Econometric Analysis in Agricultural and Environmental Economics

AREC 422, Spring 2025

Syllabus

January 14, 2025

Instructor: Professor Louis Preonas (he/him)	Office:	2104 Symons Hall
University of Maryland	Email:	lpreonas@umd.edu
Dept. of Agricultural and Resource Economics	Website:	www.louispreonas.com

1 Course Overview

Econometrics uses statistical techniques to estimate economic relationships and analyze economic questions. This course presents an introduction to applied econometric methods. The goal of the course is for you to develop a basic econometrics toolkit, which will empower you to (i) conduct econometric analysis of real-world data (a valuable skill on the job market); and (ii) engage more fully (and more critically) with academic research in economics, public policy, and program evaluation.

2 Learning Outcomes

By the end of the course, I will expect you to:

1. Understand the principles of the linear regression model, both in theory and in practice.
2. Develop the ability to analyze economic data and conduct econometric analyses using the `R` software package.
3. Learn to be critical of regression results interpreted as causal, while also learning how to build an argument towards causal interference.

3 Prerequisites

This course assumes you have completed intermediate-level courses in **Applied Microeconomics** (AREC326 or equivalent), **Calculus**, and **Statistics**. You will learn to apply economic principles and microeconomic theory to motivate empirical analysis using real-world economic datasets. Statistics provides the foundation on which econometrics is built, and a working knowledge of basic probability and statistics is essential.

4 Required Resources

4.1 Course Website

We will conduct most course logistics on ELMS. This includes downloading and submitting assignments, posting blogs, and posting grades. I will also upload lecture slides, notes, and in-class exercises to ELMS.

4.2 Textbook

This course will not strictly follow a textbook. However, I enthusiastically recommend:

- Jeffrey M. Wooldridge. *Introductory Econometrics: A Modern Approach* (any edition).

Wooldridge provides a comprehensive reference for students learning econometrics from the ground up, which will help guide you through the first half of the course. The second half of the course will focus on causal inference, which Wooldridge also covers (though in less detail).

4.3 Notes and Slides

I will upload detailed notes on the material we cover in each lecture. **These notes will effectively serve as your primary textbook for the course.** I will also post lecture slides.

4.4 Software

To learn econometrics, you need to conduct econometric analysis. For this course, we will use the `R` software package (version 4.4.2; https://cran.rstudio.org/) and the `RStudio` Desktop environment (https://www.rstudio.com/products/rstudio/download/). These applications are free, open-source, and available for Windows, Mac, Linux, and Unix. I will provide detailed instructions on how to install `R` and `RStudio`, in order to get everyone up to speed. Lab computers around campus also have this required software pre-installed.

Throughout the semester, you will hopefully become proficient `R` coders. However, **this is not a coding course**, and I will provide detailed guidance on the `R` commands necessary to complete each assignment. **No prior coding experience is required**.

5 Course Structure

5.1 Class Meetings

This course will meet in person, **Tuesdays and Thursdays, 11:00am–12:15pm Eastern Time**, in **Symons Hall 0215**. Most class periods will follow a lecture-style format, where I cover key

concepts in detail. Some classes will also include interactive breakout sessions, where I will expect students to participate and work through examples using tools developed in this course. There will also be two days where students prepare short presentations for the class.

5.2 Attendance and Participation

I expect you to attend class in person. Actively engaging during lectures will help discipline you to keep up with new material, ask questions, and interact with your classmates. This course progress quickly, and you do not want to fall behind. I may institute lecture comprehension quizzes if classroom attendance is low.

5.3 Office Hours

I will hold office hours **3:30–4:30pm on Tuesdays** and **9:30–10:30am on Thursdays**, in **Symons Hall 2104**. While I prefer in-person office hours, I am happy to use Zoom on a case-by-case basis. Please feel free to show up unannounced to office hours—no appointments necessary!

5.4 Cell phones and Laptops in the Classroom

Research has shown that electronic devices present an irresistible distraction that detracts from the classroom environment and interferes with learning and active participation. The bottom line is that cell phone or laptop use during class disrupts the learning experience for other students and shows disrespect for everyone.

My expectation is that **all cell phones will be silenced and put away for the duration of each class**. Laptops and tablets will be permitted **only for taking notes and annotating lecture slides**. I will make exceptions for ADS accommodations and for interactive in-class activities. Disregarding this policy may impact your in-class participation grade.

6 Policies and Resources

It is our shared responsibility to know and abide by the University of Maryland's policies that relate to all courses, which include topics like:

- Academic integrity
- Student and instructor conduct
- Accessibility and accommodations
- Attendance and excused absences
- Grades and appeals
- Copyright and intellectual property

Please visit www.ugst.umd.edu/courserelatedpolicies.html for the Office of Undergraduate Studies' full list of campus-wide policies. I am happy to discuss them further if you have questions.

