

# Syllabus

## ECO 4421: Econometrics (Probability and Statistics for Economists)

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Spring 2021

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### Office Hours

- I will have office hours on Zoom Wednesdays from 15h00 — 15h50 (Period 8). If you plan to arrive after 15h10, please email me in advance (so he knows to stay).
- For questions on the lecture material, please ask those to me. For questions on problem sets, please ask those in the Slack channel (details below), managed by Eli (who will be grading the problem sets).
- Eli will be taking office hours by request. If you have multiple questions that you would rather talk about over Zoom, then reach out to him over Slack (or email but he prefers Slack), and you can schedule a time. He will then let everyone know, so that other people can join if they have questions. Otherwise, you can message your questions in the main channel or a PM over Slack, and he will answer them. Additionally, Eli will be holding Office Hours where he sits in a Zoom call that people can join before problem set submission deadlines and exam dates. Before these occur, he will create the meetings in the “Zoom Conferences” tab on Canvas for you to join.

### Course Description

ECO 4421 introduces students to the theoretical concepts in probability and statistics that form the core of econometrics. The emphasis is on understanding the theoretical concepts that are used by economists to estimate economic relationships and to evaluate policy. The first part of the course focuses on basic probability and statistics. In the last month of the course we apply the theoretical concepts to practical problems that are important in economics. We will discuss an application in development economics (the causal effect of providing fertilizer to farmers in developing countries), an application in labor economics (the causal effect of education on wage), and an application in education economics (the causal effect of class size on test scores). We focus on disentangling causation from correlation, but also discuss other uses of statistics in economics, such as prediction.

The course has the following objectives:

1. Learn fundamental theoretical concepts in probability.

2. Learn the practical *intuition* of general statistical concepts, including standard errors, hypothesis testing, and confidence intervals.
3. Learn to disentangle causation from correlation.
4. Learn the basics of the R statistical programming language.
5. Learn the dangers of relying on assumptions that do not typically hold in economics (e.g., correlation with the error term).
6. Learn to use simulation in R to get hands-on practice with theoretical concepts (such as the Law of Large Numbers), and to explore the consequences of incorrect assumptions.
7. Learn the basics of working with data, being aware of practical issues such as violations of missing-at-random.
8. Understand selection bias and how to interpret results accordingly.
9. Understand the benefit of randomized controlled trials.

## Prerequisites

The prerequisites for this course are: ECO 2013 & ECO 2023 & ECO 3101.

This course will introduce probability and statistics *from the beginning*. Econometrics is probability and statistics for economists, so if you've already taken a rigorous probability and statistics course, you might be bored in this class and you might consider taking a different class (e.g., in the statistics department). Although many students have taken a "statistics" class before, the most common background of students in ECO 4421 is a statistics class that used formulas without really understanding them. In this class, we will develop a strong theoretical understanding of what a standard error is and what a confidence interval is, not just how to calculate them from a formula.

If you look through the Stock & Watson textbook chapters 2 and 3 on probability and statistics, and you already understand that material, you might consider taking a different class.

This class will be divided roughly into three parts:

Part 1: Probability and learning R.

Part 2: Statistics.

Part 3: Causality and working with data.

## Textbook and Readings

The textbook for this course is Stock & Watson's *Introduction to Econometrics* published by Pearson. You may use the third edition, the "updated" third edition, or the fourth edition.

Please keep in mind the following two points:

1. You will be responsible for material from class that is not covered in the textbook.
2. You will be responsible for material from the textbook that is not covered in class.

In other words, it is required to understand the readings and to understand the lectures.

## Optional Textbook

A separate textbook, which is not required, but covers much of the same material, is J. M. Wooldridge, *Introductory Econometrics: A Modern Approach* (sixth edition), South-Western Publishing. If a topic is confusing in lecture, and it is not cleared up by Stock & Watson, consider reading the corresponding section in Wooldridge.

## Software and Programming

Some of the assignments in the course will involve simulation or empirical analysis and will require the use of a statistical software. R is the statistical software for this course. You will likely find RStudio to be a more user-friendly way of using R. You are not required to have any knowledge of R or other programming experience, but you must be willing to learn. R and RStudio are already installed on many computers around campus (e.g., Marston Science Library), as well as on UF apps: <https://info.apps.ufl.edu/published-applications/>. You can also install R on your personal computer—R is free (open source) and available for Windows, Mac, and Linux. To download R, go to: <https://www.r-project.org/>. To download RStudio, go to: <https://www.rstudio.com/products/rstudio/download/> and download the free “RStudio Desktop Open Source License” version.

