

Supply Chain Management
Course Number: 22:799:663
Course Title: Demand Analysis/Management for Value Chains

COURSE DESCRIPTION AND OBJECTIVES

This course focuses on the applications of forecasting models and methodologies throughout supply chains, for use in business-related activities, including operations, sales, marketing and Finance. The course aims to help students understand the significance of data analysis and model selection in business-related decision making and the development of managerial insights. Sophisticated techniques for forecasting are developed and illustrated by combining theory, examples, practical applications, and case studies. The course utilizes the R programming language.

Course Format

The course will consist of a combination of lectures, case presentations, and class discussions. One or more textbook chapters will be covered in one session (see schedule below). The lecture/discussion component will be devoted to presentation and discussion of theories, concepts, analytical techniques, and methods that are helpful for the supply chain management. The class sessions will have assigned reading materials from the text (see schedule below). The text serves as background information for lectures and casework. Students are *expected to read* the corresponding chapter *before* each class.

COURSE MATERIALS

- Textbook: [Practical Time Series Forecasting with R](#) by Galit Shmueli
- @Risk student software license purchase (around \$65)
https://www.palisade.com/cart/products_EN.asp?cat=51&panel=0
- Check Canvas (Canvas.rutgers.edu) and your official Rutgers email account regularly. - [Other materials, if applicable]

PREREQUISITES

- Must have a windows machine to run the @Risk simulation software
- Must have knowledge about probability and statistics
- Must have some background with programming. The course will be taught using R, first two lectures will provide introduction to R.

SOFTWARE REQUIREMENTS

- Tableau
 - @Risk
 - RStudio, R
 - Windows Excel
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LEARNING GOALS AND OBJECTIVES

Supply Chain Management knowledge

- Mastery of fundamental supply chain management concepts.
- Ability to integrate and apply supply chain management concepts to resolve business problems.

Ethical judgment

- Recognition of ethical dilemmas in decision-making scenarios.
- To critically evaluate business decision-making scenarios and develop innovative and ethical solutions.

Global perspective

- An understanding of the global and diverse business environment.
- Ability to participate in a culturally and demographically diverse environment.

Persuasive communication

- Students will be able to communicate information in a clear, concise manner.
- Students will be able to communicate relatively complex ideas in an understandable manner.

CLASS POLICIES:

The professors retain the right to make changes to the syllabus during the semester.

- Attendance is required and will monitor informally. The professor does not need to know the reasons for a student's absence, but they are responsible for any material covered during their absence.
- The professor will not provide individual tutoring, as this would constitute an unfair advantage for a student.
- Students are encouraged to ask questions during the lecture or at the end of class so that the entire class can benefit.
- The professor retains the right to make changes to the syllabus during the semester.
- Updates to the syllabus, assignments, class cancellations, as well as important announcements, will be posted on Canvas. It is the student's responsibility to check Canvas regularly.
- Please adhere to professional behavior in class. Refrain from using phones, attending to personal use of computers, chatting, reading the newspaper, etc.
- Please do not call the SCM and Marketing Sciences Department about grades and other

- course information. The secretaries in the Department will not have this kind of information.
- Final course grades are final. Changes will only be made if there is a mistake in the calculation of the final grade.
 - Accommodating students with special learning needs: In accordance with the university policy, students with documented sensory and/or other learning disabilities should inform the professor, so that their special needs may be accommodated.
 - Make-up exams are not automatically granted. If you know that you will miss an exam, you are required to inform the professor and drop the class.
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ACADEMIC INTEGRITY

I do NOT tolerate cheating. Students are responsible for understanding the RU Academic Integrity Policy <http://academicintegrity.rutgers.edu/>

I will strongly enforce this Policy and pursue *all* violations. On all examinations and assignments, students must sign the RU Honor Pledge, which states, “On my honor, I have neither received nor given any unauthorized assistance on this examination or assignment.” I will screen all written assignments through *SafeAssign* or *Turnitin*, plagiarism detection services that compare the work against a large database of past work. Don’t let cheating destroy your hard-earned opportunity to learn. See business.rutgers.edu/ai for more details.

ATTENDANCE AND PREPARATION POLICY

- Expect me to attend all class sessions. I expect the same of you. If I am to be absent, my department chair or I will notify you via email and Canvas as far in advance as possible. If you are to be absent, report your absence in advance at <https://sims.rutgers.edu/ssra/>. If your absence is due to religious observance, a Rutgers-approved activity, illness, or family emergency/death and you seek makeup work, also send [me/TA] an email with full details and supporting documentation [within X days of your first absence]. [Explain other aspects of your absence policy in detail; it will save you trouble later.]

