

Department of Economics  
University of Texas at Austin

ECO 348K: Time Series Econometrics (34850)  
Spring 2025

**Lectures:** RLP 0.112; Tuesdays & Thursdays 11:00 a.m. - 12:30 p.m.  
**Course Website:** [Canvas](#)

**Instructor:** Dr. Sahil Ravgotra  
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Office: BRB 3.128  
Office Hours: Tuesdays & Thursdays 3:30 - 4:30 p.m. or by appointment

**Teaching Assistant:** Zhenghao Li  
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Office Hours: BRB 2.128; MW 4:00 - 5:30 p.m.

## Course Description

This course is designed to provide students with a comprehensive understanding of time series models and their applications in economic and financial analysis. The course will cover various aspects of time series analysis, from basic models and properties to more advanced topics such as autoregressive conditional heteroskedasticity (ARCH) models, error correction models, structural breaks, cointegration, spectral decomposition, state-space and non-linear time series models. Through a combination of theoretical concepts and practical applications, students will develop the skills necessary to analyze and forecast time series data in economics and finance. With hands-on experience in model estimation and hypothesis testing, students will emerge well-prepared to tackle complex economic and financial challenges using advanced econometric methods and statistical tools.

**Prerequisites:** Economics 341K or 441K, and 420K or 420S with a grade of at least C- in each.

**Readings:** I will use different sources to prepare the lectures so the focus should be on the lecture notes and slides. However, the Enders textbook provides a good complement.

- **Essential Reading:**

- Enders, W. (2015). Applied Econometric Time Series. 4th Ed.. John Wiley & Sons.

- **Useful Readings:**

- Asteriou, D. & Hall, S. (2011). Applied Econometrics. Macmillan
- Diebold, F. X. (2004). Elements of Forecasting. South-Western Cengage.
- Ghysels, E., & Marcellino, M. (2018). Applied economic forecasting using time series methods. Oxford University Press.
- Gujarati, D. (2003). Basic Econometrics. 4th Ed., McGraw-Hill.

- Harris, R. & Sollis, R. (2003). Applied Time Series Modelling and Forecasting. Wiley.
- Wooldridge, J. M. (any edition). Introductory econometrics: a modern approach. Cengage.

• **More Advanced Readings:**

- Hamilton, James D. (1994). Time Series Analysis. Princeton University Press, New Jersey.
- Hayashi, Fumio (2000). Econometrics. Princeton University Press, New Jersey.

**Software:** Students are required to use the statistical package STATA in this course. Class examples will be illustrated using STATA, and students will use **STATA for empirical exercises in homework assignments**. You have several options for accessing STATA:

- STATA can be purchased and installed on your computer. A six-month student STATA/BE license is available for \$48 at: [Buy STATA](#)
- You can access STATA licenses owned by UT remotely on the Stat Apps Server (Wincompute). Instructions for doing this are at: [Remote Access](#). Note that the number of available STATA licenses is limited, which might make access difficult during peak use times (i.e., the evening before a homework assignment is due).
- Various computer labs on campus have access to Stata, including the data lab in PCL. It may be possible to access these labs remotely, see: [Remote Labs](#)
- We will use STATA in the class, but students are expected to improve their software skills on their own. There are many tutorials available online that you can also consult: [Learning Stata](#)

**Lecture Format:** Lectures will be in person on Tuesdays & Thursdays from 11:00 a.m. - 12:30 p.m. in RLP 0.112. There will be no class recordings.

**Assessment and Grading:**

1. **Homework Assignments (40% of total grade):** Throughout the course, you will be assigned **five** homework assignments that are directly related to the course material. These assignments will be posted on Canvas one week before the due date. They must be submitted at the beginning of class as a single PDF file along with the codes as indicated in the course schedule below. The *tentative due dates are Jan 30, Feb 13, Feb 27, Mar 13 & Apr 17*. You are **allowed to skip one assignment**. If you complete all five assignments, only the four with the highest grades will be considered (i.e., the lowest-graded assignment will be dropped). *Each assignment carries a weightage of 10% towards your total grade..*
2. **Take-Home Exams (35% of total grade):** There are two **take-home exams**:
  - **Take-Home Exam - 1 (17.5%):** This is a take-home assignment with a 24-hour completion window. You will receive the exam at 11:00 a.m. on Feb 17 and must submit it by 11:00 a.m. on Feb 18. The exam will cover all course material taught up to and including Lecture 10.
  - **Take-Home Exam - 2 (17.5%):** This is a take-home assignment with a 24-hour completion window. You will receive the exam at 11:00 a.m. on March 31 and must submit it by 11:00 a.m. on April 1. The exam will cover course material taught from Lecture 12 up to and including Lecture 20.
3. **Final Exam (25%):** The final exam is an **in-class exam** on Friday, May 2, 3:30 pm-5:30 pm (tentative). This exam is cumulative and covers the entire course material. You are allowed a formula/cheat-sheet for your final exam. The cheat-sheet should be handwritten one side of an 8.5 × 11 inch paper. You are required to turn in your cheat-sheet along with your exam.

