

University of Maryland-College Park, Department of Economics  
Master of Science in Applied Economics Program  
Fall 2022

## ECON 687: Economic Applications of R Programming

Instructor: Yesol Huh

Email: [yhuh@umd.edu](mailto:yhuh@umd.edu)

Office hours: Mondays 5-5:45PM via Zoom

Teaching assistant: Zhenxun Liu

Email: [zliu1995@umd.edu](mailto:zliu1995@umd.edu)

Office hours: Wednesdays 5-6PM via Zoom

Lectures (zoom): Thursdays 6:30-9:00PM

Midterm Exam (in-person): October 20, 6:30-8:30PM

Final Exam (in-person): December 15, 6:30-9:30PM

### Lectures

Each Thursday, the class will meet online on 6:30-9:00PM, with a 30 minute break around 7:30PM. Students are highly encouraged to keep their camera on during the meetings. The weekly in-person meetings are a mix of lecture and lab exercises.

## General Description and Overview

This course builds on the data analysis and econometric skills learned in the Empirical analysis sequence of ECON 643, 644, and 645. The STATA skills acquired in that sequence, such as basic data manipulation and econometric estimation, will be extended to the R programming language. The fundamentals of more advanced scientific programming—objects, data structures, loops, functions—will be introduced with applications to economics and the social sciences. This course will place emphasis on working with real-world data. Additional emphasis is placed on good coding practices and reproducible research using R Markdown. Students are expected to know the econometrics concepts covered in ECON 643, 644, and 645.

## Workload and Expectations

This course does not assume that you have had any prior programming experience outside of Stata. That being said, if Stata is your only programming experience, you should expect to put in

significant amount of work each week. If you have had significant prior programming experience, especially in R, you might find that the first half of the course moves somewhat slow for you.

Mastering the material covered in this course requires a significant amount of work outside of class. Students should expect to spend more time outside of class than in class – typically at least twice as much time.

## Learning Outcomes

Our program has 7 general learning outcomes for students:

- 1: Ability to understand, evaluate and analyze economic data**
- 2: Ability to understand and interpret statistical evidence from economic data**
- 3: Ability to apply empirical evidence to assessing economic arguments**
- 4: Ability to apply macroeconomic theories to policy discussions
- 5: Ability to apply microeconomic theories to policy discussions
- 6: Ability to communicate economic ideas to a broader audience**
- 7: Ability to evaluate the effectiveness of policy programs using sound economic techniques**

The learning outcomes that pertain to this course are: 1, 2, 3, 6 and 7

Students will generalize existing knowledge of STATA to R. Students will establish basic competency in scientific programming tools and concepts in R. Students will be able to compose readable, professional code.

## Textbook

The course covers selected material from the following publications. All are publicly available for free online.

- Hadley Wickham & Garrett Grolemund, “R for Data Science,” available for free at <https://r4ds.had.co.nz/>
- William N Venables et al, “An Introduction to R,” available at <https://cran.r-project.org/doc/manuals/r-release/R-intro.pdf>
- Florian Oswald et al, “Introduction to Econometrics with R,” available at <https://scpoecon.github.io/ScPoEconometrics/>
- Florian Heiss, “Using R for Introductory Econometrics,” available for free at <http://www.urfie.net/>
  - The free version is available as a HTML5 online book and may be somewhat difficult to navigate online. If you prefer, you can purchase a PDF copy online or a hardcopy through Amazon

## Logistics

- Required Statistical Software: R and R Studio. (All are free and setup information will be covered in the beginning of the course.)

## Graded Course Components

There are 5 graded components to the course. The 5 components and their relative weights in the course grade are: in-class participation (5%), assignments (20%), course project (25%), midterm (20%), and the final exam (30%).

### In-class discussions (5%)

Students will participate in class with questions and suggestions about the material being covered and during the various programming tasks. The participation will be graded on a 5-point scale.

### Assignments (20%)

There are four assignments over the course of the semester. HW assignments will always be posted to the Assignments section of the course ELMS/Canvas page. Input data file will either be supplied or a description of where to obtain the dataset will be included in the assignment. I expect you to submit an R Markdown file that I am able to run from my own machine. Students are also required to submit the knitted output file.

Assignments should be submitted through ELMS by 6PM on the due date. No late work will be accepted. Each assignment will be graded on a scale of 10, and each question will specify the number of points attached to it.

