

ECON 7950. ADVANCED TIME SERIES ECONOMETRICS

Spring 2020

Instructor: Ivan Mendieta-Muñoz, Ph.D.	Time: Mo, 2:00 p.m.-4:40 p.m.
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Contact information:

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Consultation hours: Tu, 10:30 a.m.-12:30 a.m. or by appointment.

[Personal website.](#)

[University website.](#)

Course Page: [Canvas](#)

Prerequisites: ECON 7801.

This assumes that students have a working knowledge in econometric theory, matrix algebra, multivariate calculus, and time series econometrics from a classical perspective.

Course Description and Objectives: This course concentrates on advanced time series applications. Its primary purpose is to introduce you to a variety of advanced state-of-the-art estimation techniques and statistical methods used in empirical time series research. Emphasis is on hands-on implementation of the methods covered in the course. Topics include nonlinear time series models; statistical methods in the frequency domain; advanced statistical methods in the time domain; and linear and nonlinear state-space models. We will illuminate the many facets of these statistical methods from both the classical (frequentist) and Bayesian points of view. The course will equip students with the necessary knowledge to be able to undertake advanced econometric analysis of the type commonly associated with modern macroeconomic research.

Textbook References:

- Douc, Randal, Eric Moulines, and David S. Stoffer (2014). *Nonlinear Time Series. Theory, Methods, and Applications with R Examples*. Boca Raton: Taylor & Francis Group.
- Durbin, James, and Siem Jan Koopman (2012). *Time Series Analysis by State Space Methods*. Oxford: Oxford University Press. 2nd Edition.
- Kroese, Dirk P., and Joshua Chan (2014). *Statistical Modeling and Computation*. London: Springer.
- Greenberg, Edward (2013). *Introduction to Bayesian Econometrics*. New York City: Cambridge University Press. 2nd Edition.
- Hansen, Bruce (2019). *Econometrics*. *Mimeo*. [Available here](#). (Accessed 4 December 2019).
- Shumway, Robert H., and David S. Stoffer (2017). *Time Series Analysis and its Applications. With R Examples*. London: Springer. 4th Edition.

Readings outside these texts may also be assigned.

Students are also encouraged to keep up with current economic news. *Financial Times*, *New York Times* and *Wall Street Journal* are excellent sources and they are free on campus. You may also want to peruse *The Economist*. Additionally, an excellent website where you can find op-ed pieces by leading economists is *Project Syndicate*.

University Policies:

- 1. The Americans with Disabilities Act.** The Department of Economics at the University of Utah seeks to provide equal access to its programs, services and activities for people with disabilities. If you need accommodations in this class, reasonable prior notice needs to be given to the instructor and to the Center for Disability Services (162 A. Ray Olpin Student Union Building, 581-5020 (V/TDD)) to make arrangements for accommodations (more information can be found [here](#)). All written information in this course can be made available in an alternative format with prior notification to the Center for Disability Services.
- 2. University Safety.** The University of Utah values the safety of all campus community members. To report suspicious activity or to request a courtesy escort, call campus police at 801-585-COPS (801-585-2677). You will receive important emergency alerts and safety messages regarding campus safety via text message. More information regarding safety and to view available training resources (including helpful videos) can be found [here](#).
- 3. Addressing Sexual Misconduct.** Title IX makes it clear that violence and harassment based on sex and gender (which includes sexual orientation and gender identity/expression) is a civil rights offense subject to the same kinds of accountability and the same kinds of support applied to offenses against other protected categories such as race, national origin, color, religion, age, status as a person with a disability, veteran's status or genetic information. If you or someone you know has been harassed or assaulted, you are encouraged to report it to the Title IX Coordinator in the Office of Equal Opportunity and Affirmative Action, 135 Park Building, 801-581-8365, or the Office of the Dean of Students, 270 Union Building, 801-581-7066. For support and confidential consultation, contact the Center for Student Wellness, 426 SSB, 801-581-7776. To report to the police, contact the Department of Public Safety, 801-585-2677(COPS).
- 4. Undocumented Student Support.** Immigration is a complex phenomenon with broad impact—those who are directly affected by it, as well as those who are indirectly affected by their relationships with family members, friends, and loved ones. If your immigration status presents obstacles to engaging in specific activities or fulfilling specific course criteria, confidential arrangements may be requested from the Dream Center. Arrangements with the Dream Center will not jeopardize your student status, your financial aid, or any other part of your residence. The Dream Center offers a wide range of resources to support undocumented students (with and without DACA) as well as students from mixed-status families. To learn more, please contact the Dream Center at 801.213.3697 or visit the [Dream Center website](#).

