San José State University
College of Social Sciences/Department of Economics
ECON 138, Business and Economic Forecasting, Section 1, Fall, 2023

Course and Contact Information

Instructor(s): Rui Liu
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Office Hours: M 4-5 pm at DMH 143; Th 12-1 pm via Zoom (click here to make an appointment)
Class Days/Time: Monday 6-8:45 pm
Classroom: DMH 165
Prerequisites: ECON 1A, ECON 1B, ECON 103A and a semester of statistics.

Course Description

The purpose of this course is to introduce an array of methods and practices for analyzing time-series data and generating statistical forecasts. This will be accomplished through a mix of theoretical discussions and software-based applications to real-world problems.

Course Format

Technology Intensive, Hybrid, and Online Courses

Each class session will include a brief lecture followed by hands-on laboratory work. During lectures, the instructor will cover forecasting concepts and provide demonstrations to facilitate understanding of these concepts. Students will then participate in laboratory exercises to gain hands-on experience of concepts covered in lecture. As such, regular attendance and active participation in lab activities is essential for learning and succeeding in the course. Students should bring a laptop to class for use in laboratory exercises, but owning a laptop is not a requirement for taking this course – please see below for loan/rental options. Students will be assessed via homework problems, quizzes, and a final project.

Given that the format and content of this course is quite different than that of typical economics courses, it is especially important that you stay on top of your homework and regularly practice your new skills. Unlike many of your other courses, **this is not a course in which you can cram at the last minute**! Should you miss a class, it is extremely important to find out what you missed—preferably by contacting one of your fellow students—and to practice lab activities on your own. Being proactive about seeking help is similarly important in achieving a successful outcome. Please ask questions when you don't understand information in lecture, laboratory activities, or readings -- asking questions and offering ideas is welcomed and encouraged!

Course Learning Outcomes (CLO)

CLOs	PLOs	Assignment
1. Explain a variety of statistical model and filtering tools for time series and identify correct methods to analyze these models.	PLO 3 research methods PLO 4 Specialist Area-Quantitative Methods PLO 5 Communication	Learning outcomes are satisfied by weekly problems sets that contain two parts. The theory part helps students to gain basic understanding of the time series analysis. The application part asks students to do practical time series analysis using R. Six quizzes are designed in a way such that students have to correctly identify the methods and apply them to real world problems. Weekly muddy point discussions help student gain a deeper understanding of the materials.
2. Choose an appropriate ARIMA model for a given set of data and fit the model using an appropriate package.	PLO 4 Specialist Area-Quantitative Methods	Weekly homework and quizzes
3. Be able to apply R in time series/forecasting situations	PLO 4 Specialist Area-Quantitative Methods	Such expected learning outcome are satisfied by the weekly R project which requires that students form an interesting forecasting question, gather relevant data, apply appropriate methods, and write up their results in the form of a well-written report.
4. Compute forecasts for a variety of linear methods and models.	PLO 4 Specialist Area-Quantitative Methods	Weekly homework, quizzes and final project

Required Texts/Readings

Textbook

Hyndman, R.J., & Athanasopoulos, G. (2021) Forecasting: principles and practice, 3rd edition, OTexts: Melbourne, Australia. OTexts.com/fpp3.

Optional Readings

Shmueli, G., & K. C. Lichtendahl, Jr. (2016) Practical Time Series Forecasting with R: A Hands-On Guide, 2nd edition, Axelrod Schnall. ISBN-10: 0997847913

Grolemund, G., & Wickham, H. (2017). R for Data Science. O'Reilly Media. https://r4ds.had.co.nz/.

Other technology requirements / equipment / material

As noted above, to participate in in-class lab activities, you will need to use a laptop. If you do not own a laptop, several options are available to you. First, for in-class lab activities, we will be doing pair programming, which refers to programming with a partner and regularly switching who is the "driver" and who is the "navigator". As such, an excellent option for students without a laptop is to simply pair with a classmate who does own a laptop – something which can worked out during the first week of class. Second, if you prefer to work with your own laptop, you can rent one from library as detailed below. Finally, for completing homework assignments, studying for quizzes, and working on your final project, you may use SEEL Econ lab located at CCB 100, as detailed below.

Renting laptops
Laptops can be borrowed from the library for free for relatively short periods of time. Unfortunately, this option is rather tedious in that you would need to install R and other relevant software each time you borrowed a laptop. A better, long-term solution would be to rent a laptop through SJSU IT IMS Equipment Loaning Program, which allows for rentals by the week as well as by the semester. Please see the ITS website for more details at https://sjsuequipment.getconnect2.com/.

Computer labs
Most computer labs on campus will not have the necessary software installed that is required for this class. As such, please use the following computer lab in Central Classroom Building (across from Clark Hall) which is well-equipped for our needs: CCB 100.

Course Requirements and Assignments

During this course, you will be required to participate in class and to complete the following: homework, quizzes, and a final project (see details below in "Grading Information" and "Schedule"). Students will use the RStudio environment for programming activities, assignments, and projects.

"Success in this course is based on the expectation that students will spend, for each unit of credit, a minimum of 45 hours over the length of the course (normally three hours per unit per week) for instruction, preparation/studying, or course related activities, including but not limited to internships, labs, and clinical practica. Other course structures will have equivalent workload expectations as described in the syllabus."

Homework (25%)

Throughout the semester, you will be required to complete weekly homework assignments (13 total assignments). No late homework assignments will be accepted, but I will allow each student **to drop their three lowest homework scores**, such that the remaining 10 assignments count 3% each. Homework

assignments will be checked for plagiarism, and assignments that demonstrate plagiarism will receive a score of zero. See Canvas for further details on submitting homework assignments.

