

Economics 481 – Business Forecasting Techniques

Fall 2021

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UNIVERSITY COURSE DESCRIPTION:

ECON 481, Business Forecasting Techniques (3 credits). A survey of contemporary business forecasting techniques, with emphasis on smoothing, decomposition, and regression techniques.

Prerequisite: SCM 200 or STAT 200

COURSE OVERVIEW:

This course covers the basics of forecasting and time series analysis as used in finance, economics, and business. Basic time series topics will include linear regression, ARMA models, trend modeling, seasonal adjustments, and forecast evaluation. This course will develop all of these using the R programming language and tools such as R-Studio and the forecast package.

The goal of this course is for students to obtain a hands-on experience with using financial, economic, business, crime, traffic, and other data to construct and evaluate forecasts. You will learn how to (1) forecast in R, (2) create basic data visualization to “let the data speak to you”, (3) select and evaluate models that provide the ex-ante best forecasts, and (4) evaluate ex-post forecasts.

The primary teaching objectives for this course are (1) to introduce students to a range of commonly used business forecasting techniques, including the underlying rationales and strengths and weaknesses, (2) to suggest strategies for choosing modeling techniques appropriate for given situations or data series, (3) to illustrate the mechanics of applying these techniques, and (4) to provide students with the experience of preparing, presenting, and defending a forecast to top management.

COURSE LEARNING OBJECTIVES:

- Basic problems, issues, and limitations in forecasting
- Graphical examination of time series
- Identify the appropriate forecasting methods for any given data

- Smoothing methods to model a time series and forecast
- Regression models for trend and seasonal components
- Regression models incorporating autocorrelation and external information
- ARIMA modeling tools
- Formulating a well-defined forecasting process in example applications
- Understand out of sample limitations in most forecasting solutions
- Interpret the results and write a basic report useful for management in decision making
- Be able to apply the open-source language, R, for forecasting and time series

REQUIRED TEXTBOOK:

Galit Shmueli and Kenneth C. Lichtendahl, Jr., *Practical Time Series Forecasting with R: A Hands-On Guide*, (2nd edition), Axelrod Schnall Publishers. ISBN-10: 0997847913, [<http://www.forecastingbook.com>].

OPTIONAL TEXTBOOKS:

Rob J. Hyndman and George Athanasopoulos, *Forecasting Principles and Practice*, (2nd edition), [available online at <https://otexts.com/fpp2/>].

Jared P. Lander, *R for Everyone: Advanced Analytics and Graphics*, 2nd edition, Addison-Wesley. ISBN-10: 013454692X. [available online through the Penn State library at <https://catalog.libraries.psu.edu/catalog/29304286>].

Hyunyoung Choi and Hal Varian, *Predicting the Present with Google Trends*, [available online at https://www.google.com/googleblogs/pdfs/google_predicting_the_present.pdf].

REQUIRED SOFTWARE:

Both of these are open source:

1. R and R-Studio will be used for all projects.
2. We will use the *forecast* package for R extensively. We will use the current version, 8.14: [<https://pkg.robjhyndman.com/forecast/>].

EVALUATION/GRADING:

First Hourly Exam	20%
Second Hourly Exam	20%
Final Exam	30%
Problem Sets	10%
Project	20%

	100%

Grading Ranges:

A	= 90.00 - 100%	C +	= 75.00 - 77.49%
A -	= 87.50 - 89.99%	C	= 70.00 - 74.99%
B +	= 85.00 - 87.49%	D	= 60.00 - 69.99%
B	= 80.00 - 84.99%	F	= below 60.00%
B -	= 77.50 - 79.99%		

PROVISIONS FOR POSSIBLE SYLLABUS ADDENDA OR REVISIONS:

There may be changes in the assignments and the dates. Students are responsible for learning of any changes in the syllabus that are announced in class. Any changes to the course policies will be distributed in writing.

In the event of a campus closure, course requirements, classes, deadlines and grading schemes are subject to changes that may include alternative delivery methods, alternative methods of interaction with the instructor, class materials, and/or classmates, a revised attendance policy, and a revised semester calendar and/or grading scheme. Information about course changes will be communicated through email and in writing.

COURSE POLICIES:

Students are expected to take full responsibility for his/her academic work and academic progress. Students are expected to attend class regularly, for consistent attendance offers the most effective opportunity open to all students to gain developing command of the concepts and materials of the course. A study (Romer, *JEP*, Summer 1993) found that the difference in performance for a student who attends regularly and one who attends sporadically is about a full letter grade. However, attendance in class, in and of itself, is not a criterion for evaluation of the student's degree of success or failure. Furthermore, absences do not alter what is expected of the student qualitatively and quantitatively. Absences will not be used in the computation of grades.

