Syllabus

ECO 4421: Econometrics
(Probability and Statistics for Economists)

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Course Time and Location

Section 23A5:	M/W	11h45 — 13h40	(Periods 5 & 6).	Location: MAT 0114
Section 2400:	M/W	13h55 — 15h50	(Periods 7 & 8).	Location: MAT 0114

Class will typically end before the end of the period. However, please keep your schedule open in case we need to use the full time for a particular day.

Office Hours ("OH")

- I will have office hours on Zoom Thursdays from 15h00 — 16h00. The meeting URL is here: `https://ufl.zoom.us/j/95984155529?pwd=cTVjQm5vb3d3UVdVZlVoT1VIb0NDQT09`. If you plan to arrive after 15h10, please email me in advance (so I know to wait).

- Jemmy will have office hours on Zoom Tuesdays from 10h00 to 11h00 and is also available for individual meetings.

- I will have office hours the first week, but Jemmy will not.

- For questions on the lecture material, please ask those to me. For questions on problem sets, please ask those to Jemmy (who will be grading the problem sets).

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 summarize, communicate, and 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.

8. 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 recommended 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: R and Probability.
Part 2: Statistics.
Part 3: Causality and working with data.

Lectures

During lecture we often have in-class exercises. I will post a handout of the slides of lecture before each lecture in case you prefer to print them out, but these handouts do not contain the exercises that we do in class. In the handouts, the area where we will do an exercise is blank so that you can fill that area in during class (alternatively you may prefer to write the exercises on a separate sheet of paper).

Textbook and Readings

The lectures are self-contained and the **required reading** is to *study each lecture before the next since each lecture builds on the previous one*. You do not need to read the lecture slides of the next lecture in advance, but it is critical that you review the slides from the previous lecture before the next, and that you clear up any misunderstand that you have before the next lecture.

The recommended 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. It is more important to study the lecture notes, but if you find something confusing in the lecture notes, you might find it helpful to study the recommended or optional (see below) textbooks.

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")

Please follow the following minimal guidelines for the assignments:

1. If you have questions regarding the problem sets, 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.

2. Write legibly or use software that can write math.

   - 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`.

3. Staple your problem sets if needed (otherwise -3 points). I do not bring a stapler. This is your responsibility.

4. Turn your problem sets in at the beginning of class. It is not fair to others if you turn them in later.

5. Show your work. Even if you get the correct answer, you will often be penalized many (possibly most) of the points if you do not show your work for how you arrived at an answer.

6. You are encouraged to work with other students on the problem sets, but **each student must write up their answer separately**. There should not be any part of your problem set that is the same or that is just a rewording of what someone else wrote.

   - The only exception to this is that some of the lines of your R commands can be copied. When this is the case, please state explicitly who you copied the R code from. Even if you copy R code, it is still your responsibility to fully understand what you copied.

7. 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 reasons to be granted extensions to turn problem sets in late. Turn the problem set in early to avoid these computer-related problems In summary, I will not accept the virtual analog of "my dog ate my homework" as a valid excuse.

8. You may drop one problem set. I strongly encourage you to do all of the problem sets and plan to complete all and turn all in. The reason I allow for one drop is that you might have an unexpected but unexcused reason for not turning one in: perhaps you finished your problem set but the day it was due you forgot it at home; or you just forgot to take it out of your bag and turn it in; or your computer crashed right and you did not have a backup.

Lecture Critiques

You will also be assigned "lecture critiques". To pass each one, you must submit a few sentences giving details on at least one or more of the following:

1. Make a specific suggestion for what to add to the slides or how to improve them in some way.

   (a) If you propose the addition of a new slide, be very specific. Draw on a paper exactly how you imagine the slide, rather than giving a vague description. Also specify the current slide after which the new slide should be placed.

   (b) The suggestion may be small, such as a grammar improvement or spelling typo.

   (c) Instead of suggesting to add a slide, you could suggest to remove a slide. If this is the case, please be very specific in your explanation of why you think a slide should be removed. You need to say more than just "this slide was confusing so it should be removed."

   (d) You might suggest some humor that relates to one of the slides, or concepts. For example, you might suggest a specific meme for a slide. The point of this is that suggesting a joke or meme pushes you to understand the concept, and also to think about how to communicate it.

2. Which slides you found confusing and what in particular (be as specific as possible) you found confusing about them. This critique must be constructive in some way (i.e., lead to a potential improvement in the slides). You do not have to come up with the exact way to improve them, as in (1) above, but you must say something like "give a second example about abc because it is not clear from the first example because the first example only does xyz".

3. 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). Please do not copy an existing exercise and just change the numbers.

Your critique should show that you spent some time studying the lecture. These critiques will be graded as 0/80/100. 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 course grade up.

The goal of these lecture critiques is to give you a gentle push to study each lecture before the next one, as well as an opportunity for you to point out improvements that could help students in future semesters of econometrics.

Exams

There will be three exams. You will not be able to use a calculator. The location and times of all exams are the same as our normal class location and time. The tentative dates for the three exams are as follows:

Exam 1: Monday, 20 September
Exam 2: Monday, 25 October
Exam 3: Wednesday, 8 December

If you have an excused conflict (e.g., a religious holiday) with any ECO4421 class this semester, or if you have two other exams on one of the exam dates listed above, please email me by the end of the first week of class.

Grades

Your final grade will be calculated as follows:

Exam 1	15%
Exam 2	25%
Exam 3	25%
Assignments	30%
Lecture critiques	5%
Total	100%

We use Canvas for the individual assignments and exam grades, but to calculate your overall grade please aggregate the individual grades according to the weights listed above. 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

Attendance Policy and Behavior

Irregular attendance or inattentiveness will most likely result in a substantial reduction in course performance. Econometrics requires participation and attention. Please shut off or put away laptops, tablets, phones and other electronic devices or toys during class, unless asked otherwise. Also notify me if you will be absent from class. I adhere to the UF attendance policy, described in detail at `https://catalog.ufl.edu/ugrad/1718/regulations/info/attendance.aspx`.

Student Responsibility

Enrollment in this course constitutes acknowledgment of the following:

1. You are expected to wear approved face coverings at all times during class and within buildings even if you are vaccinated. Please continue to follow healthy habits, including best practices like frequent hand washing. Following these practices is our responsibility.

   - Course materials will be provided to you with an excused absence, and you will be given a reasonable amount of time to make up work.

2. Check your emails at least once a day. It is your responsibility to make sure you do not miss an email from me. I use the email list to communicate important information. Every time that a student thought they did not receive an email from me in the past, after investigating we have discovered that they did indeed receive it and they just incorrectly processed it (e.g., they deleted it accidentally because they did not realize it was a class email). It is your responsibility to make sure you do not incorrectly process emails.

3. 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.

4. I will adhere to university copyright policies as found at `http://guides.uflib.ufl.edu/copyright/`.

5. 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.

6. Students are allowed to record video or audio of class lectures. However, the purposes for which these recordings may be used are strictly controlled. The only allowable purposes are (1) for personal educational use, (2) in connection with a complaint to the university, or (3) as evidence in, or in preparation for, a criminal or civil proceeding. All other purposes are prohibited. Specifically, students may not publish recorded lectures without the written consent of the instructor.

Course Outline

1. **Summation Operator**

2. **Introduction to R**

3. **Probability**
   Stock and Watson, Chapter 2
   Wooldridge, Appendix B

4. **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.

- v1 (2021-08-18): the initial syllabus.