- For weather emergencies, consult the campus home page. If the campus is open, the class will be held.
 - Expect me to arrive on time for each class session. I expect the same of you. [If you are going to be tardy, then. .]
 - Expect me to remain for the entirety of each class session. I expect the same of you. [If you are going to leave early, then. .]
 - Expect me to prepare properly for each class session. I expect the same of you. Complete all background reading and assignments. You cannot learn if you are not prepared. The minimum expectation is that for each [X]-hour class session, you have prepared by studying for at least twice as many hours.
 - Expect me to participate fully in each class session. I expect the same of you. Stay focused and involved. You cannot learn if you are not paying attention.
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ASSIGNMENTS

Homework:

There will be four homework assignments posted online.

- Homework outlined on the syllabus will be described in class and on the Canvas.
- You will have approximately one week to complete the homework assignment. All assignments are due at the beginning of the class.
- All assignments must be completed using R and @Risk, and the file must be uploaded to canvas.
- NO LATE HOMEWORK WILL BE ACCEPTED!!

Case Analysis:

Team-based case presentations and discussions are used to develop critical thinking and teamwork skills around Supply Chain Management strategies. Teams will consist of 3-5 members and will present their assigned cases at the assigned class. If you are not familiar with how to analyze and discuss business cases, I recommend you take a look at *The Case Study Handbook: How to Read, Discuss, and Write Persuasively About Cases* by William Ellet.

- The entire class (and not just the assigned team) is required to read and analyze the cases.
- The team is required to propose and present a solution to the business problem that is detailed in the case. The team should also provide a summary of their solutions.
- After the presentation, an in-depth discussion with the entire class follows.

Demand Management Assignment:

Each group will conduct an assessment of demand management based on real-world data. The assessment can be conducted in a company that the students select. Alternatively, the students may be given a dataset by the instructors to analyze. The purpose is to evaluate the current state and uncover areas of improvement. The students will be expected to provide regular updates on the progress of the project.

Participation:

The professor will call upon the students to share their point of view, analysis, insights, and recommendations on the class lecture, cases, and handouts during the class. If a student does not participate, they will not receive any points for participation. It is imperative that the students read the chapters, cases, and handouts before the class and be prepared to answer questions. Class participation is important to develop critical thinking skills and increase overall class learning.

Exam:

There will be one exam, worth 30% of the final grade. The nature of the exams is essay-based and closed books and closed notes. Make-up exams are not encouraged; the notification must be given BEFORE the exam in a written form. Otherwise, a make-up exam will not be allowed, and the student receives no credit for the exam.

EVALUATION

Category	Percent	Points
Homework	20%	80
Case Analysis	15%	60

Demand Management Assignment	15%	60
Participation	20%	80
Exam	30%	120
Total	100%	400

Grade Points

- The final grade will be based on the final scores. Throughout the semester, grades will be posted on the class website regularly. Please review the postings and communicate with me if there are any discrepancies. Point totals are **NOT** rounded up at the end of the semester.

Grade	Points
A	400-377
A-	376-361
B+	360-349
B	348-337
B-	336-321
C+	320-309
C	308-293
C-	292-281
D	280-241
F	240-0

COURSE SCHEDULE

Date	Topic	Readings	Case/HW	Assignments
Wk1	Course Introduction	<ul style="list-style-type: none"> Introduction to R Data Types in R Variable assignment Vectors Data frames 		Chapter 1 PTSF Shmueli
Wk2	Introduction to SCM and Demand Management and Forecasting Methods	<ul style="list-style-type: none"> R Input and Output R Data Wrangling Static forecasting with R Supply Chain Management The Demand Management Process Univariate and Multivariate introduction. 		<i>Chapter 2 PTSF Shmueli</i> Quiz: 5 questions true or false questions