### Course Project (25%)

Students will replicate findings from an empirical paper published in an economics journal with publicly available data. Students will work in groups of 2 or 3, and each group will submit one report. All students will be replicating the same paper that the instructor chooses. This will include a mix of econometric results as well as tables and data visualizations.

Crucially, aside from the programming work, students should also describe both the intuition and econometric foundations of what they're replicating, and contextualize it within the rest of the paper. Students should also discuss their replication results, whether and how their replication results differ from that of the original paper, and provide feedback about the original paper. Examples of reports and expectations will be provided in class and on the ELMS/Canvas website.

The final product will be a zipped folder containing all code necessary to run the analyses so that I can download the file and run it without issue, as well as a written report as described above. I prefer the report to be in a R Markdown file with the report and the analysis/code integrated, but it is also okay to submit a report written in Word or LaTeX.

Students will complete the course project work in 5 installments (see the “Tentative Schedule” for due dates), with 2 being major deadlines and 2 being quick check-ins.

- First check-in (1 point)
- Complete first draft, including descriptive analysis (7 points)
- Second check-in (1 point)
- Final draft of completed course project (16 points)

Additional details will be provided in class and on the course’s ELMS/Canvas website.

### Midterm (20%)

Midterm will be a 2 hour in-person exam on October 20, 6:30-8:30PM. Students need to plan to take the exam in person on campus. Students should bring their own laptop to the exam.

I will prepare an exam that I think students should be able to solve in 75 minutes, though students are welcome to use the entire exam time.

The midterm is open note, open book, open internet. Students can use whatever notes they like, including online resources. But students may not communicate with anyone except the proctor during the exam. Any student caught using a cell phone, email, or communicating with anyone in any way will receive a zero. Students who spend too much time leafing through books and web pages will run out of time.

### Final Exam (30%)

Final exam will be a 3-hour in-person proctored exam on December 15, 6:30-9:30PM. Students need to plan to take the exam in person on campus. Students should bring their own laptop to the exam.

I will prepare an exam that I think students should be able to solve in 2 hours, though students are welcome to use the entire exam time. The final exam will be cumulative. Most or all of the exam will consist of a series of empirical problems to be solved using R and submitted electronically. There may be additional questions on general programming concepts.

The final is open note, open book, open internet. Students can use whatever notes they like, including online resources. But students may not communicate with anyone except the proctor during the exam. Any student caught using a cell phone, email, or communicating with anyone in any way will receive a zero. Students who spend too much time leafing through books and web pages will run out of time.

### Final Course Grades

At the end of the term, every student will have a numerical course grade between 0 and 100. I will decide upon the numerical cutoffs between various letter grades based on my professional judgement. I will consider students' performance relative to the class. I will also consider absolute standards of professional competence. The cutoffs that I use will respect the ordinal ranking of numerical course grades. No student with a given numerical course grade will receive

a lower letter grade than someone else with a lower numerical course grade. At my discretion, I might give an A+ to one or two students at the very top of the grade distribution.

## Tentative Schedule

lecture	date	material	Assignments	Class project
1	9/1	Intro to R, part 1		
2	9/8	Intro to R, part 2		
3	9/15	Introduction to tidyverse and visualizing	HW 1 due	Submit group members
4	9/22	Data wrangle 1: tidying, data import, dates		
	9/29	<i>No class on 9/29. This class will be made up on Saturday 10/15</i>		
5	10/6	Data wrangle 2: summarizing & control (if/else)		Check-in #1
6	10/13	Tidying, visualizing, and summarizing with actual data	HW2 due	
7	Saturday 10/15 11AM-1:30PM	Linear regression models		
8	10/20	Midterm exam – Proctored in-person exam in College Park		
9	10/27	Causal inference 1: Cross-sectional data		Draft 1 due
10	11/3	Functions		
11	11/10	Causal inference 2: Panel data, fixed effects	HW3 due	
12	11/17	Causal inference 3: Instrumental variables		Check-in #2
	11/24	<i>Thanksgiving day – no class</i>		
13	12/1	Binary choice models	HW4 due	
14	12/8	Review & advanced topics		Final draft due
15	12/15	Final exam – Proctored in-person exam on Campus in College Park		

## Other Logistics

Policies related to all graduate courses at the University of Maryland are posted on this page of the Graduate School's website:

<https://gradschool.umd.edu/faculty-and-staff/course-related-policies>

Please familiarize yourself with these policies related academic integrity, non-discrimination policy, accessibility, absences and accommodations, grading, academic standing, grievance procedures, and other important policies.

