Overview

This course builds on the brief introduction to time series econometrics offered in ECON 645. Students will learn the theory of stationary and non-stationary processes and how this theory applies to econometric techniques for estimation and forecasting based using time series data. The techniques will be applied in macroeconomic, financial, and business applications. More specifically, the topics covered include, among others, autoregressive-moving average processes, filters, vector autoregression models, and non-stationary time series analysis. Time permitting; special topics in time series will also be covered.

We will delve into the theory of time series, but we will greatly focus our attention on the application of this theory to data analysis. We will do so by engaging extensively in the use of R. This class attempts to be, to the greatest extent possible, self-contained, and we will be covering both time series as well as the fundamentals of working with R.

Reading Material

Required Textbook
Walter Enders, *Applied Econometric Time Series*. 4th Edition, Wiley. 2015. ("WE")

Recommended Texts

- Francis Diebold; *Elements of Forecasting*. 4th Edition, Cengage. 2007. ("FD")

- Lutz Killian & Helmut Lutkepohl, *Structural Vector Autoregressive Analysis*. Cambridge University Press. 2017. ("LK")

  A pdf version of the Fourth Edition to Diebold can be found here: https://www.sas.upenn.edu/ fdiebold/Teaching221/FullBook.pdf

- Robert Shumway & Davind Stoffer, *Time Series Analysis and Its Applications*. 4th Edition, Springer Texts. 2017. ("SS")

We will also rely on my own set of notes developed on these topics which will be distributed throughout the semester.

Learning Objectives

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, 4, 6.

Grading Scheme

25%	Problem Sets
25%	Midterm Exam
10%	Class participation and online discussions
40%	Empirical projects and class presentation

The course will be graded on a curve. I will assign letter grades based on each student's final overall score and my professional judgment. The cutoffs used will respect the ordinal ranking of the numerical course grade. That is to say, students with a sufficiently higher numerical final course grade will receive a higher letter grade than those with a lower numerical course grade. Roughly speaking, having an overall score one standard deviation above the class average typically implies a letter grade of "B+" or above.

While I will not assign letter grades to individual evaluation components, I will circulate key statistics of the distribution of grades of each assignment. For example, I will make public the max, mean, median, as well as some percentiles of the distribution of the midterm examination.

Empirical Projects

Students will be required to work on two empirical projects throughout the semester. These projects will be done in small groups and mimic the style of brief (i.e.: max 5 pages) policy memos, or research notes written for a professional audience. The first project (worth 10% of the final grade) will entail the estimation of a VAR model in an attempt to understand the effects of monetary policy.

The second project (worth 30% of the final grade) will involve the development of an econometric model to forecast US inflation. Students will submit their projections no later than the end of the penultimate class, and we will compare these forecasts with the figures released by the BLS shortly thereafter.

Students will also perform a critical evaluation of their results in twenty minute presentations towards the end of the course. Presentations should introduce and explain each group's model, as well as analyze the main drivers behind their performance and potential sources of improvements. Lastly, in order to provide an opportunity for bonus points, I will provide my own inflation forecast. Any model that performs better than mine will receive extra credit.

Practice Problems

There will be four problem sets (roughly one every two weeks) throughout the semester. These practice problems represent an important part of the learning experience, as well as a guide as to what to expect in the midterm examination. Problem sets have both required and optional questions, with only required problems being expected by the due date. Students are encouraged to collaborate and consult each other, but must submit their individual answers. Solutions to these practice problems will be provided immediately after each problem set's deadline, so late submissions will not be accepted. Please plan accordingly.

Given the ongoing covid-19 situation all submissions must be made electronically and exclusively via ELMS. Students are encouraged to either type their answers, or to create a pdf document of their scanned responses (this can be done via a plethora of smartphone applications in case a scanner is unavailable). In either case, files should be submitted via ELMS before the corresponding deadline.

Online Discussions

For each online discussion you will earn a grade between 0 and 100. Your final online discussion grade is a simple average of your online discussion grades throughout each discussion of the semester. People who do not contribute anything of merit will get zeros. People who make insightful and constructive contributions will get 100.