Wk3	Demand Classification	<ul style="list-style-type: none"> Identifying demand patterns, Lumpy, smooth, erratic etc. Volume and Covariance classification model Simple classification techniques. Exploratory data analysis Plotting time series using timetk function 	HW1 assigned	<p>Chapter 3 PTSF Shmueli</p> <p>HW 1 assigned:</p> <ol style="list-style-type: none"> Problem 1.5 p23 Impact of Sept 11 Air Travel Demand Classification problem (see canvas) Problem 1.5 p23 Impact of Sept 11 Air Travel assigned 2.6 Problem 1 Air Travel p42 2.6 problem 3 p43
Wk4	Forecast accuracy, Bias Regression models	<ul style="list-style-type: none"> Methods to cluster SKU's for time series. Various Cost functions, forecast accuracy methods Control Charting Training, Testing and validation methods 		<p>Chapter 4,5 PTSF Shmueli</p> <p>Assigned reading posted online.</p> <p>Quiz: 5 questions true or false questions</p>
Wk5	Exponential, Moving Avg. Holt Holt Winters Regression,	<ul style="list-style-type: none"> Forecasting methods. 	<p><i>Case Study A</i></p> <p>HW 2 assigned</p>	<p>Chapter 6,7 PTSF Shmueli</p> <p><i>Case Study A</i> 11.1 Forecasting public page Transportation Demand p211 Group 1</p>
Wk5	Regression (cont) ARIMA and	<ul style="list-style-type: none"> Multiple, Stepwise, Logistic and Discriminant Regression Use causal variables to improve forecast accuracy Binary Forecast 	<p><i>Case Study B</i></p> <p>HW 1 due</p> <p>HW 2 assigned</p>	<p>Assigned Reading Material</p> <p><i>Case Study B</i> Forecasting Tourism Page 215 Group 2</p> <p>HW 2 assigned</p> <ol style="list-style-type: none"> 3.7 Prob1 p67 5-8 Prob 1-4 p 107-109

				<p>3) 6.5 Prob 1 p 133-135</p> <p>4) 7.5.3 Pro p 172-173</p> <p>5) 8.5 1-10 p 187-188</p> <p>Exam 1:</p>
Wk 6	<p>ML methods</p> <p>ModelTime</p> <p>XGBoost,</p> <p>Support Vector Machine (SVM)</p> <p>Neural Net (Nnet) for time series</p>	<ul style="list-style-type: none"> • ModelTime • XGBoost for time series • Introduction to SVM and solve time series models using SVM • Introduction to Neural Net • Solving time series problems using Neural Net 	<i>Case Study C</i>	<p>Chapter 8,9 PTSF Shmueli</p> <p><i>Case Study C</i></p> <p><i>Forecasting stock price movements</i></p> <p><i>Page 219</i></p> <p><i>Group 3</i></p>
Wk8	<p>Developing a case for Developing and deploying Intelligent demand forecasting models using techniques taught in the class</p>	<ul style="list-style-type: none"> • Ensemble Models • CRISP-DM • Application of Data Science for other Supply Chain problems • Industrialization techniques for • How to sell Machine learning model for adoption by business 	<i>Case Study D</i>	<p>Assigned lecture notes for this class</p> <p>HW 3:</p> <p>1) Forecast using ensemble method and using all the forecasting methods.</p> <p><i>Group 4</i></p> <p><i>ACAT Forecasting see canvas for case study details</i></p>
Wk 9	<p>Supply Chain Risk Analytics</p>	<ul style="list-style-type: none"> • Introduction to Risk analytics using @Risk • Introduction to Monte Carlo Simulation 	<i>Case Study A presentation due group 1</i>	<p><i>Introduction to @Risk</i></p> <p><i>Group 1 Submit Case Study A</i></p> <p><i>HW 2 Due</i></p> <p>Quiz: 5 questions true or false questions</p>
Wk 10	<p>Distribution Fitting</p>	<ul style="list-style-type: none"> • Fitting data distribution • Developing Risk models 	<p><i>Case Study B presentation due group 2</i></p> <p>HW 3 assigned</p>	<p><i>HW 3 ARIMA and SVM</i></p> <p><i>Risk Models</i></p> <p><i>Group 2 Case Study B</i></p>
Wk 11	<p>Correlation and Copula</p>	<ul style="list-style-type: none"> • Correlation and Risk analysis 	<i>Case Study C presentation due group 3</i>	<i>Group 3 submit Case Study C</i>

	Exam 2	<ul style="list-style-type: none"> • Supply Chain Risk Models • Models with correlation and impact on risk analysis 	HW 3 assigned	Exam 2
Wk 12	Supply Chain Risk Analytics and Stochastic Optimization	<ul style="list-style-type: none"> • Using Monte Carlo Simulation for risk assessment in Supply Chain • Identifying Supply chain bottlenecks with simulation • Stochastic Optimization techniques for Demand and inventory. 	<i>Case Study D presentation due group 4</i> <i>Simulation Case study assigned</i>	<i>Group 4 Submit Case D</i> <i>Simulation Case study assigned all groups</i> <i>Monte Carlo</i> <i>Simulation Supply Chain planning with Risk</i>
Wk 13	Sensitivity Analysis\ Supply Chain Sustainability	<ul style="list-style-type: none"> • Sensitivity analysis • Explaining Risk simulation outputs • Supply Chain Sustainability 		Assigned Reading Material <i>HW3 Due</i> Quiz: 5 questions true or false questions
Wk 14	Managing Supply and Demand	<ul style="list-style-type: none"> • Forecasting and impact on Inventory • Determining Optimal level of product availability • Inventory optimization based on forecast prediction • The implication of inventory and locked capital and balancing service levels 		
Wk 15	Project Presentations Final Exam	<ul style="list-style-type: none"> • Supply Chain Risk presentation • Exam 3 	Group A-D presentation due	All groups Submit Supply Chain Risk Case Study