Please note:

- **Late assignments/exams will not be accepted** neither other type of accommodation will be given. There is **no make-up exams** for reasons outside the university excused absences: [Dean of Students info](#). Those requests should be sent to me in writing before the exam. The TA does not handle those issues.
- You are allowed/encouraged to discuss the homework assignments with your working group (will be assigned at the beginning of the semester) but you **must submit your own write-up of solutions**. Please note that you are **not allowed to discuss the take-home exams** with your classmates or working group members.

- Re-grading requests refer to the whole assignment/exam and not to specific questions/parts. All requests should be made in writing within five working days of receiving tests and assignments back. Later requests will not be accepted.
- I will use plus/minus grade categories when assigning final grades (i.e. A, A-, B+, B, ..., D-, F). Grades will be curved, meaning that your letter grade will be assigned based on your weighted average course score and your performance relative to the rest of the class.
- **Regular attendance** in lectures and help sessions is crucial for achieving good grades.

## Lecture Schedule (Tentative)

1. Lecture 1 (Jan 14) - Enders CH-1
  - Introduction to the course and syllabus
  - Review of Stochastic Processes
  - Review of Classical Gauss Markov Assumptions
2. Lecture 2 (Jan 16) - Enders CH-2
  - Basic models and properties
  - Autoregressive (AR) Model and its statistical properties
  - ACV and ACF
3. Lecture 3 (Jan 21)- Enders CH-1 & 2
  - Measuring dependence in a time series
  - AR(p) Model and its statistical properties
  - ACV, ACF and PACF
4. Lecture 4 (Jan 23)- Enders CH-2
  - Moving Average (MA) models
  - Autoregressive Moving Average (ARMA) model
  - Box-Jenkins Methodology: Identification
  - **HW1 posted**
5. Lecture 5 (Jan 28)- Enders CH-2
  - ARMA model: cont.
6. Lecture 6 (Jan 30)- Enders CH-2
  - Detection of serial correlation
  - Forecasting and accuracy
  - **HW1 due**
7. Lecture 7 (Feb 4)- Enders CH-2
  - Forecasting
  - Model selection and forecasting
  - Forecasting evaluation
8. Lecture 8 (Feb 6)- Enders CH-2
  - Model Selection
  - Information Criteria: Bayes Information Criterion, Akaike Information Criterion
  - **HW2 posted**

9. Lecture 9 (Feb 11)- Enders CH-3
  - Financial Time Series and Volatility
  - Autoregressive Conditional Heteroskedasticity (ARCH) models
  - Kurtosis and ARCH models
  - Estimation and testing of ARCH models
10. Lecture 10 (Feb 13)
  - Review session
  - **HW2 due**
11. Lecture 11 (Feb 18)
  - **Midterm Exam - 1**
12. Lecture 12 (Feb 20)- Enders CH-3
  - Generalised ARCH (GARCH) models: Estimation and testing
  - Integrated GARCH models
  - Stochastic volatility
  - Financial applications
  - **HW3 posted**
13. Lecture 13 (Feb 25)- Enders CH-5 & 6
  - Dynamic Multivariate modelling
  - Autoregressive Distributed Lag (ADL) Model
  - Error Correction Model (ECM)
  - Quick Review: Geometric Series
14. Lecture 14 (Feb 27)- Enders CH-5 & 6
  - Vector Autoregression (VAR)
  - VAR: IRFS and Forecasting
  - **HW3 due**
15. Lecture 15 (Mar 4)- Enders CH-5 & 6
  - VAR: IRFS and Forecasting cont.
16. Lecture 16 (Mar 6)- Enders CH-5
  - Granger Causality
  - Testing for Granger Causality
  - Lag Length Selection
  - Review: Residual Sum of Squares
  - **HW4 posted**
17. Lecture 17 (Mar 11)- Enders CH-4
  - Non-Stationary Processes
  - Deterministic and Stochastic Trends
  - Testing for unit roots
  - Spurious regression
  - Seasonal unit roots

