

ECON 6343: Econometrics III

The University of Oklahoma

Department of Economics

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Office Hours: 4:30pm-6:30pm on Wednesdays and 10:30am-12:30pm on Thursdays (in-person or virtual, book me here)

Meeting Time and Place: 9:00am-10:15am on Tuesdays and Thursdays, Room 338/CATE 1

Course Website: Canvas

Teaching Assistant (TA): Mahla Shourian (mahla.shourian@ou.edu)

TA Office Hours: By appointment

COURSE DESCRIPTION

This course is part of the graduate econometrics sequence and a sequel to Advanced Econometrics and Econometrics II. This course focuses on the analysis and modeling of time series data and is designed for Ph.D. students within the economics department and other related departments that emphasize intricate data analysis. The primary objective of this course is to equip you with the necessary skills for the time series econometric methods you will encounter in subsequent studies and to apply these skills using statistical software Stata. Additionally, certain concepts covered, such as difference equations and seasonality, will prove valuable in your advanced macroeconomics courses. I aspire for this course to present concepts in time series analysis in a manner that ignites your interest in pursuing time series econometrics as your minor subfield in near future.

Knowledge of a PhD level econometrics course, multivariate calculus, some probability and mathematical statistics, and matrix algebra is assumed. To refresh your memory on these, I recommend that students acquaint themselves with the multiple regression analysis in Jeffrey M. Wooldridge's introductory textbook, "Introductory Econometrics: A Modern Approach" and William Greene's advanced textbook, "Econometric Analysis" (or Bruce Hansen's advanced textbook, "Econometrics.") The appendices in the advanced textbooks provide a concise overview of the concepts that I assume you are already familiar with.

LEARNING OBJECTIVES

Upon successfully completing this course, students should:

- have a solid theoretical understanding of dynamic time series models and asymptotic theory.
- recognize and interpret various temporal patterns within time series data, including trends and seasonality.
- gain proficiency in selecting and estimating appropriate time series models, such as ARIMA, VAR, and GARCH, to forecast and infer from time series.
- differentiate between stationary and nonstationary time series data and transform nonstationary data into stationary ones
- identify cointegrated time series and estimate error correction models.
- become familiar with statistical software Stata in order to apply the methods learned in this course.

DELIVERY and COMMUNICATION

This course will primarily be delivered in a synchronous and in-person format. The course is scheduled to run for 14 consecutive weeks. The course entails attending lectures, reading lecture slides (and suggested material if necessary), engaging with class discussions, working on problem sets (not for credit) and taking examinations. We will meet for two and a half hours every week.

This syllabus is only tentative and subject to change. I will update it according to the progress of this course. **It is your responsibility to check Canvas course website for updates, course material, and problem sets.** I will share the content for each week ahead of the class through the corresponding weekly content area on the Canvas course website. There may be changes regarding the course such as grading policy, exams and empirical project if deemed necessary, but they will be explicitly announced in class at least one month ahead. During the final week of the course, special attention will be given to addressing your questions, particularly concerning the final examination.

Email is the fastest way to contact me.

EVALUATION

Throughout the course, you will engage in various assessments, including in-class discussions, problem sets, midterm examination and final examination. Your successful completion of the course will be determined by your performance in these assessments. Attendance in classes is highly recommended. Please feel free to inform me about your absences if you find it suitable.

Examinations: There will be one midterm examination (**tentative date: 10/19/2023**) and one final examination (**at CATE 338, from 8am-10am on Monday, 12/11/2023**). No make-up exams will be given. If a student misses a midterm examination for any reason, the weight of that examination will be added to that of the final examination. I would like to have the flexibility

to speed up or slow down depending on how I think the class understands the material. So, the midterm date may be subject to change according to the progress but will be announced one week in advance. Both exams will be open book and note.

Problem Sets: There will be several problem sets. **They will not count towards your final grade and will not be graded.** I will make them available on Canvas course website. It is important to know that the problem sets are very important in that the basic ideas covered by them invariably show up on the midterm and the final examinations. Although the problems sets are not to be graded, group discussion on how to solve them is highly encouraged.

Participation: During my lectures, students will have ample opportunity via discussions and directed questions to engage in class material. To enhance the learning experience, I intend to incorporate various active learning activities such as one-minute papers, think-pair-share, and concept mapping as students consider questions posed by either themselves or me. These activities are specifically designed to facilitate a deeper comprehension and understanding of the course material. Your active participation in these activities will contribute to the allocation of participation points, acknowledging your contributions to the learning process.

GRADING

The weights in the final grade are assigned as follows:

Weight Scheme	
Problem Sets	0%
Midterm Exam	35%
Final Exam	60%
Participation	5%

The grading scale is:

Total Score in % (x)	Letter Grade
$90 \leq x$	A
$70 \leq x < 90$	B
$60 \leq x < 70$	C
$55 \leq x < 60$	D
$x < 55$	F

I reserve the right to change the grading scale. The required score for the final grade could be lower but not higher. For example, the current requirement for an A is at least a 90%, but later I may change the cut-off point to 85%, but will not change it to 95%.