Class Schedule

Class #	Date	Topic	Readings	Note

MODULE 1: Stationary Models

Class #	Date	Topic	Readings	Note
Class 1	06/01/21	Introduction to Time Series & Preliminaries	WE:1	Groups assigned
Class 2	06/08/21	Stationary Univariate Models	WE:2	Problem Set 1 posted
Class 3	06/15/21	Stationary Univariate Models	FD:7 & 8	Empirical Project 1 assigned
Class 4	06/22/21	Stationary Multivariate Models	WE:5	Problem Set 1 due
				Problem Set 2 posted
Class 5	06/29/21	Stationary Multivariate Models	LK:2 & 4	

MODULE 2: Forecasting Principles & Non-stationary Models

Class #	Date	Topic	Readings	Note
Class 6	07/06/21	Principles of Forecasting	WE:2	Problem Set 2 due
			FD: 3-8	Empirical Project 2 assigned
Class 7	07/13/21	MIDTERM EXAM		Empirical Project 1 due
Class 8	07/20/21	Non-stationary Models	WE:4	Problem Set 3 posted
Class 9	07/27/21	Cointegration Analysis	WE:6	

MODULE 3: State Space Models

Class #	Date	Topic	Readings	Note
Class 10	08/03/20	State Space Models	SS:6	Problem Set 3 due
				Problem Set 4 posted
Class 11	08/10/21	Dynamic Factor Models	SS:7	Forecasts due
Class 12	08/17/21	Final Student Presentations		Problem Set 4 due

Standard Policies of the University of Maryland

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 viawww.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".)

Contact Hours: Three credit master's-level courses at the University of Maryland require a minimum amount of contact between instructors and students. Our courses' 12 weekly meetings only satisfy 80% of the university's contact requirement. The other 20% is satisfied by weekly mandatory and graded online contact. In principle, the contact hours requirement could be satisfied by scheduling 3 additional 150-minute meetings per term, or 6 additional 75-minute meetings, or 10 additional 45-minute meetings. But in practice the contact hours requirement is satisfied by the weekly online discussions. The weekly online discussions are a more flexible way to ensure that our program's courses in DC provide the same level of student-instructor contact as the traditional 15-week face-to-face version of the same course when it is taught on campus in College Park.

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. The courses in our DC program are 12-week courses that cover all the same material as a traditional semester-long 3-credit course (15 weeks). The compressed schedule makes it possible to complete our degree in just 15 months if you take 2 courses each term. But the compressed schedule also implies an accelerated pace with an average of 25% more work per week in a given course (15/12 = 1.25). The normal full-time load in a master's program is 3 courses per semester, or 6 courses per year. The weekly work load when taking 2 of our DC courses per term is equivalent to the load from 2.5 "normal" 15-week courses - so 2.5/3.0=83% of a full-time load. Students who take 2 courses per quarter in our program complete 8 courses per year. So over the course of a year, taking 2 courses per quarter in our DC program is equivalent to 133% of a full-time load (8/6 = 1.33).

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 here: 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. Last, please note that the exams in this course will ask students to affirm the UMD Honor Pledge: "I pledge on my honor that I have not given or received any unauthorized assistance on this assignment/examination."

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 get yourself caught up in the course. 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). Since our program is an evening program in downtown Washington, DC, rather than a day program in College Park, we do not always cancel classes on the same days as the College Park campus. The program director will always 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.

UMD Counseling Center: Sometimes students experience academic, personal and/or emotional distress. The UMD Counseling Center in Shoemaker Hall provides comprehensive 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, Learning Assistance Service, and the Testing Office, all described at http://www.counseling.umd.edu/

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 week of the term 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.

Academic Progress: The UMD 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 enrolled 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 have their enrollment in the program terminated 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.

Students should not be coming to our suite on 16th Street until after the District of Columbia lifts social distancing restrictions, and after our program announces that it's OK to begin using the suite.

Laptop Computer Requirements: 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 a 15-inch screen. Screens smaller than 13 inches are probably not practical.

Because this course is being taught online, you will also need to have a webcam and a microphone. Students are expected to participate in the class meetings and office hours with their camera turned on.