**COVID Policies:** Up-to date information about UMD COVID-19 policies and guidance are posted at

<https://umd.edu/4Maryland>

Given the evolving nature of the pandemic, the guidance and polices are subject to change. The plans are always coordinated with state and county health officials, with additional guidance provided by the University System of Maryland. The focus will always be on the health and well-being of our entire campus community.

We strongly urge all students, staff and faculty to read announcements they receive about COVID related guidance and policy, and to stay familiar with the information. We thank you all for your individual efforts to help protect the collective health of our entire community.

**Laptop Computer Requirement:** Completing some of this course's requirements will require a laptop computer (not a notebook or a tablet!) with at least 1 GB of RAM and at least 5 GB of free space available on the hard-drive. We recommend laptops with at least a 15-inch screen. Screens smaller than 13 inches are probably not practical.

**Work Load:** Mastering the material covered in this course requires a significant amount of work outside of class. Students should expect to spend more time outside of class than in class – typically at least twice as much time.

**Academic Progress:** The graduate school requires that students maintain a GPA of at least 3.0. Students whose cumulative GPA falls below 3.0 will be placed on academic probation by the graduate school. Students on academic probation must ask the program's director to petition the graduate school if they want to remain in the program. The petition must include a plan for getting the student's GPA up to at least 3.0. Students who do not live up to their plan can be forced to leave the program without having earned the degree. Note: a grade of "B" corresponds to a GPA of 3.0. A grade of "B-" corresponds to a GPA of 2.7.

**Excused Absences:** If you miss any class meetings for any reason, you are still responsible for all material covered during the meeting you missed. It is your responsibility to work with study partners, the teaching assistant, and the instructor to make sure you catch up on the missed material. Instructors routinely facilitate things by posting lecture notes, etc.

If you need to miss an exam or other graded course requirement because of illness, injury, or some other emergency: Follow doctor's orders and get documentation. Get in touch with the instructor as soon as you're able – preferably prior to missing the exam or deadline. Communicate with the instructor to make up the course requirement as soon as possible. You are entitled to recover before you make up the course requirement, but you are not entitled to extra days to study beyond the time the doctor's note says you've been incapacitated. If you are incapacitated for more than a week or so beyond the end of the term,

your grade in the course will be an “Incomplete.” In such cases you must negotiate a plan with your instructor for completing the course requirements. Once you make up the course requirement the instructor will change your "I" to the appropriate letter grade.

**School Closings and Delays:** Information regarding official University closing and delays can be found on the campus website and the snow phone line: (301) 405-SNOW (405-7669) The program director will also announce cancellation information to the program as an announcement on the program’s ELMS/Canvas site. This will generally be done by 1:00 p.m. on days when weather or other factors are an issue. When classes need to be canceled during the semester, we make every effort to schedule makeup classes.

**UMD Counseling Center:** Sometimes students experience academic, personal and/or emotional distress. The UMD Counseling Center in Shoemaker Hall provides comprehensive and confidential support services that promote personal, social, and academic success. The cost of these services is covered by the fees you already paid when you registered for classes, and there is no additional charge if you use the services. Proactively explore the range of services available, including the Counseling Service, Accessibility and Disability Service, and the Testing Office, all described at <http://www.counseling.umd.edu/>

**Graduate Academic Counselor:** The UMD Graduate School also has an academic counselor available to support students who are having difficulty navigating mental health resources on campus, are considering a leave of absence and/or need assistance finding mental health care off campus. The Graduate Academic Counselor also facilitates bi-weekly Graduate Student Circle Sessions which provide an opportunity to learn about resources and connect with other graduate students. Students can learn more about the Graduate Academic Counselor by going to: <https://gradschool.umd.edu/gradcounselor>

**Course Evaluations:** Near the end of the term, you will receive an email inviting you to submit a voluntary and anonymous course evaluation. Your feedback on courses will be very helpful in improving the quality of instruction in our program.

**Access to Morrill Hall and Morrill 1102:** Morrill Hall is locked every day from 7:00 p.m. - 7:00 a.m. Your university ID gives you swipe access to the back door of the building. There is keypad access to the door of Morrill 1102. The code will be shared with students by the program coordinator.