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**Econometric Analysis in Agricultural**

**and Environmental Economics**

**AREC 422, Fall 2022**

**Syllabus**

August 23, 2022

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## 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  Logistics

### 4.1  Class Meetings

This course will meet **in person**, **Tuesdays and Thursdays, 12:30–1:45pm 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.

### 4.2  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.

### 4.3  Regarding the Pandemic

I am optimistic that we are *finally* approaching a return to "normalcy". However, it is quite possible that a COVID spike will force us to change the format of the course mid-semester. If so, flexibility will be key.

For this semester to be a success, we must respect each other's physical health. **Do not come to class if you are feeling sick. If you have a COVID exposure, please take a rapid test and isolate if your test is positive.**

We must also respect our collective mental health, as we are still living through challenging times. Remember to check in with yourselves, and with your classmates. I am happy to discuss any questions or concerns you might have, so that we may establish a safe, welcoming learning environment.

### 4.4  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.

However, **COVID protocols take precedence over in-person attendance**. If you have to miss class due to illness or COVID precautions, I strongly encourage your to review the relevant material that you missed (I will post slides, notes, and exercises on ELMS). I also reverse the right to institute lecture comprehension quizzes if classroom attendance is low.

### 4.5 Office Hours

I will hold in-person office hours **3:30–4:30pm on Tuesdays** and **10:00–11:00am on Thursdays**, in **Symons Hall 2104**. While I prefer holding office hours in person, I am also happy to use Zoom (on a case-by-case basis).

### 4.6 Email

Please email me at lpreonas@umd.edu with any questions, concerns, or ideas 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 reply.

## 5 Course Materials

### 5.1 Software

To learn econometrics, you need to conduct econometric analysis. For this course, we will use the `R` software package (version 4.2.1; 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**.

### 5.2 Textbooks

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).

### 5.3 Notes

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.**

## 6 Grading

The grade breakdown for the course is:

| Exercises | 10% |
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| Problem sets | 15% |
| Blog | 10% |
| Paper presentation | 15% |
| Midterm exam | 25% (or 20%) |
| Final exam | 25% (or 30%) |

**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.

**Problem Sets (15%)**

There will also be 3 longer 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 for each day past their due date.

**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.

**Paper Presentation (15%)**

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.

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

The midterm exam will be in class on **Thursday, October 20**. The final exam will be **Monday, December 19 at 1:30–3:30pm**, 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%.

**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 in 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.

# 7   Campus Policies

It is our joint responsibility to understand and abide by the University of Maryland's policies related to all courses which include topics such as Academic Integrity, student and instructor conduct, accessibility and accommodations, attendance and excused absences, grades and appeals, and copyright and intellectual property. You can find a full list of these policies at http://www.ugst.umd.edu/courserelatedpolicies.html and I am happy to discuss them further if you have questions.

## 8  Course Schedule

| Lecture | Date | Material* | Reading** |
|---|---|---|---|
| 1 | Aug 30 | Course info; intro to econometrics | W 1.1–1.2 |
| **Part I: Linear Regression** | | | |
| 2 | Sept 1 | Review of math, probability, and statistics | W Appx. A–B |
| 3 | Sept 6 | Properties of estimators; conditional expectations | W Appx. C, 2.1 |
| 4 | Sept 8 | Linear regressions; deriving Ordinary Least Squares | W 2.2–2.4 |
| 5 | Sept 13 | Assumptions of the Simple Linear Regression | W 2.5 |
| 6 | Sept 15 | Confidence intervals | W 4.1, 4.3, Appx. C.5 |
| 7 | Sept 20 | Hypothesis tests | W 4.2, Appx. C.6 |
| 8 | Sept 22 | Binary variables; statistical significance | W 4.2, Appx. C.6 |
| 9 | Sept 27 | Multiple Linear Regression: interpretations, assumptions | W 3.1–3.2 |
| 10 | Sept 29 | Multicollinearity, omitted variables | W 3.3–3.5 |
| 11 | Oct 4 | Linear combination tests | W 4.4–4.5 |
| 12 | Oct 6 | Data scaling and functional form | W 6.1–6.2, 9.1 |
| 13 | Oct 11 | Dummy variables and interaction terms | W 7.2–7.4, 6.2 |
| 14 | Oct 13 | Omitted variable bias | W 3.3 |
| 15 | Oct 18 | Heteroskedasticity and robust standard errors; review | W 8.1–8.2 |
|  | Oct 20 | **Midterm exam (normal room, 12:30–1:45pm)** | |
| **Part II: Causal Inference** | | | |
| 16 | Oct 25 | 3 types of regressions; introduction to impact evaluation | W 1.4 |
|  | Oct 27 | No class (Louis is traveling) | |
| 17 | Nov 1 | Impact evaluation | |
| 18 | Nov 3 | Randomized controlled trials | |
| 19 | Nov 8 | Instrumental variables | W 15.1–15.2 |
| 20 | Nov 10 | Selection on observables designs | |
| 21 | Nov 15 | Regression discontinuity designs | |
| 22 | Nov 17 | Time series data; event study designs | W 10.1, 10.4 |
|  | Nov 22 | No class (Thanksgiving week) | |
| 23 | Nov 29 | Panel data; differences in differences | W 13.3 |
| 24 | Dec 1 | Fixed effects | W 14.1 |
|  | Dec 6 | Student presentations | |
|  | Dec 8 | Student presentations | |
|  | Dec 19 | **Final exam (normal room, 1:30–3:30pm)** | |

\* Lecture topics subject to change

\*\* W = Wooldridge. Readings are optional.