Late assignments will not be accepted. Make-up exams and quizzes will not be given. Students missing an exam will be required to complete a 15-page paper on a topic chosen by the instructor in lieu of a make-up for the missed exam.

Students who focus on the business of the class increase their likelihood of success. They can do so by listening attentively to the instructor or to other students while participating in discussions. They can take notes that will help them to review the material. During class, they can participate as fully as possible and volunteer to answer questions. Failing to focus decreases the likelihood of success. During this class, it is inappropriate to study for other classes or to read letters or magazines or newspapers. Eating or drinking in class is also distracting.

Students should minimize all behaviors that distract others during the class. Talking to other students apart from class discussions is inappropriate. Students who carry a cell phone should mute it during class time. Students who arrive late should seat themselves as quietly and as near to the door as they can. Students who must leave before the class period ends should exit quietly.

Deferred grades are not normally offered. The course material is designed to be completed within

the semester time frame.

Class participation is highly encouraged. Participation implies more than mere presence in the classroom. It is an active, meaningful, thoughtful, and relevant contribution to discussion and other activities. Students are expected to contribute significantly to discussion voluntarily or when called upon.

Course materials including assignments, data sets, R code, and announcements are posted on the Canvas page associated with this course. Course assignments will be submitted through Canvas.

Veterans and currently serving military personnel and/or dependents with unique circumstances (for example, upcoming deployments, drill/duty requirements, VA appointments, etc.) are welcome and encouraged to communicate these, in advance if possible, to the instructor in the case that special arrangements need to be made.

For notification about campus closures, please refer to Penn State York's website at <http://www.yk.psu.edu>, call the weather hotline at 717 771-4079, or sign up for live text messages at PSUTXT (<http://live.psu.edu/psutxt>). This is a service designed to alert the Penn State community via text messages to cell phones when situations arise on campus that affect the ability of the campus - students, faculty and staff - to function normally.

Academic support services for this course are available at the Nittany Success Center including study groups, 1:1 tutoring, study skills instruction, and computer support.

ACADEMIC INTEGRITY STATEMENT:

Academic integrity is the pursuit of scholarly activity in an open, honest, and responsible manner. Academic integrity is a basic guiding principle for all academic activity at the Pennsylvania State University, and all members of the University community are expected to act in accordance with this principle. Consistent with this expectation, the University's Code of Conduct states that all students should act with personal integrity, respect other students' dignity, rights and property, and help create and maintain an environment in which all can succeed through the fruits of their efforts.

All Penn State University policies regarding ethics, honorable behavior, and academic integrity apply to all of the courses in which you are enrolled. Academic dishonesty includes, but is not limited to, cheating, plagiarizing, fabricating information or citations, facilitating acts of academic dishonesty by others, having unauthorized possession of examinations, submitting work of another person or work previously used without informing the instructor, tampering with the academic work of other students, or acts of falsification, misrepresentation or deception. For any material or ideas obtained from other sources, such as the text or things you see, for example, on the web or in the library, a source reference must be given. Direct quotes from any source must be identified as such. All exam answers must be your own, and you must not provide any assistance to other students during exams. Any instances of academic dishonesty will be pursued under the University regulations concerning academic integrity. Academic dishonesty can result in assignment of "F" by the course instructor or "XF" by Judicial Affairs as the final grade for the student.

DISABILITY ACCOMMODATION STATEMENT:

Penn State welcomes students with disabilities into the University's educational programs. Every Penn State campus has an office for students with disabilities. The Student Disability Resources (SDR) website provides contact information for every Penn State campus. For further information, please visit the Student Disability Resources website, <http://equity.psu.edu/student-disability-resources>. At Penn State York, the disabilities services coordinator is Peggy Violette [muv92@psu.edu; 717-771-4013]. Her office is in the Nittany Success Center on the upper floor of the Pullo Performing Arts Center and located adjacent to the library. At Penn State Mont Alto, the disability services coordinator is Kendra Wolgast [kmw24@psu.edu; 717-749-6045].

In order to receive consideration for reasonable accommodations, you must contact Ms. Violette or Ms. Wolgast as early as possible in the semester, participate in an intake interview, and provide documentation. If the documentation supports your request for reasonable accommodations, you will be provided you with an accommodation letter. Please share this letter with your instructors and discuss the accommodations with them as early as possible. You must follow this process for every semester that you request accommodations.

COUNSELING AND PSYCHOLOGICAL SERVICES STATEMENT:

Many students at Penn State face personal challenges or have psychological needs that may interfere with their academic progress, social development, or emotional well-being. The university offers a variety of confidential services to help you through difficult times, including individual and group counseling, crisis intervention, consultations, online chats, and mental health screenings. These services are provided by staff who welcome all students and embrace a philosophy respectful of clients' cultural and religious backgrounds, and sensitive to differences in race, ability, gender identity and sexual orientation.