Exams and Grading Policy: The course grade will be based on thirteen homework assignments focused on different advanced time series applications. Therefore:

Homework Assignments (100%)

Late assignments will not get credit except in the cases of:

1. *Medical emergencies.*
2. *Officially sanctioned University activities.*
3. *Religious obligations.*

As indicated in PPM 9-7 Sec 15, the appropriate unit should provide a written statement for the reason of absence. In cases 2 and 3, students should get in touch with me at least one week before the exam and reschedule the examination. Students will not be assigned extra credit work to improve their grades. Senior class students' work will not be graded differently.

Grading system follows the university standards:

- Excellent, superior performance: A (90-100%), A- (85-89.9%)
- Good performance: B+ (80-84.9%), B (75-79.9%), B- (70-74.9%)
- Standard performance: C+ (65-69.9%), C (60-64.4%), C- (55-59.9%)
- Substandard performance: D+ (50-54.9%), D (45-49.9%), D- (40-44.9%)
- Unsatisfactory performance: E (0-39.9%)

Important dates:

Martin Luther King Jr. Day holiday #1	Monday, January 20
Spring Break	Sunday-Sunday, March 8-15
Presidents' Day holiday #2	Monday, February 17

Class Rules:

1. I encourage student cooperation in homework assignments. However, each student must present her own assignment. Duplication of the same assignment under different names is not acceptable and is considered cheating. Cheating in homework assignments or exams and other types of academic misconduct will be dealt with in accordance with the University regulations. Full details on procedures and penalties can be found [here](#). Punishments can be severe, so don't do it.
2. Come to class in time.
3. Read the assigned material in advance and familiarize with the subject before the lecture.
4. I will use Canvas for announcements, homework assignments, posting extra readings, etc. However, Canvas is not a substitute to attending class. It is your responsibility to keep up with the class.
5. Turn off your cell phones and remove them from your desk.
6. Do not believe any of the material you read in the textbooks or elsewhere. Learn it well and critically.

Course Outline: The following outline is approximate. We may slow down or speed up in accordance with the needs and demands of the class.

1. Review of Time Series Methods from a Frequentist Perspective

- (a) Univariate time series analysis
 - i. Unit root testing
 - ii. ARMA and ARIMA models
 - iii. Time domain decomposition methods
- (b) Multivariate time series analysis
 - i. Reduced-form VAR models and SVAR models
 - ii. VEC models and SVEC models

2. Additional Time Series Methods

- (a) Frequency domain analysis
 - i. Parametric and non-parametric spectral estimation
 - ii. Multiple series and cross-spectra
 - iii. Signal extraction and optimum filtering
 - iv. Statistical methods in the frequency domain
- (b) Advanced Time Domain Topics
 - i. Long memory ARMA and fractional differencing
 - ii. GARCH and Threshold models
 - iii. Multivariate ARMAX models

3. State Space and Hidden Markov Models

- (a) Linear Gaussian models
 - i. Filtering, smoothing and forecasting
 - ii. Smoothing splines and the Kalman smoother
 - iii. Structural components models
 - iv. State space models with correlated errors
- (b) Markovian models
 - i. MCMC methods
 - ii. Stability and convergence
 - iii. Sample paths and limit theorems
 - iv. Bayesian inference
- (c) Non-Gaussian and non-linear state space models
 - i. Switching processes with Markov regimes
 - ii. Particle filtering
 - iii. Particle smoothing
 - iv. Stochastic volatility and Bayesian inference
 - v. Asymptotics of MLE for NLSS

