

**ECON 684: Applied Time Series Analysis and Forecasting
Winter 2022-2023 Syllabus**

**University of Maryland, College Park
Master of Science in Applied Economics Program
Washington, DC location**

Instructor: David Burk, dburk@umd.edu

Class times: Wednesdays, 6:45pm – 9:30pm (including a break in the middle). The first day of class is November 30. We will have to schedule one additional class session; we will settle the date of that extra session on the first day of class. **The final exam is February 15.** There will be no class on December 28.

Instructor Office Hours: Weekly, over Zoom, at a TBD time. We will establish the regular time on the first day of class.

TA: Sueyoul Kim (shelkim@umd.edu)

TA Office Hours: TBA

Course Overview:

This master's-level course covers estimating, testing, and forecasting time series models. It will develop fundamental concepts through the study of univariate time series, and then generalize those concepts to multivariate time series. Specific topics include ARIMA models, volatility models, unit roots, spurious regression, cointegration, VAR models, and Granger causality. There will be an emphasis on macroeconomic applications, such as studying the relationships between unemployment and inflation (i.e., the Phillips curve); unemployment and GDP (i.e., Okun's Law); the macroeconomy and various shocks; and the term structure of interest rates.

Prerequisites

Econ 642 and Econ 645.

Evaluation

Problem Sets: 10% (4 problem sets in total)
Weekly Online Discussion Participation: 5%
Replication Project: 20%
Midterm: 30%
Final: 35%

The course will be graded on a curve. Your score for each component (problem sets, weekly online discussion participation, replication project, and exams) will be normalized and then combined into one "overall course score." I will assign letter grades based on those scores and my professional judgement. Having a score one standard deviation above the mean typically results in an A. Students with an unsatisfactory understanding of the course material—who fail to grasp the major concepts of time series analysis and are unable to conduct a reasonable empirical analysis of time series data—will receive a grade of B- or below.

Problem Sets: Students may work in groups; if they do so a group should submit one set of answers for the whole group.

Weekly Online Discussion: There will be weekly online discussions which students are required to contribute to. Those discussions will typically deal with course reading. I will provide initial prompts for each week's discussion and facilitate discussion to make sure it is instructive and worthwhile. The discussion will be open for at least two days, but will never be open on the day of class.

Replication Project: Students will replicate the primary results of a research paper of their choosing that uses some of the methods discussed in class. Students are responsible for producing a short (less than 3 pages of single-spaced text, plus tables and figures) but highly polished paper that includes a summary of the central argument of the paper, their replication results, and an evaluation of the paper. (This paper could be a useful writing sample for any job applications). If time and class size permits, students also will give a brief but focused presentation of their work to their classmates. To facilitate the production of high quality output, there are several intermediate assignments related to the replication paper: selecting an appropriate paper (I will help!); drafting a summary of the paper's argument and an outline of the proposed replication paper; obtaining the necessary data; and completing the replication analysis.

Reading Materials and Software

The main text which the course follows closely is *Applied Econometric Time Series*, Fourth Edition, by Walter Enders, 2015. Earlier editions are acceptable substitutes.

In addition, we will also study several articles and book chapters, all of which are available online to UMD students and will be posted on ELMS/Canvas:

- Bernanke, Ben S. and A. Blinder, "Credit, Money and Aggregate Demand," *The American Economic Review*, vol. 82, no. 4, 1992, pp. 901-921.
- Hansen, B., "The New Econometrics of Structural Change: Dating Breaks in U.S. Labor Productivity," *The Journal of Economic Perspectives*, Vol. 15, No. 4. (Autumn, 2001), pp. 117-128.
- Hamilton, J. "What is an Oil Shock?," *Journal of Econometrics*, April 2003, vol. 113, pp. 363-398.

For empirical analysis, you may use whatever software you like. I will use Stata in class; however, if you want to use (or learn to use) R, I can help with that as well—just let me know!

Tentative Schedule of Topics and Due Dates

This may change as the course proceeds. Keep an eye on ELMS/Canvas announcements. The date listed is for the synchronous online classes on Wednesdays.

Class #	Topic	Reading
Nov. 30	What Time Series is Good For; Statistics, Econometrics, and Math Review; Difference Equations	Enders, Chapter 1
Dec. 7	ARMA Processes: Introduction, and Moving Averages	Enders, Ch. 2
Dec. 14	ARMA Processes: Autoregressions and ARMA; PS1 DUE	
Dec. 21	MLE Estimation Theory; Intro to Forecasting	section on MLE from your econometrics text book
Dec. 28	NO CLASS – WINTER BREAK	
Jan. 4	Modeling Volatility: ARCH and GARCH processes; PS2 due; select paper to replicate	Enders, Ch. 3
Jan. 11	Midterm; Non-stationary Processes: Trends and Unit Roots; Cointegration; Structural Breaks; submit draft of summary of paper	Enders, Ch. 4
MAKE UP CLASS (Date TBD)	Non-stationary Processes and Structural Breaks (continued)	
Jan. 18	Intro to Vector Auto-Regression; PS3 due	Enders, Ch. 5
Jan. 25	Structural VARs; obtain data needed for replication	
Feb. 1	Applications of VARs; PS4 due	Bernanke and Blinder 1992
Feb. 8	Applications of VARs; replication paper due	Hamilton 2003
Feb. 15	FINAL EXAM	

Course Objectives

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 primarily are 1, 2, 3, 4, and 6.

Other Standard Policies for the Program and 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](mailto:)" email address for every graduate student. All official UMD communications will be sent to students at their "[@umd.edu](mailto:)" email address. You are responsible for reading your [@umd.edu](mailto:) 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.

I will do my best to respond to email within 36 hours.

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

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 workload 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. However, the DC program takes just 1 week off between terms. 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 "normal" full-time load in the traditional semester-based program ($8/6 = 1.33$).

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 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 free, comprehensive, and confidential counseling / mental health services 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>

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.

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 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.