

# Agricultural and Applied Economics 637: Applied Econometric Analysis II

## Syllabus

Spring 2026

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**Instructor:** Prof. Dustin Frye

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**Office:** 422 Taylor Hall

**Office Hours:** Wednesdays 10 am – 12 pm; Thursday 11:30 am – 12:30 pm; or by appointment. (Zoom or In-Person)

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**Office Hours:** TBD

### 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, B30 Taylor Hall

**Discussion Sections:** 301: B30 Taylor Hall, 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:

Problem sets are the primary component of your course grade. There will be **six** problem sets, each based on material covered in class. Assignments will require substantial work with data and code, and students should expect each problem set to require significant time to complete.

Each problem set has a firm submission deadline. No late submissions will be accepted. This policy is necessary because solutions are made available immediately after the submission deadline and may be discussed in the Discussion Section that follows. Allowing late submissions after solutions have been released would create an inequitable grading environment.

Extensions are granted only in exceptional circumstances and must be arranged in advance of the posted deadline. Requests made after the deadline has passed will not be considered. In cases where a student anticipates a conflict, the instructor may provide early access to the assignment, allowing the student to complete and submit the work before the standard deadline. Extensions that would allow submission after solutions are released will not be granted under any circumstances.

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 should submit a single assignment as a group of *up to three* people.

All assignments must be submitted by the set dates and times on each assignment. Submission dates are: *Feb 6<sup>th</sup>, Feb 20<sup>th</sup>, Mar 13<sup>th</sup>, Mar 27<sup>th</sup>, and Apr 17<sup>th</sup>*. Written materials being submitted must be typed. Your submission should include both the PDF of your responses as well as any scripts or do files. Early in the semester, the TA will help you get familiar with Overleaf/LaTeX 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 Apr 30<sup>th</sup>. 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, Sijan, to the email and add AAE 637 to the subject line so we are both aware.

**AI:**

The AI landscape is evolving rapidly, and tools such as ChatGPT, Copilot, Gemini, and related large language models can be useful learning aids when used appropriately. In this course, AI tools are permitted as supplements to learning, not as substitutes for engaging with the course material, exercising econometric judgment, or developing independent analytical skills.

All submitted work must reflect the student's own understanding. Students are fully responsible for the correctness of their analysis, the appropriateness of their research design,

the interpretation of results, and the content of any code they submit, regardless of whether AI tools were used during the learning process.

While modern AI tools can be helpful for engaging with recent econometric methods and ideas, they are often unreliable for STATA-specific syntax and implementation due to limitations in available training data. Students should independently verify any AI-generated output before incorporating it into their work.

This course does not provide instruction on how to use AI tools. On selected assignments, students may be asked to briefly disclose whether and how AI tools were used as part of their learning or workflow.

**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: Regression, Causality, and Research Design: *Weeks 1–2*

This section reviews linear regression and introduces the causal inference framework and research design concepts that will be used throughout the course.

MHE 2, MHE 3.1

CI 3

TE 6–10, 13

- “Let’s Take the Con out of Econometrics,” Leamer (1983)
  - “The Credibility Revolution in Empirical Economics,” Angrist & Pischke (2010)
- 

## 2. Selection on Observables: *Weeks 3–4*

This section examines identification strategies based on conditional independence and related assumptions, including controls, fixed effects, and matching-based estimators.

MHE 3.2, 3.3, 5.1

CI 5

TE 14, 16

- “Matching as an Econometric Evaluation Estimator,” Heckman, Ichimura & Todd (1998)
  - “Propensity Score Matching Methods for Nonexperimental Causal Studies,” Dehejia & Wahba (2002)
- 

## 3. Inference and Dependence: *Weeks 5–6*

This section focuses on inference with an emphasis on robust standard errors, clustering, and dependence across observations.

MHE 8

CI 2.26–2.27

TE 13.3

- “Robust Standard Errors in Small Samples,” Imbens & Kolesar (2016)
  - “GMM Estimation with Cross Sectional Dependence,” Conley (1999)
  - “When Should You Adjust Standard Errors for Clustering?” Abadie et al. (2022)
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## 4. Difference-in-Differences: *Weeks 7–9*

This section develops panel data methods, with particular emphasis on difference-in-differences designs and recent advances in settings with staggered treatment timing.

MHE 5.2

CI 8, 9.6

TE 17, 18

- “Difference-in-Differences with Variation in Treatment Timing,” Goodman-Bacon (2021)
  - “What’s Trending in Difference-in-Differences?” Roth et al. (2023)
  - “Difference-in-Differences with Multiple Time Periods,” Callaway & Sant’Anna (2021)
  - “Revisiting Event-Study Designs: Robust and Efficient Estimation,” Borusyak, Jaravel, Spiess (2024)
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## 5. Synthetic Control Methods: *Week 10*

This section introduces synthetic control methods for constructing counterfactual outcomes in panel settings.

CI 10

TE 21

- “Synthetic Control Methods for Comparative Case Studies,” Abadie, Diamond & Hainmueller (2010)
  - “Using Synthetic Controls,” Abadie (2021)
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## 6. Instrumental Variables: *Weeks 11–12*

This section revisits instrumental variables, with emphasis on interpretation, heterogeneity, and modern applications such as shift-share and evaluator designs.

MHE 4

TE 19

- “Identification and Estimation of Local Average Treatment Effects,” Imbens & Angrist (1994)
  - “Weak Instruments in Instrumental Variables Regression,” Andrews, Stock & Sun (2019)
  - “Bartik Instruments: What, When, Why, and How,” Goldsmith-Pinkham, Sorkin & Swift (2020)
  - “Judging Judge Fixed Effects,” Frandsen, Lefgren & Leslie (2020)
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## 7. Regression Discontinuity Designs: *Week 13*

This section covers regression discontinuity designs and key issues in implementation and interpretation.

MHE 6

CI 6

TE 20

- *A Practical Introduction to Regression Discontinuity Designs: Foundations*, Cattaneo, Idrobo & Titiunik (2020)
  - *Extensions*, Cattaneo, Idrobo & Titiunik (2021)
  - “Manipulation of the Running Variable in the Regression Discontinuity Design,” McCrary (2008)
- 

## 8. Maximum Likelihood and Duration Models: *If Possible*

This section introduces likelihood-based estimation and selected models beyond OLS. Coverage will depend on course pacing.

- “Binary Response Models for Panel Data,” Chamberlain (2010)
- *Discrete Choice Methods with Simulation*, Train (2009)
- “Econometric Methods for the Duration of Unemployment,” Lancaster (1979)