University of Maryland-College Park, Department of Economics
Master of Science in Applied Economics Program
Fall 2021

ECON 687: Economic Applications of R Programming

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

Lectures (zoom): Tuesdays 6:30-7:15PM, 7:30-8:15PM
Final Exam (in-person): December 7, 6:30-9:30PM

Lectures

Each week there will be two synchronous online class meetings of 45 minutes each on Tuesday, from 6:30 to 7:15PM and then from 7:30 to 8:15PM. Generally speaking, first meetings will be lectures and second meetings will be lab sessions and student presentations. Students are highly encouraged to keep their camera on during the meetings.

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. Additional emphasis is placed on good coding practices and reproducible research using R Markdown. This is not an econometrics class—I will review econometric concepts briefly during lectures, but since they were already covered in ECON 643, 644, and 645, the expectation is that students will already know the econometrics concepts.

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.

Required Textbook

- Hadley Wickham & Garrett Grolemund, "R for Data Science," available for free at https://r4ds.had.co.nz/
- 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 4 graded components to the course. The 4 components and their relative weights in the course grade are: assignments (30%), course project (25%), presentation (10%), and the final exam (35%).

Assignments (30%)

There are five 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. The lowest score out of the five assignments will be dropped automatically. For this reason, there will be no exceptions.

Each assignment will be graded on a scale of 10, and each question will specify the number of points attached to it. I will drop the lowest score and use the other four scores. For instance, if the student had scores of 4, 6, 9, 8, 10: this will translate into course point of $(6+9+8+10)/40*30 = 24.75$ points.

Final Exam (35%)

Final exam will be a 3-hour in-person proctored exam on December 7, 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.

Each question will be worth some number of raw points. The proportion of total course exam points will depend on the proportion of total raw points earned on each exam. So a student who has earned 86% of all the possible raw Final Exam points will receive 30.1 of the 35 possible Final Exam points ($0.86*35 = 30.6$).

Course Project (25%)

Students will replicate findings from an empirical paper published in an economics journal with publicly available data. Students can either work solo or pair up for this project. This will include a mix of econometric results as well as tables and data visualizations. After the second class, I will post a google sheet with a list of papers, and students can add their names to the paper that they would like to work on. There can be at most two students working on the same paper (either separately or together). If you would like to replicate a paper that is not on the list, please email the instructor with the paper. In that case, you are responsible for finding the data, and you should upload the data when submitting the project.

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 data and 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.

Besides the project milestones that are a part of the Presentations as described below, students will complete the course project work in 3 installments (see the "Tentative Schedule" for due dates)

- Complete project proposal, indicating which descriptive analysis and main tables will be replicated (2 points)
- Complete first draft, including descriptive analysis (8 points)
- Final draft of completed course project (15 points)

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

Presentations (10%)

Each student will give a short (10-20 minute) presentation at some point during the term (along with their partner if the work is done in pair). The presentation will be of work in progress on the course project. We will have 1 or 2 student presentations per week, beginning after Week 8. The presentations will consist of an introduction to the paper being replicated, as well as discussion of a few results that the students have chosen to replicate. Students are expected to discuss some of the R code they have used in their replication project.

Presenters are required to send complete first drafts of their presentation to me via email at yhuh@umd.edu by noon on the Thursday before they present. I will reply with feedback by end of Friday. The actual presentation must include revisions that address the feedback. Final drafts are due at the same email address by 5:00 PM on Tuesday.

Online discussions (non-graded component)

Because programming is best learned by trial-and-error, in each lecture slides (or associated R code) that is posted online, I will include two or three short programming tasks. Completing these programming tasks are optional but highly encouraged. Students can discuss these tasks on the online discussion board. If there is demand, the TA will also go over these tasks during the office hours.

More generally, students can use the online discussion board to post questions about their class project or material covered in class. I will check the online discussion board twice a week.

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. Highly competent students will get A's. Barely competent students will get B's. Incompetent students will get B-'s or worse. 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.

Tentative Schedule

lecture	date	material	Assignments	Class project
1	8/31	Introduction to R; objects in R		
2	9/7	Data manipulation and tidyverse		
3	9/14	Plotting (ggplot2) and R Markdown		
4	9/21	Data wrangle: data import, dates	HW1 due	Project proposal due
5	9.28	Data wrangle 2 & control (if/else)		
6	10/5	OLS, standard error corrections	HW2 due	
7	10/12	Time series analysis		
8	10/19	Functions	HW3 due	
9	10/26	Panel data 1: simple pooled data, diff-in-diff		
10	11/2	Panel data 2: Fixed effects, Instrumental variable		Draft 1 due
11	11/9	Probit and Logit models	HW4 due	
12	11/16	Functional (map, apply)		
13	11/23	Advanced plotting		
14	11/30	Review & advanced topics	HW5 due	
15	12/7	Final exam		Final draft due

Other Logistics

Course Website: Copies of the course syllabus, your grades, and other relevant links and documents will be posted on the course's ELMS/Canvas website. You can access the site via www.elms.umd.edu. You will need to use your University of Maryland "directory ID" and password.

Email: The University has adopted email as the primary means of communication outside the classroom, and I will use it to inform you of important announcements. Students are responsible for updating their current email address via http://www.registrar.umd.edu/current/ (Under the first major heading of "Online Transactions" there is a link to "Update Contact Information".)

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 Integrity: The University of Maryland has a nationally recognized Code of Academic Integrity. You should inform yourself about the UMD policies related to academic misconduct:

https://www.studentconduct.umd.edu/home/current-students

Cases of academic misconduct, including plagiarism and giving or receiving unauthorized assistance on exams, will be referred to the UMD Office of Student Conduct. If found responsible for academic misconduct, students can be subject to sanctions. The standard sanction for graduate students found responsible for cheating on exams is expulsion from the university.

Student Conduct: Students are expected to treat each other with respect. Disruptive behavior of any kind will not be tolerated. Students who are unable to show civility to one another or myself will be referred to the Office of Student Conduct. You are expected to adhere to the Code of Student Conduct.

Excused Absences: The University of Maryland's policy on excused absences is posted here: http://www.president.umd.edu/administration/policies/section-v-student-affairs/v-100g
     Please note:
     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 – not the instructor's – 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're 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. If classes need to be cancelled during the semester, it may be necessary to move the final exam back a week so missed classes can be made up.

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

Students with Disabilities: The University of Maryland does not discriminate based on differences in age, race, ethnicity, sex, religion, disability, sexual orientation, class, political affiliation, or national origin. Reasonable accommodations will be arranged for students with documented disabilities. Students who have an accommodations letter from the Accessibility and Disability Service (ADS) should meet with me during the first few weeks of the semester to discuss and plan for the implementation of your accommodations. If you require reasonable accommodations but have not yet registered with ADS, please contact the Accessibility and Disability Service at 301-314-7682 or adsfrontdesk@umd.edu.

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.

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.

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.

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.

Covid-19 Information: https://umd.edu/4Maryland
    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 posted at https://umd.edu/4Maryland. We thank you all for your individual efforts to help protect the collective health of our entire community.