18. Lecture 18 (Mar 13)- Enders CH-2, 4 & 7
  - Structural breaks
  - Typologies of breaks: Discrete change, Gradual change
  - Testing for a Break: Chow test, QLR test
  - **HW4 due**
19. Lecture 19 (Mar 25)- Enders CH-2, 4 & 7
  - Structural breaks: cont.
20. Lecture 20 (Mar 27)
  - Review session
21. Lecture 21 (Apr 1)
  - **Midterm Exam - 2**
22. Lecture 22 (Apr 3)- Enders CH-6
  - Cointegration
  - Engel-Granger Methodology
  - Dynamic OLS
  - Review of ECM
23. Lecture 23 (Apr 8)- Enders CH-6
  - Cointegration: cont.
24. Lecture 24 (Apr 10) - Notes
  - State-Space Models:
    - Local Level Models
    - Estimation
    - **HW5 posted**
25. Lecture 25 (Apr 15) - Notes
  - State-Space Models
    - Structural Time Series Models
26. Lecture 26 (Apr 17) - Notes
  - Nonlinear Time Series Models
    - Markov Switching Models
    - Time Varying Parameter Models
    - CAPM Model
    - **HW5 Due**
27. Lecture 27 (Apr 22)
  - Review Session - 1
28. Lecture 28 (Apr 24)
  - Review Session - 2

## University Policies & Resources

**Statement on Academic Integrity:** The University of Texas Honor Code states: The core values of The University of Texas at Austin are learning, discovery, freedom, leadership, individual opportunity, and responsibility. Each member of the university is expected to uphold these values through integrity, honesty, trust, fairness, and respect toward peers and the community. Each student in this course is expected to abide by the UT Honor Code and uphold academic integrity. Students who violate University rules on academic dishonesty are subject to disciplinary penalties, including the possibility of failure in the course and/or dismissal from the University. Since such dishonesty harms the individual, all students, and the integrity of the University, policies on academic dishonesty will be strictly enforced. For further information, please visit the Student Conduct and Academic Integrity website at: [conduct](#).

What this means for this course: You are allowed/encouraged to study together with your groups and to discuss information and concepts covered in the lecture and the recitation sections. However, this cooperation should never involve one student having possession of or copying directly from another student's work that is to be graded. Should such copying occur, both students involved will receive zeros for the assignment. In addition, directly copying from websites/books, etc., for the homework will also return zero for the assignment. In addition, any collaborative behavior or use of unauthorized material for graded work will lead to University disciplinary action. Finally, using books, notebooks, notes, electronic (e.g. phones), or other means during the exams, or copying from other students, violates the University and course policies.

In this course, every element of class assignments must be fully prepared by the student. The **use of generative AI tools for any part of your work will be treated as plagiarism**. If you have questions, please contact me.

**Use of Class Materials:** No materials used in this class, including, but not limited to, lecture handouts, videos, assessments (quizzes, exams, papers, projects, homework assignments), in-class materials, review sheets, and additional problem sets, may be shared online or with anyone outside of the class unless you have my explicit, written permission. Unauthorized sharing of materials promotes cheating. It is a violation of the University's Student Honor Code and an act of academic dishonesty. I am well aware of the sites used for sharing materials, and any materials found online that are associated with you, or any suspected unauthorized sharing of materials, will be reported to Student Conduct and Academic Integrity in the Office of the Dean of Students. These reports can result in sanctions, including failure in the course. Additionally, all these materials are copyright-protected works. Any unauthorized copying of the class materials is a violation of federal law and may result in disciplinary actions being taken against the student.

**Diversity, Equity, and Inclusion:** It is my intent that students from all diverse backgrounds and perspectives be well served by this course, that student's learning needs be addressed, and that the diversity that students bring to this class can be comfortably expressed and be viewed as a resource, strength, and benefit to all students. Please come to me at any time with any concerns.

**Other:** Please do not use phones/laptops/tablets in the class, as it is distracting to me and your classmates. If you need to use technology inside the classroom for a specific reason, please talk to me before the class.

**ADA Notice:** The university is committed to creating an accessible and inclusive learning environment consistent with university policy and federal and state law. Please let me know if you experience any barriers to learning so I can work with you to ensure you have equal opportunity to participate fully in this course. If you are a student with a disability, or think you may have a disability, and need accommodations please contact Services for Students with Disabilities (SSD). Please refer to SSD's website for more information: [SSD website](#). If you are already registered with SSD, please deliver your Accommodation Letter to me as early as possible in the semester so we can discuss your approved accommodations and needs in this course.

