Department of Economics
University of Texas at Austin

ECO 395M: Time Series Econometrics (Spring 2026)

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Lectures: BRB 1.118, MW 11:00 a.m. – 12:30 p.m.
TA Help sessions: BRB 2.136, Fridays 11:00 a.m. – 12:00 p.m.
Course Website: Canvas

Course Description

This course offers a rigorous introduction to modern econometric methods for analyzing time series data, with a primary emphasis on applications in macroeconomics and finance. The central goal is to understand the dynamic behavior of economic time series, the econometric challenges they present, and the appropriate modeling strategies for inference, forecasting, and policy analysis. Throughout the course, students build both theoretical intuition and practical skills for constructing and estimating time series models relevant to macroeconomic questions.

The course begins with foundational topics, including trend and cycle decomposition, stationarity, and univariate time series models such as Autoregressive Moving Average processes. Students learn forecasting techniques and methods for dealing with autocorrelation and heteroskedasticity. The course then covers cointegration and long-run relationships among macroeconomic variables. Multivariate extensions are introduced through Autoregressive Distributed Lag models, followed by a detailed study of Vector Autoregressions, with particular attention to identification strategies, impulse response analysis, and applications to monetary policy shocks.

Advanced topics cover local projections as an alternative framework for dynamic causal analysis; nonlinear time-series methods, including structural breaks and Markov-switching models; state-space representations; maximum likelihood estimation; and Bayesian estimation of DSGE models. These topics are developed alongside a rigorous treatment of recursive estimation techniques and Kalman filtering.

By the end of the course, students will be able to decompose economic time series into their fundamental components, address non-stationarity and long-run relationships, estimate and interpret both univariate and multivariate dynamic models, and apply these tools to forecasting and policy analysis. The course equips students with techniques widely used in empirical macroeconomic research, central banking, and applied economic analysis.

Prerequisites

ECO 394M Econometrics course; if you have not taken that course, you will need permission to register for this course.

Readings

There is no required textbook for this course. You are expected to study and understand the material provided during lectures, including lecture slides, notes, assigned papers, and any additional resources distributed. The **first part of the course** will primarily be based on the following books:

- Diebold, F. X. (2004). Elements of Forecasting. South-Western Cengage. (CH 7-9)
- Dougherty, C. (any edition). Introduction to Econometrics. Oxford University Press. (CH 7, 11 & 12)
- Verbeek, M. (2013). A Guide to Modern Econometrics. John Wiley & Sons (CH 8 & 9)
- Wooldridge, J. (sixth edition). Introductory Econometrics: A Modern Approach. Cengage. (CH 10-18)

There are several other textbooks and resources that you may use (**optional**) for further readings beyond the course slides.

- Asteriou, D. & Hall, S. (2011). Applied Econometrics. Macmillan
- Enders, W. (2015). Applied Econometric Time Series. 4th Ed., John Wiley & Sons.
- Gujarati, D. (any edition). Basic Econometrics. McGraw-Hill.
- Hamilton, James D. (1994). Time Series Analysis. Princeton University Press, New Jersey.
- Harris, R. & Sollis, R. (2003). Applied Time Series Modelling and Forecasting. Wiley.
- Hayashi, F (2000). Econometrics. Princeton University Press, New Jersey.
- Herbst, E. P., & Schorfheide, F. (2016). Bayesian estimation of DSGE models. Princeton University Press.

The **rest of the course will use several research papers**, some of which are listed below:

