	Grade
92 – 100%	A
88 – 91.99%	AB
82 – 87.99%	B
75 – 81.99%	BC
70 – 74.99%	C
60 – 69.99%	D
Below 60%	F

Other Class Policies

Attendance:
I will not be taking attendance; however, I expect you to be present and participate in both the lectures and Discussion Sections of the course.

Email:
If you have questions or concerns about the class, you are always welcome to email me. I will do my best to respond within 24 hours, however I don't typically check my email over the weekend, so it might be Monday morning before I get back to you. When sending an email please add the TA, Jacob, to the email and add AAE 637 to the subject line so we are both aware.

AI:
The AI landscape is changing rapidly and I view these tools (ChatGPT, Microsoft Colab, Bard, etc.) as amazing resources for learning. I encourage you to use AI in a way that *supplements* this course, but I would recommend you use your judgement when evaluating whether the solutions produced by these models are beneficial for your long term goals of learning in the course. I have found LLM's struggle with writing code in STATA and they certainly are not up to date with many of the latest techniques we will be discussing. Additionally, our endeavor is to be precise in our language and discussion of our toolkit, these LLM's are unlikely to be attuned to our needs.

Regrading:
Please note that if you ask for a regrade, the entire assignment will be regraded (including all of the other questions).

University-wide Policies

Academic Integrity: By virtue of enrollment, each student agrees to uphold the high academic standards of the University of Wisconsin-Madison; academic misconduct is behavior that negatively impacts the integrity of the institution. Cheating, fabrication, plagiarism, unauthorized collaboration, and helping others commit these previously listed acts are examples of misconduct which may result in disciplinary action. Examples of disciplinary action include, but is not limited to, failure on the assignment/course, written reprimand, disciplinary probation, suspension, or expulsion.

Diversity Inclusion: Diversity is a source of strength, creativity, and innovation for UW-Madison. We value the contributions of each person and respect the profound ways their identity, culture, background, experience, status, abilities, and opinion enrich the university community. We commit ourselves to the pursuit of excellence in teaching, research, outreach, and diversity as inextricably linked goals. The University of Wisconsin-Madison fulfills its public mission by creating a welcoming and inclusive community for people from every background - people who as students, faculty, and staff serve Wisconsin and the world.

Accommodations for Students with Disabilities: The University of Wisconsin- Madison supports the right of all enrolled students to a full and equal educational opportunity. The Americans with Disabilities Act (ADA), Wisconsin State Statute (36.12), and UW-Madison policy (Faculty Document 1071) require that students with disabilities be reasonably accommodated in instruction and campus life. Reasonable accommodations for students with disabilities is a shared faculty and student responsibility. Students are expected to inform me of their need for instructional accommodations by the end of the third week of the semester, or as soon as possible after a disability has been incurred or recognized. I will work either directly with you or in coordination with the McBurney Center to identify and provide reasonable instructional accommodations. Disability information, including instructional accommodations as part of a student's educational record, is confidential and protected under FERPA.

Course Outline and Readings

1. **Introduction: Review of Regression and Causality**
    a. **Refreshing our Memory**
    MHE 3.1
    TE 13
    b. **Building a Common Language: Potential Outcomes, DAGs, Treatment Effects**
    MHE 2
    CI 3
    TE 6 – 10
    c. **Research Design and Randomization**
    CI 4.1
    - "Causality and design-based inference", Bowers, J. & Leavitt, T. (2020)
    - "Let's take the Con out of Econometrics", Leamer (1983)
    - "The Credibility Revolution in Empirical Economics: How Better Research Design is Taking the Con out of Econometrics", Angrist and Pischke (2010)

2. **Selection on Observables**
    a. **Controls & Fixed Effects**
    MHE 3.2 & 5.1
    TE 16
    b. **Matching and Propensity Score Methods**
    MHE 3.3
    CI 5
    TE 14
    - "Matching As An Econometric Evaluation Estimator", Heckman, Ichimura, and Todd (1998)
    - "Propensity Score-Matching Methods for Nonexperimental Causal Studies", Dehijia and Wahba (2002)

3. **Inference**
    - MHE 8
    - CI 2.26-2.27
    - TE 13.3
    - "Robust Standard Errors in Small Samples: Some Practical Advice." Imbens and Kolesar (2016)
    - "GMM estimation with cross sectional dependence" Conley (1999)
    - "Clustering, spatial correlations, and randomization inference." Barrios et al. (2012)
    - "When Should You Adjust Standard Errors for Clustering?" Abadie et al. (2022)

