

# DSO 424: Business Forecasting

Spring Semester, 2017

**Instructor:** Inga Maslova    **Office:** BRI 303 C    **Email:** IMaslova@marshall.usc.edu

**Web Page:** Blackboard

**Schedule:** TTh 02:00pm – 03:50pm in JFF LL103

**Office Hours:** TTh 12:30 pm - 1:30 pm on Blackboard via Collaborate and in BRI 303 C, or by appointment

**Prerequisites:** BUAD 310, BUAD 311 or any equivalent applied business statistics course. If you are concerned about your preparation, please come see me.

**Course Description:** Today, successful firms compete and win based on analytics. If you are wondering about how to take advantage of predictive analytics, data science, and big data, this is the course for you! This course covers topics in time series analysis and other statistical techniques on forecasting. These are time series regression, decomposition methods, exponential smoothing, and the Box-Jenkins forecasting methodology to name a few. Forecasting is not an armchair activity, nor is it an exercise in mathematical formalism, a one-click-and-you're-done computer project, or an uncritical appeal to past experience. Rather, the modern forecaster must be a creative thinker who is able to use available information wisely, draw on the experience of others, use technical arguments when needed and, finally create a computer-based forecasting system that allows management to plan effectively. Probably no such paragon exists, but we should at least aim for an appreciation of all these skills and the ability to work in a team to achieve success. Virtually every area of business makes use of some type of forecast. For example:

1. Marketing managers use a sales forecast to establish promotional budgets.
2. Accountants rely on forecasts of costs and revenue in tax planning.
3. Financial experts must forecast cash flows to maintain solvency.
4. The personal department depends on forecasts as it plans recruitment of new employees and other changes in the workforce.
5. Production managers rely on forecasts to determine raw-material needs and the desired inventory of finished products.

This course is intended for students working in the field of economics, business, marketing, production, operations research, international trade, accounting, etc., who want a non-technical introduction to applied time series econometrics and forecasting.

**Learning Objectives:** In business forecasting, time series models are used to analyze data that are collected sequentially over time. A primary goal of these models is to exploit the association structure of the observations in order to predict future values. The course will emphasize the usefulness of regression and Box-Jenkins forecasting procedures for analyzing time series data. Topics to be covered include the concept of stationarity, autoregressive and moving average models, identification and estimation of models, prediction and assessment of model forecast, seasonal models, and intervention analysis. The course goals are for each student to understand time series methods and obtain “hands on” experience using, analyzing, and developing forecasting models for business applications.

Student Learning Outcomes: At the end of the course, the student will be able to

1. Analyze any time series data using various statistical approaches
2. Generate reasonable forecast values
3. Make concise decisions based on forecasts obtained

**Textbook:** *Practical Time Series Forecasting with R: A Hands-On Guide*, 2nd Ed. by Galit Shmueli and Kenneth C. Lichtendahl Jr., 2016.

Textbook website: <http://www.forecastingbook.com/>

PRACTICAL TIME SERIES FORECASTING WITH R is a hands-on introduction to quantitative forecasting of time series. Quantitative forecasting is an important component of decision making in a wide range of areas and across many business functions including economic forecasting, workload projections, sales forecasts, and transportation demand. Forecasting is widely used also outside of business, such as in demography and climatology. The book introduces readers to the most popular statistical models and data mining algorithms used in practice. It covers issues relating to different steps of the forecasting process, from goal definition through data collection, visualization, pre-processing, modeling, performance evaluation to implementation and communication. PRACTICAL TIME SERIES FORECASTING WITH R is suitable for courses on forecasting at the upper-undergraduate. It offers clear explanations, examples, end-of-chapter problems and cases. Methods are illustrated using the free and open-source software R.

**Course topics:** This course covers the following topics: pre-processing, characterization, and visualizing time series, model performance evaluation, smoothing methods, regression models, Box-Jenkins models, seasonal ARIMA models, models with binary outcome, and neural networks. We will cover the 11 chapters of the textbook, plus additional topics in ensemble modeling if time permits.

**Grades:** Grades will be based on class participation, homework assignments, in-class labs, midterm exam, paper summary, and final project. The weights for each are given in the table below.

Item	When	Due dates	Percent of the grade
Class participation	every class	end of each class	5 %
HW	every 2 weeks	due in a week	20 %
Labs	weekly	next day by midnight	20 %
Midterm	March 9, 2017	at the end of the class	25 %
Paper summary	February 23, 2017		5 %
Final project		due on May 4	25 %

Table 1: Grade weights

Final grades represent how you perform in the class relative to other students. Historically, the average grade for this class is about a (B+/A-). Three items are considered when assigning final grades:

1. Your average weighted score based on the percentages given in the table above.
2. The overall average percentage score within the class.
3. Your ranking among all students in the class.

**Class Participation:** Each class you will complete the examples shown by the instructor and submit your work on Blackboard at the end of the class. This work can't be submitted later since you must be present in class for it.