Counseling and Psychological Services at Penn State York: 717-771-4088 or 717-771-4045

Counseling and Psychological Services at Penn State Mont Alto: 717-749-6094

Penn State Crisis Line (24 hours/7 days/week): 877-229-6400

Crisis Text Line (24 hours/7 days/week): Text LIONS to 741741

Counseling and Psychological Services at Commonwealth Campuses:
<http://senate.psu.edu/faculty/counseling-services-at-commonwealth-campuses/>

Counseling and Psychological Services at University Park (CAPS): 814-863-0395

EDUCATIONAL EQUITY/REPORT BIAS STATEMENT:

Penn State takes great pride to foster a diverse and inclusive environment for students, faculty, and staff. Acts of intolerance, discrimination, or harassment due to age, ancestry, color, disability, gender, gender identity, national origin, race, religious belief, sexual orientation, or veteran status are not tolerated and can be reported through Educational Equity via the Report Bias web page: <http://equity.psu.edu/reportbias/>

COURSE REQUIREMENTS:

Two hourly examinations and a final examination will be administered during the semester. The final exam is cumulative while the hourly exams include only the material covered since the previous exam. The approximate timing of the hourly exams is listed below. The final exam will take place during the scheduled final exam period as listed in the schedule published later in the semester. Exams may consist of any or all of the following types of questions: multiple choice, true/false, essay, short answer, fill in the blanks, matching, mathematical problems, and graphing. All exams will be administered in Canvas during the scheduled class time for this course. Students will have a limited amount of time to complete the exam in Canvas once he or she begins. The hourly exams each make up 20 percent the course grade. The final exam accounts for 30 percent of a student's grade for the course.

There will be several problem sets assigned throughout the semester. These will involve working through forecasting problems using R. Each student needs to submit their work through an assignment link in Canvas. You receive credit for a "good faith" effort to fully complete the exercises. You are not graded on whether you obtain the correct answer. The problem sets are meant to be a learning tool to reinforce course material and to give students experience in using forecasting software. Make sure to check the posted solutions and learn from your mistakes. These problem sets account for 10 percent of the course grade.

The remaining 20 percent of the course grade is a forecasting project. Each student will be given a time series data set to analyze. This assignment will require you to apply a variety of forecasting techniques you have learned throughout the semester. Your project will involve a short write-up summarizing and justifying your forecast. Details of the case and requirements for the project, including grading expectations, will be distributed later in the semester. The paper is not graded based on how close the forecast is to actual outcomes but on the ability to support the final forecast with valid reasoning. The paper must be submitted through the appropriate assignment link in Canvas by noon on Tuesday, December 7.

The concept of doing extra work for extra credit does not exist within this course. The final grade is based on stated assignments and requirements. Please recognize that your tuition dollars earn you the right to participate in this course. It is your demonstrated attainment of course concepts and content that earn you a final grade.

Finally, please feel free to come see me in Zoom to ask questions or to discuss difficult material. The course material is all cumulative. If you do not understand what happens in the first week, you will not understand what happens in the last week. If my office hours are not convenient, you may set up an appointment for an alternative time.

Topics

1. Course Introduction
2. R Introduction (Lander, Chapters 1-6)
 - Loading R and R-Studio
 - Getting R packages
3. Review of Basic Statistics
 - Descriptive statistics
 - Random variables
 - Hypothesis tests
 - Regression
4. Forecasting Philosophy (Schmueli and Lichtendahl, Chapter 1)
5. Forecasting Preliminaries
 - Time series data and visualization (Schmueli and Lichtendahl, Chapter 2; Hyndman and Athanasopoulos, Chapters 2.1-2.5 and 2.7-2.9)
 - Performance evaluation and objectives (Schmueli and Lichtendahl, Chapter 3; Hyndman and Athanasopoulos, Chapters 3.1 and 3.3-3.5)
 - Overview of forecasting tools (Schmueli and Lichtendahl, Chapter 4)
6. Judgmental Forecasts (Hyndman and Athanasopoulos, Chapter 4)

*** First Hourly Exam ***

7. Smoothing Methods (Schmueli and Lichtendahl, Chapter 5)
 - Moving averages
 - Simple exponential smoothing
 - Advanced exponential smoothing
8. Time Series Econometric Methods
 - Regression: trend and seasonality (Schmueli and Lichtendahl, Chapter 6)
 - Regression: autocorrelation and external information (Schmueli and Lichtendahl, Chapter 7)
9. Presenting and Monitoring Forecasts (Schmueli and Lichtendahl, Chapter 10)

*** Second Hourly Exam ***

10. Advanced Forecasting Techniques
 - Neural networks (Schmueli and Lichtendahl, Chapter 9)
 - Nowcasting with Google Trends (Choi and Varian)

*** Final Exam ***