

University Maryland, College Park  
Master of Science in Applied Economics

ECON684:  
Applied Time Series Analysis and Forecasting:

Winter 2023-24

January 13, 2024

**Instructor:** Martin Stuermer<sup>1</sup> (Email: stuermer@umd.edu)

**Office Hours:** Saturday 11am to 12pm (by appointment on Zoom)

**Class Time:** Thursday 6:45 – 9:30 pm (including 15-minute break)

**Class Location:** Washington, DC location: 1400 16th St, NW, suite 140

**Teaching Assistant:** Nabil Ryandiansyah (Email: ryandian@umd.edu)

**Teaching Assistant's Office Hours:** Tuesday, 5.15 - 6.15 pm, by appointment

**Please provide me with *critical* feedback during the semester. This allows me to better adjust the syllabus based on your interests. Always check the latest version of our syllabus in ELMS.**

## Course Objectives

My goal is to provide you with a powerful tool for analyzing macroeconomic, financial, and business data. We will develop fundamental concepts through the study of univariate times series, and then generalize those concepts to multivariate time series. The topics include univariate auto-regressive moving average (ARMA) processes, volatility models,

---

<sup>1</sup>The views expressed here are those of the author and do not necessarily reflect the views of the International Monetary Fund, its Executive Board, or its Management.

vector autoregression (VAR) models, forecasting as well as non-stationary and trend analysis. We will discuss robustness and establishing causality. For each topic, we will emphasize its economic applications. More specifically, our program has seven 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.

## **Prerequisites**

ECON 642 and ECON 645.

## **Textbook and Course Materials**

The course will to certain extent follow the textbook Applied Econometric Times Series, Fourth Edition, by Walter Enders (2015). Earlier editions are acceptable substitutes.

Recommended reading is Structural Vector Autoregressive Analysis by Lutz Killian & Helmut Lutkepohl (2017). Preliminary chapters of the book are available online on Lutz Kilian's personal webpage.

Lecture slides for each topic as well as reading materials will be posted on the course web-page in ELMS. Students are encouraged to review slides and readings to complement the textbook.

## **Evaluation**

The course grades will be calculated based on the weighted average of the following components:

- **Problem Sets (10%)**
- **Midterm Exam (20%)**
- **Final Exam (20%)**
- **Replication Presentations (20%)**
- **Replication Paper (20%)**
- **Participation in Class and Online Discussions (10%)**

**Problem Sets (PS):** We will have two problem sets. I will typically ask you to analyze a specific data-set, mocking a real world work request.

**Midterm and Final Exams:** The exams can cover all topics of the class.

**Replication Presentations:** We will replicate key results from papers in the literature and check their robustness to changes in data and specifications. Each student will select one paper from a list and will give a **first presentation** (about 15 min, 7 slides) to the class summarizing the paper (research question, contribution, methodological approach and key baseline regression equation, data-set, and results) during the first half of the semester. We will provide feedback and discuss. Presentation will be evaluated on content (50%) and clarity of exposition (50%).

In the second half of the semester, each group will give a **second presentation** (about 15 min, 7 slides) showing the results from replicating the key baseline regression of the paper. The presentation will also include two additional robustness checks chosen by the students.

**Replication Paper:** Around the end of the semester, every participants submits a concise (maximum 6 pages in 1.5 space excluding figures and tables) and polished paper that replicates a key result from a notable paper in the literature. The replication paper is expected to include:

- (1) a max. 150 words abstract summarizing to what extent the original paper is replicable and the results of two robustness checks,
- (2) an introduction in which the participant briefly describes the motivation, research question, methodology, data of the paper, then summarizes the results of the replication exercise ( comparing them to the original results) and of two robustness checks;
- (3) a section describing the data and to what extent it was possible to replicate it,

- (4) a section with the key estimation equation that is used for the replication,
- (5) a section on the replication results comparing them to the original paper, discussing differences and their possible explanations,
- (6) a section showing the results for two robustness checks of the participants choice (different than the ones in the original paper) and discussing them, and
- (7) a short conclusion. Please put all figures and tables into an appendix and provide a clean STATA do file.

The paper is graded on content (50%) and clarity of exposition (50%). It is important that it is concise.

**Participation in Class Discussions:** I encourage students to actively participate in class discussions. I expect everyone to read at least the introduction of our colleagues' papers and to ask questions and make suggestions to the presenters.

**Participation in Online Discussions:** I encourage students to actively participate in the online discussions. I will post questions or small exercises to deepen your comprehension of the class subjects. I will grade the quantity and quality of participation.

## Grading:

Students' grades will be based on the weights provided in the Evaluation section. The numerical course grades will be translated into letter grades as follows:

|        |    |
|--------|----|
| 100-93 | A  |
| 92-90  | A- |
| 89-80  | B+ |
| 79-70  | B  |
| 69-60  | B- |
| 59-50  | C+ |
| 49-40  | C  |
| 39-30  | C- |
| 29-20  | D+ |
| 19-10  | D  |
| 9-0    | F  |

Note: A+ is reserved for students who show exemplary performance in the course.