**Counseling and Mental Health Center:** The Counseling and Mental Health Center serves UT's diverse campus community by providing high quality, innovative and culturally informed mental health programs and services that enhance and support student's well-being, academic and life goals. To learn more about your counseling and mental health options, call CMHC at (512) 471-3515. If you are experiencing a mental health crisis, call the CMHC Crisis Line 24/7 at (512) 471-2255.

**Behavior Concerns Advice Line (BCAL):** If you are worried about someone who is acting differently, you may use the Behavior Concerns Advice Line to discuss by phone your concerns about another individual's behavior. This service is provided through a partnership among the Office of the Dean of Students, the Counseling and Mental Health Center (CMHC), the Employee Assistance Program (EAP), and The University of Texas Police Department (UTPD). Call 512-232-5050 or visit [behavior concerns website](#).

**BeVocal:** BeVocal is a university-wide initiative to promote the idea that individual Longhorns have the power to prevent high-risk behavior and harm. At UT Austin, all Longhorns have the power to intervene and reduce harm. To learn more about BeVocal and how you can help to build a culture of care on campus, go to: [BeVocal website](#).

**Emergency Evacuation Policy:** Occupants of buildings on the UT Austin campus are required to evacuate and assemble outside when a fire alarm is activated, or an announcement is made. Please be aware of the following policies regarding evacuation:

- Familiarize yourself with all exit doors of the classroom and the building. Remember that the nearest exit door may not be the one you used when you entered the building.
- If you require assistance to evacuate, inform me in writing during the first week of class.
- In the event of an evacuation, follow my instructions or those of class instructors.
- Do not re-enter a building unless you are given instructions by the Austin Fire Department, the UT Austin Police Department, or the Fire Prevention Services office.

For more information regarding emergency evacuation, please contact the Office of Campus Safety and Security, 512-471-5767, [safety website](#).

**Title IX Reporting:** Title IX is a federal law that protects against sex and gender-based discrimination, sexual harassment, sexual assault, sexual misconduct, dating/domestic violence, and stalking at federally funded educational institutions. UT Austin is committed to fostering a learning and working environment free from discrimination in all its forms. When sexual misconduct occurs in our community, the university can:

1. Intervene to prevent harmful behavior from continuing or escalating.
2. Provide support and remedies to students and employees who have experienced harm or have become involved in a Title IX investigation.
3. Investigate and discipline violations of the university's relevant policies ([title IX relevant policies website](#)).

Beginning January 1, 2020, Texas Senate Bill 212 requires all employees of Texas universities, including faculty, to report any information to the Title IX Office regarding sexual harassment, sexual assault, dating violence, and stalking that is disclosed to them. Texas law requires that all employees who witness or receive any information of this type (including, but not limited to, writing assignments, class discussions, or one-on-one conversations) must be reported. I am a Responsible Employee and must report any Title IX-related incidents that are disclosed in writing, discussion, or one-on-one. Before talking with me, or with any faculty or staff member about a Title IX-related incident, be sure to ask whether they are a responsible employee. If you would like to speak with someone who can provide support or remedies without making an official report to the university, please email [advocate@austin.utexas.edu](mailto:advocate@austin.utexas.edu). For more information about reporting options and resources, visit [title IX website](#), contact the Title IX Office via email at [titleix@austin.utexas.edu](mailto:titleix@austin.utexas.edu), or call 512-471-0419.

**Personal Pronouns:** Professional courtesy and sensitivity are especially important with respect to individuals and topics dealing with differences of race, culture, religion, politics, sexual orientation, gender, gender variance, and nationalities. Class rosters are provided to the instructor with the student's legal name unless they have added a preferred name with the Gender and Sexuality Center. I will gladly honor your request to address you by a name that is different from what appears on the official roster, and by the gender pronouns you use (she/he/they/ze, etc). Please advise me of any changes early in the semester so that I may make appropriate updates to my records. For instructions on how to add your pronouns to Canvas, visit [pronouns website](#).

**Land Acknowledgment:** (I) We would like to acknowledge that we are meeting on Indigenous land. Moreover, (II) We would like to acknowledge and pay our respects to the Carrizo & Comecrudo, Coahuiltecan, Caddo, Tonkawa, Comanche, Lipan Apache, Alabama-Coushatta, Kickapoo, Tigua Pueblo, and all the American Indian and Indigenous Peoples and communities who have been or have become a part of these lands and territories in Texas, here on Turtle Island.