- Blanchard, O. J., & Quah, D. (1988). The dynamic effects of aggregate demand and supply disturbances.
- Christiano, L. J., Eichenbaum, M., & Evans, C. L. (1999). Monetary policy shocks: What have we learned and to what end?. Handbook of macroeconomics, 1, 65-148.
- Coibion, O. (2012). Are the effects of monetary policy shocks big or small?. American Economic Journal: Macroeconomics, 4(2), 1-32.
- Gertler, M., & Karadi, P. (2015). Monetary policy surprises, credit costs, and economic activity. American Economic Journal: Macroeconomics, 7(1), 44-76.
- Rossi, B., & Sekhposyan, T. (2010). Have economic models' forecasting performance for US output growth and inflation changed over time, and when?. International Journal of Forecasting, 26(4), 808-835.
- Smets, F., & Wouters, R. (2003). An estimated dynamic stochastic general equilibrium model of the euro area. Journal of the European economic association, 1(5), 1123-1175.
- Smets, F., & Wouters, R. (2005). Comparing shocks and frictions in US and euro area business cycles: a Bayesian DSGE approach. Journal of Applied Econometrics, 20(2), 161-183.
- Smets, F., & Wouters, R. (2007). Shocks and frictions in US business cycles: A Bayesian DSGE approach. American economic review, 97(3), 586-606.
- Stock, J. H., & Watson, M. W. (1988). Variable trends in economic time series. Journal of economic perspectives, 2(3), 147-174.
- Stock, J. H., & Watson, M. W. (2003). Forecasting output and inflation: The role of asset prices. Journal of economic literature, 41(3), 788-829.
- Stock, J. H., & Watson, M. W. (2018). Identification and estimation of dynamic causal effects in macroeconomics using external instruments. The Economic Journal, 128(610), 917-948.

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**. There are 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

We will also make use of Matlab for the last topic in this course. Please install:

- Dynare latest version: Dynare Access
- Matlab using University Licence: MATLAB Access
  - Please download a version of Matlab that is compatible with the latest version of Dynare. Once you have Dynare working, avoid updating Matlab during the duration of this course.

Lecture Format

Lectures will be in person on Mondays & Wednesdays from 11:00 a.m. - 12:30 p.m. in BRB 1.118. Regular attendance is strongly encouraged, as **there will be no class recordings**.

TA Help Sessions

Help sessions are an integral part of the course. Weekly sessions with the TA will take place every Friday from 11:00 a.m. to 12:00 p.m. in BRB 2.136. These sessions will primarily focus on empirical applications, homework assignments, and STATA. Regular attendance is strongly encouraged and expected.

Assessment and Grading

1. **Homework Assignments (40% of total grade):** There will be **six homework assignments** aligned with the course content. Assignments will be posted on Canvas one week before the due date and must be submitted as a single PDF file (with relevant code, if required) at the beginning of class on the due date. Tentative deadlines are: *Jan 28, Feb 11, Feb 25, Mar 25, Apr 8, and Apr 22.* You are allowed to skip one assignment. If all six are submitted, the lowest grade will be dropped. Each counted assignment is worth **8%** of the total grade.
2. **Exams (40% of total grade):** There will be two exams:
   - **In-Class Exam 1 (20%):** Scheduled for **Wednesday, Mar 4** during class time (*11:00 a.m. - 12:30 p.m.*). This closed-book exam covers **Lectures 1–14** and emphasizes analytical reasoning and conceptual understanding.
   - **In-Class Exam 2 (20%):** Scheduled for **Friday, May 1** (*3:30 p.m. - 5:30 p.m.*) in BRB 1.118. This closed-book exam covers **Lectures 16–27** and emphasizes analytical reasoning and conceptual understanding.
3. **Research Paper (20% of total grade):** You will develop an original **research paper** on a topic **drawn from the material covered in this course**. The paper should demonstrate a strong understanding of time series theory and empirical methods and should be written to the standards of a **peer-reviewed academic paper**. The following components are required:

(A) **Research Proposal:** A written proposal outlining the research question, relevant literature, data, and methodology, due by **April 15**.

(B) **Final Paper:** A complete draft of the research paper, due by **Friday, May 1**.

This project will be completed in **pairs of two students**, with pairs assigned **randomly**. The research paper accounts for **20% of your total course grade**, so submissions are expected to be rigorous, well-structured, and carefully executed.

Important Notes.

- **Exam Absence Policy:** If you miss an **in-class midterm exam**, you will receive a score of **zero**. However, if the absence is due to a **university-approved excused absence**, you are still required to take the exam. In such cases, the **exam weight will not be transferred** to the other exam, and it is the student's responsibility to complete the exam through a make-up arrangement.
- **Late assignments and make-up exams:** Late submissions and requests for make-up exams will **not be accepted** except in cases of university-approved absences. Any request for accommodation must be submitted in writing **before the exam**. Please note that the TA is not responsible for handling excused absences or accommodations.
- **Academic Dishonesty:** Academic integrity is taken very seriously in this course. While you are encouraged to discuss homework problems with your assigned working group, you must submit your own individual write-up. The use of AI tools (e.g., ChatGPT or similar platforms) for assignments, exams, or any other graded component is **not permitted**.

