Econ 684

Applied Time Series Analysis and Forecasting

MS in Applied Economics
Summer 2022

Instructor Info —

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Online

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Course Info —

Prereq: Econ 641, 642, 645

Tuesdays

6.45 - 9.30pm

1400 16th st NW, Suite 140

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 will greatly focus our attention on the application of these methods to data analysis. We will do so by engaging extensively in the use of R. This class aims to be, to the greatest extent possible, self-contained, and will cover time series theory as well as the basics of working with R.

Reading Material

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

Recommended Texts

- Thad W. Mirer, *Economic Statistics and Econometrics*. 3rd Edition. ("TM")

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

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

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

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

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

15%	Problem Sets
50%	Midterm (20%) and Final (30%) exams
10%	Online discussions and class participation
25%	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.

Exams

There will be one midterm exam worth 20% of the final grade, which will include the material covered until Class #5 inclusive. There will also be a comprehensive final exam worth 30% of the final grade. Please refer to the Class Schedule for each exam date. All exams are closed book and will not include any computational topics. You will only need pen and paper.

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 15% 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.

Problem Sets

There will be three problem sets 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 and final 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.

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 0-100. Your final online discussion grade is a simple average of your online discussion grades throughout 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	05/31/22	Statistical Preliminaries		
Class 2	06/07/22	Stationary Univariate Models	WE:1-2	Problem Set 1 posted
Class 3	06/14/22	Stationary Univariate Models	FD:7 & 8	Groups assigned
				Empirical Project 1 posted
Class 4	06/21/22	Stationary Multivariate Models	WE:5	Problem Set 1 due
				Problem Set 2 posted
Class 5	06/28/22	Stationary Multivariate Models	LK:2 & 4	

MODULE 2: Forecasting Principles & Non-stationary Models

Class #	Date	Topic	Readings	Note
Class 6	07/05/22	Principles of Forecasting	WE:2	Problem Set 2 due
			FD: 3-8	Empirical Project 2 assigned
Class 7	07/12/22	MIDTERM EXAM		Empirical Project 1 due
Class 8	07/19/22	Non-stationary Models	WE:4	Problem Set 3 posted
Class 9	07/26/22	Cointegration Analysis	WE:6	

MODULE 3: Advanced Topics

Class #	Date	Topic	Readings	Note
Class 10	08/02/22	State Space Models	SS: 6 & 7	
Class 11	08/09/22	Empirical Project 2 Presentations		Problem Set 3 due
				Forecasts due
Class 12	08/16/22	FINAL EXAM		

Other Standard Policies of the University of Maryland

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.

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. The University creates an "@umd.edu" email address for every graduate student. All official UMD communications will be sent to students at their "@umd.edu" email address. You are responsible for reading your @umd.edu email address, including ELMS/Canvas Announcements I send to the class. You should make sure ELMS/Canvas Announcements and messages are forwarded to an email address that you check regularly. Failure to check email, errors in forwarding email, and returned email due to "mailbox full" or "user unknown" will not excuse a student from missing announcements or deadlines.

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.

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 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, it is your responsibility to work with 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'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 Closing 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 Counselling Center: Sometimes students experience academic, personal and/or emotional distress. The UMD Counseling Center in Shoemaker Hall provides free, comprehensive, and confidential counseling / mental health ser-

vices that promote personal, social, and academic success. All Counseling Center services are completely free for enrolled students. Proactively explore the range of services available at the Counseling Center, including the Counseling Service and Accessibility and Disability Service 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

Building Access: There is a smartphone app that can be used to enter our building after normal business hours. The program coordinator will provide information about this. We will also provide information about the code for entering the front door of our suite. Please make sure you are receiving the ELMS-Announcements that we send out to the program about these and other important matters.

COVID Policies: Up-to date information about UMD COVID-19 policies & 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 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.