Table 1: Class Schedule. *May change as the course proceeds. Keep an eye on ELMS-Canvas announcements.*

| <b>Date</b>   | <b>Topic</b>   | <b>Sections Enders</b>           | <b>Assign - ment</b> |
|---------------|--|----------------------------------|----------------------|
| Nov 30        | <b>What Time Series is Good For: Introduction</b>  | 1.1-1.2                          |                      |
| Dec 4<br>(Mo) | <b>Individual meetings about papers and presentations</b>  |                                  |                      |
| Dec 7         | <b>Univariate Stationary Process (1): Stationarity, ARMA</b><br><br><b>Univariate Stationary Process (2): Estimation, Autocorrelation, Model Selection</b><br>Presentation of Kilian's "Not All Oil Price Shocks are Alike" by Rohan Gandhi.<br>Presentation of Blanchard's and Quah's "The Dynamic Effects of Aggregate Demand Supply Disturbances" by Thomas Montgomery. | 1.9, 1.10,<br>2.1-2.4<br>2.5-2.8 |                      |
| Dec 14        | <b>Structural Change, Seasonality, Robustness</b><br>Presentation of Romer's and Romer's "The Macroeconomic Effects of Tax Changes" by Timothy Srenaski.<br>Presentation of Pindyck's "The Long-Run Evolution of Energy Prices" by Matthew Hayden.   | 2.11                             |                      |
| Dec 21        | <b>Non-Stationary Processes: Trends, Unit Roots</b><br>Presentation of Baumeister's and Kilian's "Real-Time Forecasts of the Real Price of Oil" by Shimpei Kawano.<br>Presentation of Stuermer's "150 Years of Boom and Bust" by Eliza Browning.   | 4.1-4.6                          | PS1<br>distributed   |
| Dec 28        | No Class   |                                  |                      |
| Jan 4         | <b>Univariate Forecasting</b><br>Replication presentation of Baumeister's and Kilian's "Real-Time Forecasts of the Real Price of Oil" by Shimpei Kawano.   | 2.9                              | PS1<br>due           |
| Jan 11        | <b>Multivariate Time Series Models (1): Autoregressive Distributed - Lag (ADL) Models, Vector Autoregressive (VAR) Models</b><br><b>Multivariate Time Series Models (2): Structural VARs, Identification and Causality</b><br><b>Multivariate Time Series Models (3): Structural VARs, Impulse Response Functions</b>  | 5.1, 5.2,<br>5.5                 |                      |
| Jan 18        | <b>Midterm Exam</b>  |                                  | Midterm<br>Exam      |

| <b>Date</b>    | <b>Topic</b>  | <b>Sections Enders</b> | <b>Assign - ment</b> |
|----------------|---|------------------------|----------------------|
| Jan 19         | <b>Problem Set 2 Distributed</b>  |                        | PS2 distributed      |
| Jan 25         | <b>Multivariate Time Series Models (4): Forecasting</b><br><b>Multivariate Time Series Models (5): More Ways to Identify Causal Relationships</b><br>Replication presentation of Kilian’s ”Not All Oil Price Shocks are Alike” by Rohan Gandhi.<br>Replication presentation of Stuermer’s ”150 Years of Boom and Bust” by Eliza Browning.   | 5.10-5.13              |                      |
| Jan 26<br>(Fr) | <b>Multivariate Time Series Models (5): More Ways to Identify Causal Relationships (continued)</b><br><b>Other Time Series Models and Review</b><br>Replication presentation of Blanchard’s and Quah’s ”The Dynamic Effects of Aggregate Demand Supply Disturbances” by Thomas Montgomery.<br>Replication presentation of Romer’s and Romer’s ”The Macroeconomic Effects of Tax Changes” by Timothy Srenaski.<br>Replication presentation of Pindyck’s ”The Long-Run Evolution of Energy Prices” by Matthew Hayden. | 5.10-5.13              |                      |
| Jan 29<br>(Mo) | <b>Second Problem Set Due</b>   |                        | PS 2 due             |
| Jan 31<br>(We) | <b>Hand-in paper drafts</b>   |                        |                      |
| Feb 3<br>(Sa)  | <b>Individual meetings on drafts</b>  |                        |                      |
| Feb 10<br>(Sa) | <b>Replication Papers due</b>   |                        | Papers due           |
| Feb 15         | <b>Final Exam</b>   |                        |                      |

## 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" 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. 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](http://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 15-week semester. So one should expect the average weekly workload of 3 courses per semester to approach 40 hours per week in the semester-based calendar. So maybe 12 or 13 hours per week per course. Since the 12-week version of a given course will have 25% more work per week, one should expect 15 hours of work per week for a given 12-week course, and

about 30 hours per week when taking 2 courses per term. This is less than “full time” but still a significant commitment, especially if undertaken on top of full time employment.

**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 coun-



selor 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.