SUPPORT SERVICES

If you need accommodation for a *disability*, obtain a Letter of Accommodation from the Office of Disability Services. The Office of Disability Services at Rutgers, The State University of New Jersey, provides student-centered and student-inclusive programming in compliance with the Americans with Disabilities Act of 1990, the Americans with Disabilities Act Amendments of 2008, Section 504 of the Rehabilitation Act of 1973, Section 508 of the Rehabilitation Act of 1998, and the New Jersey Law Against Discrimination. More information can be found at ods.rutgers.edu.

[Rutgers University-New Brunswick ODS phone (848)445-6800 or email dsoffice@echo.rutgers.edu]

[Rutgers University-Newark ODS phone (973)353-5375 or email ods@newark.rutgers.edu]

If you are *pregnant*, the Office of Title IX and ADA Compliance is available to assist with any concerns or potential accommodations related to pregnancy.

[Rutgers University-New Brunswick Title IX Coordinator phone (848)932-8200 or email jackie.moran@rutgers.edu]

[Rutgers University-Newark Office of Title IX and ADA Compliance phone (973)353-1906 or email TitleIX@newark.rutgers.edu]

If you seek *religious accommodations*, the Office of the Dean of Students is available to verify absences for religious observance, as needed.

[Rutgers University-New Brunswick Dean of Students phone (848)932-2300 or email deanofstudents@echo.rutgers.edu]

[Rutgers University-Newark Dean of Students phone (973)353-5063 or email DeanofStudents@newark.rutgers.edu]

If you have experienced any form of *gender or sex-based discrimination or harassment*, including sexual assault, sexual harassment, relationship violence, or stalking, the Office for Violence Prevention and Victim Assistance provides help and support. More information can be found at <http://vpva.rutgers.edu/>.

[Rutgers University-New Brunswick incident report link: <http://studentconduct.rutgers.edu/concern/>. You may contact the Office for Violence Prevention and Victim Assistance at (848)932-1181]

[Rutgers University-Newark incident report link: https://cm.maxient.com/reportingform.php?RutgersUniv&layout_id=7 . You may also contact the Office of Title IX and ADA Compliance at (973)353-1906 or email at TitleIX@newark.rutgers.edu. If you wish to speak with a staff member who is confidential and does **not** have a reporting responsibility, you may contact the Office for Violence Prevention and Victim Assistance at (973)353-1918 or email run.vpva@rutgers.edu]

If students who have experienced a temporary condition or injury that is adversely affecting their ability to fully participate, you should submit a request via <https://temporaryconditions.rutgers.edu>.

If you are a military **veteran** or are on active military duty, you can obtain support through the Office of Veteran and Military Programs and Services. <http://veterans.rutgers.edu/>

If you are in need of **mental health** services, please use our readily available services.

[Rutgers University-Newark Counseling Center: <http://counseling.newark.rutgers.edu/>]

[Rutgers Counseling and Psychological Services–New Brunswick: <http://rhscaps.rutgers.edu/>]

If you are in need of **physical health** services, please use our readily available services.

[Rutgers Health Services – Newark: <http://health.newark.rutgers.edu/>]

[Rutgers Health Services – New Brunswick: <http://health.rutgers.edu/>]

If you are in need of **legal** services, please use our readily available services: <http://rusls.rutgers.edu/>

Students experiencing difficulty in courses due to **English as a second language (ESL)** should contact the Program in American Language Studies for supports.

[Rutgers–Newark: PALS@newark.rutgers.edu]

[Rutgers–New Brunswick: eslpals@english.rutgers.edu]

If you are in need of additional **academic assistance**, please use our readily available services.

[Rutgers University-Newark Learning Center: <http://www.ncas.rutgers.edu/rlc>

[Rutgers University-Newark Writing Center: <http://www.ncas.rutgers.edu/writingcenter>]

[Rutgers University-New Brunswick Learning Center: <https://rlc.rutgers.edu/>]

[Optional items that many faculty include:

- Students must sign, date, and return a statement declaring that they understand the RU Academic Integrity Policy.

- Students must sign, date, and return a statement declaring that they understand this syllabus.]