RECOMMENDED READING LIST

My lecture slides will serve as the primary course material; however, the resources listed below will also be valuable.

- J. D. Hamilton, *Time Series Analysis*. Princeton University Press, 1994. This is a very comprehensive textbook for many of the topics we will cover. It is encyclopedic in nature; therefore, it is a particularly good as a reference textbook. It might be slightly difficult to read for those who study the subject for the first time.
- W. Enders, *Applied Econometric Time Series*, 4th (or 3rd) edition. Wiley, 2014. This textbook is fairly easy to go through and gives good intuition for many of the topics we will cover.
- H. Lukepohl and M. Krazig, *Applied Time Series Econometrics*, 1st edition. Cambridge, 2004.
- P. J. Brockwell and R. J. Davis, *Time Series: Theory and Methods*, 2nd edition. Springer, 1990. This is an excellent book for statistical theory of time series analysis, but is not directly relevant for economists.
- A. C. Harvey, *Econometric Analysis of Time Series*, 2nd edition. MIT Press, 1989. This book is very good for much of the material concerning stationary processes, but has very limited coverage of recent research topics.
- G. S. Maddala and I-M Kim, *Unit Roots, Cointegration and Structural Change*. Cambridge University Press, 1998.

I recommend that you do the readings from a combination of the textbooks for a better perspective. In addition, I will be using electronic slides during lecture. Many students find it helpful to have a hard copy in front of them for annotating. The slides will be available before lecture.

SOFTWARE PACKAGE

Another aspect of this course involves the utilization of a statistical software package to apply some of the statistical methods learned. For this purpose, we will use Stata, a commercial statistical software with several built-in econometric commands. To estimate time series regression equations, use diagnostics tools, and conduct statistical inference on parameters, it is necessary to have access to Stata. The labs in CATE 1 has access to Stata. In addition, the University of Oklahoma IT department offers to current students with active OU accounts free access to Stata for school use (for more information, see <https://itsupport.ou.edu/TDClient/30/Unified/Requests/ServiceDet?ID=270>.)

When needed, I will share my Stata codes with you. However, for additional computational resources, I highly recommend the Stata manuals. Another valuable reference that I have personally found very useful is "Introduction to Time Series Using Stata" by Sean Beckett specifically the revised edition.

UNIVERSITY POLICIES

Accommodations for Special Students: At OU, we are dedicated to ensuring the complete inclusion of all students, including those with disabilities, to enrich their OU experience. In accordance with Section 504 of the Rehabilitation Act of 1973, the Americans with Disabilities Act (ADA), and the Americans with Disabilities Act Amendments Act (ADAAA), the Accessibility and Disability Resource Center (ADRC) offers personalized accommodations, services, and support to students with documented disabilities on a case-by-case basis.

Possible disabilities include, but are not limited to, learning disabilities, AD(H)D, mental health, and chronic health. Additionally, we support students with temporary medical conditions (broken wrist, shoulder surgery, etc.) and pregnancy. To discuss potential accommodations, please contact the ADRC at 730 College Avenue, (ph.) 405.325.3852, or adrc@ou.edu. To ensure timely arrangements, kindly submit your written accommodation request within the first week of class.

Academic Integrity: Cheating is strictly prohibited at OU, because it devalues the degree you are working hard to earn. As a member of the OU community, it is your responsibility to protect your educational investment by knowing and following the rules. For specific definitions on what constitutes cheating, review the Student's Guide to Academic Integrity at <https://www.ou.edu/integrity/students>.

Religious Observance: It is the policy of the University to excuse the absences of students that result from religious observances and to reschedule examinations and additional required classwork that may fall on religious holidays, without penalty. Please feel free to contact me if any of the due dates for assessment components conflict with your religious commitments.

Title IX Resources and Reporting Requirement: Anyone who has been impacted by gender-based violence, including dating violence, domestic violence, stalking, harassment, and sexual assault, deserves access to resources so that they are supported personally and academically. OU is committed to offering resources to those impacted, including: speaking with someone confidentially about your options, medical attention, counseling, reporting, academic support, and safety plans. If you would like to speak with someone confidentially, you may contact OU Advocates (available 24/7 at 405-615-0013). You may also choose to report gender-based violence and discrimination through other means, including by contacting the Institutional Equity Office (ieo@ou.edu, 405-325-3546) or police (911). Because OU is committed to the safety of you and other students, faculty members (including me), graduate and teaching assistants are mandatory reporters. This means that we are obligated to report gender-based violence that has been disclosed to us to the Institutional Equity Office. This includes disclosures that occur in: class discussion, writing assignments, discussion boards, emails and during office hours. For more information, please visit the Institutional Equity Office.

Adjustments for Pregnancy/Childbirth Related Issues: Should you need modifications or adjustments to your course requirements because of documented pregnancy-related or childbirth-related issues, please contact me or the Disability Resource Center at 405-325-3852 as soon as possible. Also, see the Pregnant and Parenting Students' Rights at <http://www.ou.edu/eoo/faqs/pregnancy-faqs.html> for answers to commonly asked questions.