## Assignments (= “Problem Sets”)

There will be approximately five problem sets (plus or minus one). Please follow the following minimal guidelines for the assignments:

1. Write legibly or use software that can write math.
  - (a) I recommend LyX (or LaTeX in general). LyX is free (open source) and can produce professional quality documents containing math, using the powerful LaTeX typesetting engines. LyX is free and available for Windows, Mac, and Linux: <https://www.lyx.org/Download>
2. You are encouraged to work with other students on the problem sets involving R, but each student must write up their answer separately.
3. For problem sets involving a computer, it is up to you to take the necessary precautions to find a way to turn the problem set in on time. If your computer crashes, or the internet stops working for you and you cannot turn it in on Canvas before the deadline, these are not valid excuses. Turn the problem set in early to avoid these problems, or have a backup system and plan: for example, go to the library to get internet access; and use backup software to protect against the possibility of your computer crashing. In summary, I will not accept the virtual analog of “my dog ate my homework” as a valid excuse.
4. If you have questions regarding the problem set, please either go to the TA’s OH, or send emails to the TA. The TA is responsible for grading the problem sets, so to be sure about what the criteria is, ask him.

## Lecture critiques

You will also be assigned “lecture critiques”. These will sum up to one problem set (i.e., if there are 10 of them then each one is worth 1/10 of a problem set). To pass each one, you must submit a few sentences giving details on any of the following:

- Which slides you found confusing and what in particular (be as specific as possible) you found confusing about them.
- Make a suggestion for what to add to the slides or how to improve them in some way. Even if it is just a matter of grammar or spelling typos, any suggestion is fine.
- Create and solve a simple exercise that involves the material in the slides. It does not have to be a numeric exercise (it can be conceptual).

What to include in your critique is left purposely open-ended. Just be sure that your critique shows that you spent some time studying the lecture. These critiques will be graded pass/fail, and you will not receive feedback on them throughout the semester. At the end of the semester, if you are on the edge between two grades, I will take into account the quality of your critiques in order to determine whether to bump your grade up.

## Exams

There will be three exams. I will announce the dates at least two weeks in advance.

## Online proctoring

Your exams will be on Honorlock this semester. Honorlock is an online proctoring service that allows you to take your exam from the comfort of your home. All that is needed is a computer, a working webcam, and a stable Internet connection. To get started, you will need Google Chrome and to download the Honorlock Chrome Extension. You can download the extension at <https://www.honorlock.com/extension/install>. When you take an exam, log into Canvas, go to your course, and click on your exam. Clicking “Launch Proctoring” will begin the Honorlock authentication process, where you will take a picture of yourself, show your ID, and complete a scan of your room. Honorlock will be recording your exam session by webcam as well as recording your screen. Honorlock support is available 24/7/365. If you encounter any issues, you may contact them by live chat, phone (844-243-2500), and/or email (support@honorlock.com).

## Grades

Your final grade will be calculated as follows:

Exam 1	15%
Exam 2	25%
Exam 3	30%
Assignments	30%
Total	100%

Your final letter grade will be determined as follows:

93–100	A
90–92	A-
87–89	B+
83–86	B
80–82	B-
77–79	C+
73–76	C
70–72	C-
67–69	D+
60–66	D
0–59	E

## Student Responsibility

Enrollment in this course constitutes acknowledgement of the following:

1. I understand that the University of Florida expects its students to be honest in all of their academic work. I agree to adhere to this commitment to academic honesty and understand that my failure to comply with this commitment may result in disciplinary action, up to and including expulsion from the University.
2. I will adhere to university copyright policies as found at <http://guides.uflib.ufl.edu/copyright/>.
3. Students requesting classroom accommodation must first register with the Dean of Students Office. The Dean of Students Office will provide documentation to the student who must then provide this documentation to the Instructor when requesting accommodation.

## Course Outline

1. **Summation Operator**
2. **Probability**  
Stock and Watson, Chapter 2  
Wooldridge, Appendix B
3. **Introduction to R**
4. **Review of Statistical Inference**  
Stock and Watson, Chapter 3  
Wooldridge, Appendix C
5. **Simple Regression**  
Stock and Watson, Chapter 4  
Wooldridge, Chapter 2
6. **Regression: Hypothesis Tests and Confidence Intervals**  
Stock and Watson, Chapter 5  
Wooldridge, Chapter 4

**7. Linear Regression with Multiple Regressors**

Stock and Watson, Chapter 6

Wooldridge, Chapter 3

**8. Inference with Multiple Regressors**

Stock and Watson, Chapter 7

Wooldridge, Chapter 4

## Changelog

Here I will list any important updates made to the syllabus throughout the semester.