Quizzes (50%)

Six quizzes will test your conceptual knowledge from lecture and assigned readings, as well as your programming skills practiced via laboratory activities and homework assignments. **Two of your lowest quiz scores will be dropped**, such that the remaining four quizzes count 12.5% each. Please note that no makeup quizzes will be given except in emergency situations in which documentation is provided by an independent authority (e.g., a doctor's note).

Final project (15%)

The culminating assignment for this course is a final project of your choosing. You will work in groups of 1-2 students on a project that applies R to a forecasting question of your choice. This assignment will be discussed in greater detail later in the semester.

Muddy point discussion (10%)

Throughout the course, a weekly engagement on Canvas is expected from you. This involves sharing at least one "muddy point" per week – an unresolved question stemming from the lectures, a concept that isn't entirely clear to you, or an area needing further clarification. While responding to your peers' posts is encouraged, it is not obligatory. Your active participation in this reflective process will contribute to a deeper understanding of the material. There are a total of 13 muddy point discussions for you to complete, and **the three lowest scores will be dropped**.

Extra credit (<= 1 extra point)

You will have two opportunities to receive extra credit (0.5 point each) in this class. Firstly, you will receive extra credit if you schedule a 30-minute appointment with a career counselor by logging into Spartan Connect > Appointments, Drop-ins, and Workshops & Events. Secondly, you can attain additional credit by engaging in the department's seminars, workshops, and Provocative Lecture Series. These opportunities not only offer extra credit but also enrich your learning experience.

Grading Information

Grade	Percentage
A plus	96 to 100%
A	93 to 95%
A minus	90 to 92%
B plus	86 to 89 %
B	83 to 85%
B minus	80 to 82%
C plus	76 to 79%
C	73 to 75%
C minus	70 to 72%
D plus	66 to 69%
D	63 to 65%

Grade	Percentage
D minus	60 to 62%

University Policies

Per University Policy S16-9 ,relevant university policy concerning all courses, such as student responsibilities, academic integrity, accommodations, dropping and adding, consent for recording of class, etc. and available student services (e.g. learning assistance, counseling, and other resources) are listed on Syllabus Information web page (https://www.sjsu.edu/curriculum/courses/syllabus-info.php). Make sure to visit this page to review and be aware of these university policies and resources.

Econ 138 / Business and Economic Forecasting, Fall 2023, Course Schedule

Course Schedule

Week	Date	Topics	Notes (Readings, Assignments, Deadlines)
1	Aug 21	Course Overview, Intro to R and RStudio, R Markdown	Readings: • Syllabus and other course materials • Grolemund & Wickham – ch 1-8 & 27 Assignments: • Install R and RStudio on your computer
2	Aug 28	Data Loading, Data Wrangling	Readings: • Grolemund & Wickham – ch 1-8 & 27 Assignments: • HW 1 due
3	Sep 4	Labor Day	
4	Sep 11	Getting Started with Forecasting, Time Series Graphics I	Readings: • Hyndman & Athanasopoulos – ch 1&2 • Cowpertwait & Metcalfe – ch 1 Assignments: • HW 2 due
5	Sep 18	Time Series Graphics II, transformation adjustments, time series components	Readings: • Hyndman & Athanasopoulos – ch 2-3 • Cowpertwait & Metcalfe – ch 3 Assignments: • Quiz 1 • HW 3 due
6	Sep 25	STL decomposition, classical decomposition	Readings: • Hyndman & Athanasopoulos – ch 4 Assignments: • HW 4 due

7	Oct 2	Moving averages, X-11 and SEATS methods, simple forecasting methods	Readings: • Hyndman & Athanasopoulos – ch 5 • Cowpertwait & Metcalfe – ch 4 Assignments: • Quiz 2 • HW 5 due
8	Oct 9	The forecaster's toolbox (fitted values and residuals; residual diagnostics; distributional forecasts and prediction intervals; evaluating point forecast accuracy)	Readings: • Hyndman & Athanasopoulos – ch 7 • Cowpertwait & Metcalfe – ch 5 Assignments: • HW 6 due
9	Oct 16	Linear model, evaluating linear model	Readings: • Hyndman & Athanasopoulos – ch 7 Assignments: • Quiz 3 • HW 7 due
10	Oct 23	Evaluating linear model, useful predictors	Readings: • Hyndman & Athanasopoulos – ch 7 Assignments: • HW 8 due
11	Oct 30	Selecting predictors, forecasting with regression	Readings: • Hyndman & Athanasopoulos – ch 7 Assignments: • Quiz 4 • HW 9 due
12	Nov 6	Project requirement, simple exponential smoothing	Readings: • Hyndman & Athanasopoulos – ch 8 Assignments: • HW 10 due
13	Nov 13	Holt's method, Holt-Winters' method	Readings: • Hyndman & Athanasopoulos – ch 8 Assignments: • Quiz 5 • HW 11 due
14	Nov 20	ARIMA	Readings: • Hyndman & Athanasopoulos – ch 9

			Assignments: • HW 12 due
15	Nov 27	Seasonal ARIMA	Readings: • Hyndman & Athanasopoulos – ch 9
16	Dec 4	Dynamic Regression Model	Readings: • Hyndman & Athanasopoulos – ch 10 Assignments: • Quiz 6 • HW 13 due
Final Exam	Dec 11	5:15-7:30 PM	Assignments: • Final project due 7:30 pm on Dec 11