Final Exam Preparation Period: Pre-finals week will be defined as the seven calendar days before the first day of finals. I may cover new course material throughout this week. For specific provisions of the policy please refer to OU's Final Exam Preparation Period policy.

Emergency Protocol: During an emergency, there are official university procedures that will maximize your safety. If you receive an OU Alert to seek refuge or hear a tornado siren that signals severe weather,

1. LOOK for severe weather refuge location maps located inside most OU buildings near the entrances.
2. SEEK refuge inside a building. Do not leave one building to seek shelter in another building that you deem safer. If outside, get into the nearest building.
3. GO to the building's severe weather refuge location. If you do not know where that is, go to the lowest level possible and seek refuge in an innermost room. Avoid outside doors and windows.
4. GET IN, GET DOWN, COVER UP.
5. WAIT for official notice to resume normal activities.

Armed Subject/Campus Intruder: If you receive an OU Alert to shelter-in-place due to an active shooter or armed intruder situation or you hear what you perceive to be gunshots,

1. Avoid: If you believe you can get out of the area WITHOUT encountering the armed individual, move quickly towards the nearest building exit, move away from the building, and call 911.
2. Deny: If you cannot flee, move to an area that can be locked or barricaded, turn off lights, silence devices, spread out, and formulate a plan of attack if the shooter enters the room.
3. Defend: As a last resort fight to defend yourself. For more information, visit OU's Emergency Preparedness site at <https://www.ou.edu/cas/modlang/emergency-preparedness>

Fire Alarm/General Emergency: If you receive an OU Alert that there is danger inside or near the building, or the fire alarm inside the building activates,

1. LEAVE the building. Do not use the elevators.
2. KNOW at least two building exits.
3. ASSIST those that may need help.
4. PROCEED to the emergency assembly area.
5. ONCE safely outside, NOTIFY first responders of anyone that may still be inside building due to mobility issues.

6. WAIT for official notice before attempting to reenter the building. For more information, visit OU's Fire On Campus site at https://www.ou.edu/campussafety/fire-marshall/policies/fire_on_campus

Mental Health Support Services: If you are experiencing any mental health issues that are impacting your academic performance, counseling is available at the University Counseling Center (UCC). UCC is located on the second floor of the Goddard Health Center, at 620 Elm Rm. 201, Norman, OK 73019. To schedule an appointment call 405-325-2911. For more information, please visit UCC at <https://www.ou.edu/ucc>.

Inclusivity: In the vibrant OU community, each member brings a wealth of experiences and ideas that profoundly enrich our classrooms and campus life. As fellow community members, we are presented with a remarkable opportunity to learn and evolve collectively by wholeheartedly valuing and embracing the diverse contributions of every individual.

Throughout this course, I wholeheartedly encourage each and every one of you to cultivate an open-minded approach towards one another. Let us foster a nurturing and supportive learning community where each student can flourish as individuals. Do not hesitate to openly share your thoughts, ideas, and personal experiences. Together, we can collaboratively create an all-encompassing and nurturing learning space where fairness, equality, and objectivity are upheld, ensuring that everyone is treated equitably and without discrimination. If you harbor any thoughts, suggestions, or concerns regarding how we can enhance our inclusive community, please feel free to reach out to me. For more information, visit the Gender and Equality Center at <https://www.ou.edu/gec>

If you have any questions concerning the course, feel free to contact me or schedule an office hour appointment. I am committed to being responsive and will check my emails daily throughout the course. Rest assured that I will provide timely answers to all students' inquiries related to the course.

TENTATIVE COURSE SCHEDULE

Note that the schedule is subject to change depending on the pace of the course. Not all material would be covered, and extensions of the basic models not listed below may be added to deepen our understanding of these techniques. Moreover, the material will not be necessarily covered in the same order as below.

1. Introduction to Time Series Processes
 - (a) Difference equations
 - (b) Stationarity conditions
 - (c) Autocovariance and autocorrelation functions
 - (d) Operators
2. Theory of Stationary Univariate Time Series Processes
 - (a) Wold decomposition
 - (b) Autoregressive (AR), moving average (MA), and autoregressive moving average (ARMA) models
 - (c) Seasonality
 - (d) Forecasting from ARMA models
 - (e) Autoregressive conditional heteroskedasticity (ARCH) and generalized ARCH models
3. Theory of Stationary Multivariate Time Series Processes
 - (a) Vector version of the univariate concepts above
 - (b) Dynamic reduced forms
 - (c) Granger causality
 - (d) Impulse response functions
4. Regression with Stationary Processes
5. Estimation and Inference for Time Series Models
6. Nonstationary Processes
 - (a) Difference and trend stationary processes
 - (b) Integrated processes
 - (c) Brownian motion and functional limit theorem
 - (d) Unit root tests: Dickey-Fuller (DF), augmented DF, and Phillips–Perron
7. Nonstationary Regression and Cointegration
 - (a) Spurious regression
 - (b) Regression on time trends
 - (c) Regression with variables integrated of order 1, $I(1)$

(d) Error correction model and cointegration

IMPORTANT DATES

Examination Schedule		
	Date Distributed	Date Due
Midterm Examination	10/19	10/19
Final Examination	12/11	12/11