6.1 Contacting Me

Please email me at lpreonas@umd.edu with any personal, academic, or intellectual questions/concerns that you might have. Emailing me directly is safer than messaging me through ELMS, since ELMS-forwarded emails typically bypass my primary inbox. **Please put "AREC422" in the subject line.** Do not be shy about sending follow-up emails if I forget to respond. As a general guideline, please **check the syllabus and ELMS** before emailing questions like "When is the problem set due?".

6.2 Course Announcements

I will send **important** announcements via ELMS messaging. Please make sure that your email and announcement notifications (including changes in assignments and/or due dates) are enabled in ELMS, so you do not miss any messages. You are responsible for checking your email and Canvas/ELMS inbox with regular frequency.

6.3 Communication with Peers

With a diversity of perspectives and experience, we may find ourselves in disagreement and/or debate with one another. As such, it is important that we agree to conduct ourselves in a professional manner. We must work together to foster a classroom environment in which we can respectfully discuss and deliberate controversial questions. I encourage you to confidently exercise your right to free speech—bearing in mind, of course, that you will be expected to craft and defend arguments that support your position. Free speech has its limit, and this course is **NOT** the space for hate speech, harassment, or derogatory language. I will make every reasonable attempt to create an atmosphere in which each student feels comfortable voicing their argument without fear of being personally attacked, mocked, demeaned, or devalued.

Any behavior (including harassment, sexual harassment, and racially and/or culturally derogatory language) that threatens this atmosphere will not be tolerated. Please alert me immediately if you feel threatened, dismissed, or silenced at any point during our semester together and/or if your engagement in discussion has been in some way hindered by the learning environment.

6.4 Disability Accommodations

If you have a documented disability and wish to discuss academic accommodations with me, please email me as soon as possible.

6.5 Learning Assistance

I encourage you to visit tutoring.umd.edu to learn more about the wide range of campus resources available to you. For help sharpening your communication skills, you can schedule a virtual appointment with the campus Writing Center. There are a wide range of resources to support you with whatever you might need (see go.umd.edu/assistance), If you just need someone to talk to, visit counseling.umd.edu. Most services are free because you have already paid for them, and everyone can benefit from these resources . . . all you have to do is ask.

7 Assignments

Exercises	10%
Problem sets	15%
Blog	10%
Paper presentation	10%
In-class participation	5%
Midterm exam	25% (or 20%)
Final exam	25% (or 30%)

7.1 Exercises (10%)

After 10 classes, I will assign a short exercise that applies the material from that day's lecture. These exercises should take around 30 minutes to complete, and they will predominantly involve coding examples in `R`. I will grade them on the ($\checkmark^+$, $\checkmark$, $\checkmark^-$) scale. Each exercise will be due before the start of the next class meeting, and you will turn them in by uploading your `R` code to ELMS. Late exercises will receive a 0, and I will drop your 2 lowest exercise grades. However, **you must eventually complete all exercises, or else you will receive 0 out of 10%**. Exercises are *not* group assignments, and I expect each of you to work through them independently.

7.2 Problem Sets (15%)

There will be 3 problem sets, which will include math, coding, and short-answer questions. While I encourage you to work in small groups on the problem sets, you must each type out and turn in **your own answers** and **your own `R` code**. Duplicate copies will receive 0 credit. I will grade problem sets on a scale of 1 to 5. Late problem sets will lose 1 point per day past their due date.

7.3 Blog (10%)

One goal of this course is to use your knowledge of econometrics to think critically about real-world issues. To this end, you will each be required to find a news article in the popular press, and write a short blog summarizing and analyzing it. The article should relate to a specific topic in economics

or public policy, and your blog should discuss the article's strengths and weaknesses through the lens of applied econometrics. You will post your blog to ELMS for the class to read. I will also require each of you post 2 short comments on *other* students' blogs. This portion of your grade will reflect *both* your own blog *and* your comments on others' blogs. Late blogs will receive zero credit.

7.4 Paper Presentation (10%)

Another goal of this course is to make you better consumers of applied economic research. After spending the semester building your econometric toolkit, you will each give a short presentation to the class on an economics research paper. I will assign you each a paper to read, and you will prepare a short presentation summarizing its research question, econometric strategy, and results.

7.5 In-class Participation (5%)

This portion of you grade will reflect the extent to which you attend class and actively participate. You don't need to be the loudest or most vocal participator to receive a high participation grade. However, actively engaging your peers can provide positive spillovers and help everyone learn more effectively.

To evaluate your participation in an objective manner, I will develop a rubric where you will be able to earn participation credit in select class periods. Note: while I would prefer to focus on ways to earn positive participation credit, it is also possible to earn negative participation credit. Any behavior that is rude, distracting, non-inclusive, or disrespectful of your classmates will hurt your participation grade.