  Any suspected violation will be treated as **academic misconduct**. All such cases must be referred to the **Office of Student Conduct and Academic Integrity** for formal review; informal resolution between instructor and student is no longer an option.
- **Regrade requests:** Requests for regrading must be submitted in writing within five working days of receiving your graded work. The entire submission will be re-evaluated, not just selected questions. Requests submitted after the deadline will not be considered.
- **Grading scale:** Final grades will follow the university's plus/minus grading scale (A, A-, B+, ...). Grades will be curved based on your weighted average and overall performance in the class.

Lecture Schedule (Tentative)

Table 1 provides a tentative outline of the topics the course will cover; some adjustments should be expected. The schedule on Canvas will be updated throughout the semester with specific readings, handouts, and dates.

For your convenience, you will also receive a "Course Notebook" file, which will be updated regularly to reflect the specific topics covered in each lecture. This file will serve as a central hub and will include links to:

— Lecture slides, notes, and specific readings

— Homework assignments and solutions,

— State codes,

— Exams and solutions, and

— Any other course materials.

In short, this file will be your **one-stop resource** for everything you need in this course.

Table 1: Tentative Lecture Schedule

Lecture	Date	Topics	Assignments
1	Mon Jan 12	Introduction to the course; nature of time series data; spurious regression	
2	Wed Jan 14	Gauss-Markov assumptions; basic time series properties; AR models	
3	Wed Jan 21	ARMA models; trends, unit roots, and seasonality	HW 1 due Feb 2
4	Mon Jan 26	Canceled due to weather disruptions	
5	Wed Jan 28	Autocorrelation and heteroskedasticity	
6	Mon Feb 2	Heteroskedasticity, GARCH variants, and ARMA forecasting	
7	Wed Feb 4	ARMA forecasting, forecast evaluation, and direct vs. iterated forecasts	HW 2 due Feb 11
8	Mon Feb 9	Cointegration, Engle-Granger, Dynamic OLS, and error correction models	
9	Wed Feb 11	SVAR basics and the identification problem	
10	Mon Feb 16	SVAR identification schemes: recursive, long-run, and sign restrictions	
11	Wed Feb 18	External instruments and structural dynamic analysis	HW 3 due Feb 25
12	Mon Feb 23	Granger causality and SVAR examples: short-run restrictions	
13	Wed Feb 25	SVAR examples: short-run, long-run, and sign restrictions	
14	Mon Mar 2	Midterm review	
15	Wed Mar 4	**Midterm Exam (No class)**	Covers Lectures 1–14
16	Mon Mar 9	Sign restrictions, external instruments, and monetary policy surprises	
17	Wed Mar 11	Local projections: basics, relation to VARs, and estimation	HW 4 due Mar 25
18	Mon Mar 23	Local projections in practice	
19	Wed Mar 25	Maximum likelihood estimation	
20	Mon Mar 30	Maximum likelihood, state-space models, and the Kalman filter	
21	Wed Apr 1	Kalman filter application: Taylor rule	HW 5 due Apr 8
22	Mon Apr 6	Local level models and trend inflation	
23	Wed Apr 8	Structural time series and nonlinear models: structural breaks and TAR	
24	Mon Apr 13	Markov switching models; Proposal Presentations	
25	Wed Apr 15	Bayesian estimation of DSGE models; Proposal Presentations	HW 6 due Apr 22
26	Mon Apr 20	Bayesian computation and posterior simulation	
27	Wed Apr 22	Posterior simulation and NK model estimation example	
28	Mon Apr 27	Review	

Note: Dates, topics, and readings are tentative and subject to change. Updates will be posted on Canvas. Please keep track of the the "Course Notebook" file.

University Policies & Resources

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.

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.

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 students' well-being, and 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. For more information about reporting options and resources, visit title IX website, contact the Title IX Office via email at 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.

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.