**Homework:** Homework will be assigned every 2 weeks, and is due 1 week later. The purpose of the written homework in this course is to develop skills in understanding and communicating the ideas of business forecasting. Homework assignments should be typed neatly with necessary computer output and graphics placed in order with each corresponding homework exercise. Figures (including fonts) should be clear and readable. You are welcome to discuss homework problems with the instructor and other students in the class but all work turned in should be your own and reflect your understanding of the material. Direct copying of assignments or solutions will not be tolerated! All homework will be due at the end of the day (midnight) on the due date. All assignments will be posted and submitted on Blackboard. The grade for the homework will be reduced by 10% for every working day it is late after that, to a minimum of 30% of the original grade.

**Labs:** There will be weekly in-class labs during the semester usually taking place on Thursdays. The goal of these labs is to give you an opportunity to practice the material covered. These will generally require

some computer work and a write-up. Usually, you will turn in two files: the PDF file with your answers and a file with the technical code used to get those results. The value of each lab will be roughly proportional to its importance and the amount of work involved. Labs will be posted and turned-in on Blackboard. The labs are to be submitted the next day by midnight. The grade for the lab will be reduced by 10% for every day it is late.

**Midterm:** There will be one open-book and open-notes in-class midterm exam. No make-up will be given.

**Paper summary:** You will find, read, and summarize a scientific paper from a peer-reviewed journal. You should find a paper where applied time series analysis is used for business forecasting. The summary (up to 2 pages) and the original paper should be submitted in PDF format via Blackboard.

**Final Project:** At the end of the semester you will work on the final course project. This will count for 25% of your grade and will consist of an analysis of a business case of your choice. You will work in small groups of 3 people to conduct this project. You can choose a case of personal interest or importance, and analyze it using the techniques discussed in class. Start searching for team mates and the business case for your project right away.

The final project will consist of the following steps:

1. Choose team mates by March 23, 2017.
2. Submit the one page project proposal, one per team. Due on Apr 6, 2017.
3. Present your results during the scheduled final exam time, May 4, 2017. Each team member must be present to get credit for the project.
4. Submit the project write-up with all supporting material. Due May 4, 2017.
5. Submit individual report about your own and your team mates contribution to the projects. Due May 4, 2017.

**Software:** We will learn R and RStudio during this course. This software is free and can be downloaded at <http://www.r-project.org> and <https://www.rstudio.com/>.

**Special Needs:** Any student requesting academic accommodations based on a disability is required to register with Disability Services and Programs (DSP) each semester. A letter of verification for approved accommodations should be obtained from DSP. Please be sure the letter is delivered to me as early in the semester as possible. For more information visit [www.usc.edu/disability](http://www.usc.edu/disability).

**USC Academic Integrity:** USC seeks to maintain an optimal learning environment. General principles of academic honesty include the concept of respect for the intellectual property of others, the expectation that individual work will be submitted unless otherwise allowed by an instructor, and the obligations both to protect ones own academic work from misuse by others as well as to avoid using anothers work as ones own. All students are expected to understand and abide by these principles. SCampus, the Student Guidebook, ([www.usc.edu/scampus](http://www.usc.edu/scampus) or <http://scampus.usc.edu>) contains the University Student Conduct Code (see University Governance, Section 11.00), while the recommended sanctions are located in Appendix A.

Students will be referred to the Office of Student Judicial Affairs and Community Standards for further review, should there be any suspicion of academic dishonesty. The Review process can be found at: <http://www.usc.edu/student-affairs/SJACS/> . Failure to adhere to the academic conduct standards set forth by these guidelines and our programs will not be tolerated by the USC Marshall community and can lead to dismissal.

**Emergency Preparedness/Course Continuity:** In case of a declared emergency if travel to campus is not feasible, USC executive leadership will announce an electronic way for instructors to teach students in their residence halls or homes using a combination of Blackboard, teleconferencing, and other technologies.

**Incomplete Grades:** A mark of IN (incomplete) may be assigned when work is not completed because of a documented illness or other emergency that occurs after the 12th week of the semester (or the twelfth week equivalent for any course that is scheduled for less than 15 weeks). An emergency is defined as a

serious documented illness, or an unforeseen situation that is beyond the students control, that prevents a student from completing the semester. Prior to the 12th week, the student still has the option of dropping the class. Arrangements for completing an IN must be initiated by the student and agreed to by the instructor prior to the final examination. If an Incomplete is assigned as the students grade, the instructor is required to fill out an Assignment of an Incomplete (IN) and Requirements for Completion form (<http://www.usc.edu/dept/ARR/grades/index.html>) which specifies to the student and to the department the work remaining to be done, the procedures for its completion, the grade in the course to date, and the weight to be assigned to work remaining to be done when the final grade is computed. Both the instructor and student must sign the form with a copy of the form filed in the department. Class work to complete the course must be completed within one calendar year from the date the IN was assigned. The IN mark will be converted to an F grade should the course not be completed.

**Disclaimer:** The instructor reserves the right to alter anything about this course (but she probably won't).