7.6 Midterm (25%) and Final (25%) Exams

The midterm exam will be in class on **Thursday, April 3**. The final exam will be **Thurday, May 15 at 10:30am–12:30pm**, in the normal classroom (Symons 0215). Both will be closed-book written exams, and will not require any `R` coding or numeric calculations. The final exam will cover material from the full semester, with a heavier emphasis on the second half of the course.

If your earn a higher grade on the final than on the midterm, I will adjust the midterm/final grading weights **in your favor**, from 25%/25% to 20%/30%.

8 Grading

8.1 Academic Integrity

The University's Code of Academic Integrity is designed to ensure that the principles of academic honesty and integrity are upheld. In accordance with this code, the University of Maryland does not

tolerate academic dishonesty. Please ensure that you fully understand this code and its implications, as all acts of academic dishonesty will be dealt with in accordance with its provisions. All students are expected to adhere to this code. It is your responsibility to read it and know what it says, so you can start your professional life on the right path. As future professionals, your commitment to high ethical standards and honesty begins with your time at the University of Maryland.

Course assistance websites (such as CourseHero) and AI-generated content (such as from ChatGPT) are not permitted under any circumstances. Any use of AI-generated material would be a violation of academic integrity. Generative AI is prone to inaccuracies and bias, and does not replicate the critical thinking steps necessary for success in this course (and beyond).

Any collaboration on graded assignments is strictly prohibited unless otherwise stated. Please visit the Office of Undergraduate Studies' list of campus-wide policies and reach out if you have questions. If you ever feel pressured to comply with someone else's academic integrity violation, please reach out to me immediately. If you are ever unclear about acceptable levels of collaboration, please ask!

8.2 Grading

I will post all assignment grades on ELMS. If you have a grading question that you would like to discuss, please come to office hours or email me.

Regrade Requests: I take grading very seriously, in order to ensure that I evaluate all students' answers fairly and consistently. If you believe I have made a grading error on an assignment or exam, please email me a clear explanation of the error **within 3 days of the date the assignment was returned**, and I will reevaluate your answer and grade. All regrade decisions are final.

8.3 Letter Grades

Final grades will follow the standard scale:

100.0–97.0	A+	96.9–93.0	A	92.9–90.0	A−		
89.9–87.0	B+	86.9–83.0	B	82.9–80.0	B−		
79.9–77.0	C+	76.9–73.0	C	72.9–70.0	C−		
69.9–67.0	D+	66.9–63.0	D	62.9–60.0	D−	60–0	F

I will curve individual problem sets and exams to adjust for difficulty. If the course ends up being harder than anticipated, I may choose to move the cutoff points for final grades down. However, I will not move the cutoff points up (i.e., to make it harder to get an A).

9 Course Schedule

Lecture	Date	Material*	Reading**
1	Jan 28	Course info; intro to econometrics	W 1.1–1.2
Part I: Linear Regression			
2	Jan 30	Review of math, probability, and statistics	W Appx. A–B
3	Feb 4	Properties of estimators; conditional expectations	W Appx. C, 2.1
4	Feb 6	Linear regressions; deriving Ordinary Least Squares	W 2.2–2.4
5	Feb 11	Assumptions of the Simple Linear Regression	W 2.5
	Feb 13	No class (Louis is traveling)	
	Feb 18	No class (Louis is traveling)	
6	Feb 20	Confidence intervals	W 4.1, 4.3, Appx. C.5
7	Feb 25	Hypothesis tests	W 4.2, Appx. C.6
8	Feb 27	Binary variables; statistical significance	W 4.2, Appx. C.6
9	Mar 4	Multiple Linear Regression: interpretations, assumptions	W 3.1–3.2
10	Mar 6	Multicollinearity, omitted variables	W 3.3–3.5
11	Mar 11	Linear combination tests	W 4.4–4.5
12	Mar 13	Data scaling and functional form	W 6.1–6.2, 9.1
	Mar 18	No class (Spring Break)	
	Mar 20	No class (Spring Break)	
13	Mar 25	Dummy variables and interaction terms	W 7.2–7.4, 6.2
14	Mar 27	Omitted variable bias	W 3.3
15	Apr 1	Heteroskedasticity and robust standard errors; review	W 8.1–8.2
	Apr 3	**Midterm exam (normal room, 11:00am–12:15pm)**	
Part II: Causal Inference			
16	Apr 8	3 types of regressions; introduction to impact evaluation	W 1.4
17	Apr 10	Impact evaluation	
18	Apr 15	Randomized controlled trials	
19	Apr 17	Instrumental variables	W 15.1–15.2
20	Apr 22	Selection on observables designs	
21	Apr 24	Regression discontinuity designs	
22	Apr 29	Time series data; event study designs	W 10.1, 10.4
23	May 1	Panel data; differences in differences	W 13.3
24	May 6	Fixed effects	W 14.1
	May 8	Student presentations	
	May 13	Student presentations	
	May 15	**Final exam (normal room, 1:30–3:30pm)**	

* Lecture topics subject to change

** W = Wooldridge. Readings are optional.