4. **Visualization**
    - Kieran Healy, Data Visualization: A Practical Introduction, https://socviz.co/
    - "On Binscatter" Cattaneo et al. (2019)

5. **Panel Data Methods**
    a. **Review and the Canonical Difference-in-Difference (DID)**
    MHE 5.2
    CI 8

TE 18

b. Two-Way Fixed Effects, Staggered Timing, and Event Study

CI 9.6

TE 17

- "Difference-in-differences with variation in treatment timing", Goodman-Bacon (2018)
- "Two-way fixed effects estimators with heterogeneous treatment effects" de Chaisemartin and d'Haultfoeuille (2020)
- "Difference-in-differences with multiple time periods", Callaway and Santa'Anna (2020)
- "On the Use of Two-Way Fixed Effects Regression Models for Causal Inference with Panel Data", Imai and Kim (2020)
- "What's Trending in Difference-in-Differences? A Synthesis of the Recent Econometrics Literature" Roth, Sant'Anna, Bilinski, and Poe (2022)
- "Efficient Estimation for Staggered Rollout Designs" Roth and Sant'Anna (2022)
- "A More Credible Approach to Parallel Trends" Roth and Rambachan (2022)
- "Difference-in-Differences with a Continuous Treatment" Callaway, Goodman-Bacon and Sant'Anna (2021)
- Borusyak K., Jaravel X., Spiess J. (forthcoming). Revisiting Event Study Designs: Robust and Efficient Estimation.

c. Synthetic Controls

CI 10

TE 21

- Abadie, A. (2021). Using synthetic controls: Feasibility, data requirements, and methodological aspects. Journal of Economic Literature, 59(2), 391-425.
- "Synthetic control methods for comparative case studies: Estimating the effect of California's tobacco control program" Abadie, Diamond and Hainmueller (2010)

6. Instrumental Variables

a. Review and Heterogeneity

MHE 4

TE 19

- "Identification and estimation of local average treatment effects" Imbens and Angrist (1994)
- "Identification of causal effects using instrumental variables" Angrist, Imbens and Rubin (1996)
- "Weak instruments in instrumental variables regression: Theory and practice" Andrews, Stock and Sun (2019)
- "Tolerating defiance? Local average Treatment Effects without Monotonicity" de Chaisemartin

b. Shift-Share IV designs and Formula Instruments

CI 7.8.3-7.8.4

- "Bartik Instruments: What, When, Why and How" Goldsmith-Pinkham, Sorkin and Swift (2020)
- "Shift-share designs: Theory and inference" Adao, Kolesar and Morales (2019)
- "Quasi-experimental shift-share research designs" Borusyak, Hull and Jaravel (2020)
- "Non-random exposure to exogenous shocks: Theory and applications" Borusyak and Hull (2021)

c. Evaluator Designs ("Judge")

CI 7.8.2

- "Judging Judge Fixed Effects" Frandsen, Lefgren and Leslie (2020)
- "The criminal and labor market impacts of incarceration." Mueller-Smith (2015)

7. Regression Discontinuity

MHE 6
CI 6
TE 20

- A Practical Introduction to Regression Discontinuity Designs: Foundations", Cattaneo, Idrobo and Titiunik, (2020)
- "A Practical Introduction to Regression Discontinuity Designs: Extensions," Cattaneo, Idrobo and Titiunik, (2021)
- "Regression discontinuity designs using covariates" Calanico et al (2019)
- Manipulation of the running variable in the regression discontinuity design: A density test", McCrary (2008)

8. Maximum Likelihood & Duration Models

- "Binary Response Models for Panel Data: Identification and Information" Chamberlain (2010)
- "Discrete Choice Methods with Simulation" Train (2009)
- "Econometric Methods for the Duration of Unemployment", Lancaster (1979)
- "Economic duration data and hazard functions", Kiefer (1988)
- "Duration Models: Specification, Identification and Multiple Durations", Van Den Berg (2001)

9. Miscellaneous Topics

a. Quantile Regression

MHE 7

- Koenker and Hallock. "Quantile Regression". 2001

b. Machine Learning

- "Machine Learning Methods Economists Should Know About." Athey S, Imbens G. (2019)