UNIVERSITY OF OREGON
Department of Economics

Fall 2021
EC 607: Time-Series Econometrics
Tuesdays and Thursdays 12:00 – 1:50 in PLC 410

Instructor: Jeremy Piger

Email: jpiger@uoregon.edu

Office Hours:
Thursdays, 2:00 to 3:00: Zoom (access link through Canvas)
By appointment: In person or on Zoom. Email me to set up a time

Course Description: EC 607 is a survey course in time series econometrics with an emphasis on application. The course will focus on parametric time-series models and how they are estimated and interpreted. We will cover univariate and multivariate models of stationary and nonstationary time series, analyzed in the time domain.

Course Requirements and Grading: Your grade in the course will be determined by your performance on weekly problem sets that involve both analytical and computer-based problems.

All problem sets will be assigned on Fridays, and most are anticipated to be due the following Friday. The first problem set is due Friday, October 8 and the last problem set is due Friday, December 10. The due dates for other problem sets will be indicated on Canvas and on the problem sets themselves.

All problem sets are due by 11:59 p.m. on the due date and should be submitted online via Canvas. There will be a 5-percentage point reduction in your assignment score for every hour an assignment is late. The first problem set will contain additional information regarding preparation and submission of problem set answers.

As is department policy, a grade of incomplete will only be given in very unusual circumstances.

Software: Portions of the problem sets require use of computer software with "canned" time-series estimation routines and functions. The problem sets will also require writing your own estimation routines using suitable software. I will provide examples in R, where I use RStudio to interface with R. You can download R and RStudio for free at the following sites:

https://www.r-project.org

https://rstudio.com/products/rstudio/

If you haven't yet had any experience with R, I recommend this introduction:

https://education.rstudio.com/

Course Website: Canvas (https://canvas.uoregon.edu/) will be used to distribute documents and information relevant to the course, as well as to submit completed homework.

Cancellations: The University is closed on Thursday, November 11 (Veteran's Day) and Thursday, November 25 (Thanksgiving). In the event of an additional class cancellation, I will alert you using Canvas's email function.

Textbook: There are no required texts for the course. Here are a number of references that you may find useful:

- Hamilton, J.D., 1994, *Time Series Analysis*, Princeton University Press.
- Cochrane, J., *Time Series for Macroeconomics and Finance,* available at: https://static1.squarespace.com/static/5e6033a4ea02d801f37e15bb/t/5ed92dcb7665261af1aa23f2/1591291342389/time_series_book.pdf
- Diebold, Francis, X., *Time Series Econometrics,* available at: http://www.ssc.upenn.edu/~fdiebold/Teaching706/TimeSeriesEconometrics.pdf
- Anna Mikusheva's Lecture Notes: http://ocw.mit.edu/courses/economics/14-384-time-series-analysis-fall-2013/lecture-notes/
- J. Durbin and S.J. Koopman, 2012, *Times Series Analysis by State Space Methods,* Oxford University Press.
- Kim C.J. and C. Nelson, 1998, *State Space Models with Regime Switching: Classical and Gibbs Sampling Approaches with Applications*, MIT Press.

Course Topics

Weeks 1-2: Introduction to Time Series and ARMA Models

Covariance stationary time series, Wold Representation, ARMA models, impulse response functions, stationarity conditions for ARMA models, autocorrelation function, estimation of ARMA models via conditional MLE, deterministic trends vs. unit roots, structural breaks vs. unit roots, unit root tests, ARIMA models, estimation of ARIMA models via conditional MLE, selecting an ARMA model via information criteria

Weeks 3-4: VAR Models

Reduced form VAR models, stationarity conditions, relationship to ARDL models, estimation via conditional MLE, lag selection, structural VARs, impulse response functions, approaches to identification, non-stationary VARs, cointegration, tests for cointegration, estimating cointegrating vectors, VECMs

Week 5: Linear, Gaussian, State-Space Models and the Kalman Filter

State-space models, Kalman filtering and smoothing, EM algorithm, exact MLE of a stationary ARMA model

Week 6: Trend / Cycle decomposition

Beveridge-Nelson decomposition (univariate and multivariate), unobserved-components model and decomposition, estimation of unobserved-components models via exact MLE and the Kalman Filter

Weeks 7-8: Big Data (with an emphasis on forecasting)

Dynamic factor models, estimation of dynamic factor models via MLE and the Kalman Filter, estimation of dynamic factor models via MLE and the EM algorithm, FAVAR models, shrinkage, ridge regression, bootstrap aggregating (boosting), bagging, LASSO, cross-validation

Weeks 9-10: Models with Time Varying Parameters

Testing for structural breaks of unknown timing, dating structural breaks of unknown timing, Markov-switching models, estimation of structural break models using Markov switching, TVP models, estimation of TVP models via the Kalman Filter.

Academic Disruption: In the event of a campus emergency that disrupts academic activities, course requirements, deadlines, and grading percentages are subject to change. Information about changes in this course will be communicated as soon as possible by email and on Canvas. If we are not able to meet face-to-face, students should immediately log onto Canvas and read any announcements and/or access alternative assignments. Students are also expected to continue coursework as outlined in this syllabus or other instructions on Canvas. In the event that the instructor of this course has to quarantine, this course may be taught online during that time.

COVID Containment Plan for Classes: As the University of Oregon returns to in-person instruction, the key to keeping our community healthy and safe involves **prevention**, **containment**, and **support**. Here is information critical to how the UO is responding to COVID-19.

- **Prevention**: To prevent or reduce the spread of COVID-19 in classrooms and on campus, all students and employees must:

    - Comply with vaccination policy
    - Wear face coverings in all indoor spaces on UO campus
    - Complete weekly testing if not fully vaccinated or exempted
    - Wash hands frequently and practice social distancing when possible
    - Complete daily self-checks
    - Stay home/do not come to campus if feeling symptomatic
    - Complete the UO COVID-19 case and contact reporting form if you test positive or have been in close contact with a confirmed or presumptive case.

- **Containment:** If a student in class tests positive for COVID-19, all relevant classes will be notified via an email by the Corona Corps Care Team with instructions for students and staff based on their vaccination status. Specifically:

    - **Vaccinated and Asymptomatic students:** Quarantine not required, but daily self-monitoring before coming on campus is advised; sign up for testing through MAP 3-5 days after exposure if advised you are a contact."
    - **Unvaccinated or partially vaccinated students:** 14-day quarantine advised – do not come to class – and sign up for testing 3-5 days after notification through MAP, if asymptomatic, or through University Health Services (541-346-2770) or your primary care provider, if symptomatic.
    - **Symptomatic students:** stay home (do not come to class/campus), complete the online case and contact form, and contact University Health Services (541-346-2770) or your primary care provide to arrange for immediate COVID-19 testing.

    Students identified as a **close contacts** of a positive case will be contacted by the Corona Corps Care Team (541-346-2292).

- **Support**: The following resources are available to you as a student.
    - University Health Services or call (541) 346-2770
    - University Counseling Center or call (541) 346-3277 or (541) 346-3227 (after hrs.)
    - MAP Covid-19 Testing
    - Corona Corps or call (541) 346-2292
    - Academic Advising or call (541) 346-3211
    - Dean of Students or call (541)-346-3216

Good Classroom Citizenship

- Wear your **mask** and make sure it fits you well
- **Stay home** if you're sick
- **Get to know your neighbors** in class, and let them know if you test positive
- **Get tested** regularly
- Watch for **signs and symptoms** with the daily symptom self-check
- **Wash your hands** frequently or use hand sanitizer
- Complete the UO COVID-19 **case and contact reporting form** if you test positive or are a close contact of someone who tests positive.