



北京理工大学国际特色课程

Beijing Institute of Technology Global Courses

CSE9203 - APPLIED TIME SERIES ANALYSIS AND FORECASTING

Syllabus

July. 1 - July. 19, 2024

Term Duration: July. 1 - July. 19, 2024

Credit Points: 4

Level: Postgraduate

Instructor Name: TBA

Home Institution: Beijing Institute of Technology

Lecture Hour: 9:00-12:00

Course Description

This course offers a comprehensive exploration of financial time series analysis, providing students with a strong foundation in both the theoretical and practical aspects of the field. The curriculum begins with an overview of financial time series, introducing key concepts and methodologies used in the analysis and forecasting of financial data. Students will gain proficiency in various statistical techniques and models, including moving averages, smoothing techniques, and ARMA models, all of which are crucial for understanding market trends and volatility. Advanced topics will delve into ARIMA, ARCH, and GARCH models, addressing complex market phenomena such as long memory, stochastic volatility, and the intricacies of high-frequency data analysis. The course also emphasizes the importance of evaluating forecasting models to ensure accuracy and reliability. As financial markets evolve, the course stays current by incorporating the latest trends and techniques in financial forecasting, preparing students for the dynamic nature of financial analysis.

Course Aims:

Upon successful completion of this course, students should be able to:

1. demonstrate a clear understanding of the key principles and properties of financial time series data;
2. apply statistical techniques to decompose and analyze time series data, including the identification and handling of seasonality;
3. develop and evaluate ARMA, ARIMA, and seasonal ARIMA models for accurate financial forecasting;
4. understand and apply ARCH and GARCH models to analyze and forecast financial market volatility;
5. critically evaluate the performance of different forecasting models using backtesting and other evaluation techniques;
6. appreciate the complexities of volatility estimation and its asymmetry in the context of financial risk management;
7. stay abreast of and adapt to current trends in financial forecasting, including the application of high-frequency data analysis and machine learning techniques.

Language of Instruction

English

Required Textbook

Analysis of Financial Time Series, 3rd Edition

Author: Ruey S. Tsay

Publisher: Wiley

ISBN: 9780470414354

Introduction to Time Series Analysis and Forecasting, 2nd Edition

Author: Douglas C. Montgomery, Cheryl L. Jennings, and Murat Kulahci

Publisher: Wiley

ISBN: 9781118745113

Course Hours

This course requires 48 hours of contact including 42 hours of lectures and one 6-hour field trip. Lectures are from Monday to Friday.

Prerequisite Course

Students are expected to have taken **Statistics** or to possess a thorough knowledge of the topics covered in the mentioned course.

Course Schedule

Week	Day	Lecture	Topic	Assignment/ Notes
Week 1	Day 1	Lecture 1	Overview of Class; Introduction to Financial Time Series Analysis	Ruey S. Tsay (Chap 1)
	Day 2	Lecture 2	Moving Averages and Smoothing Techniques	Douglas C. Montgomery (Chap 3)
	Day 3	Lecture 3	Seasonality in Financial Time Series	Recommended Reading Materials Provided in Class
	Day 4	Lecture 4	Advanced Forecasting with ARMA Models	Douglas C. Montgomery (Chap 5)
	Day 5	Lecture 5	ARIMA and Seasonal ARIMA Models	Douglas C. Montgomery (Chap 5)
Week 2	Day 6	Lecture 6	Volatility Estimation and Asymmetry	Ruey S. Tsay (Chap 5)
	Day 7	Lecture 7	ARCH Models, GARCH Models, and Their Applications	Ruey S. Tsay (Chap 3)
	Day 8	Lecture 8	Long Memory Models, Stochastic Volatility, and Jump Diffusion Models	Ruey S. Tsay (Chap 9)
	Day 9	Lecture 9	Evaluating Forecasting Models	Douglas C. Montgomery (Chap 7)
	Day 10	Industrial Visit		
Week 3	Day 11	Lecture 10	Multi-period Risk Forecasting; Forecasting VaR and ES for Multi-Periods Ahead	Ruey S. Tsay (Chap 7)
	Day 12	Lecture 11	Introduction to High-Frequency Data Analysis	Recommended Reading Materials Provided in Class
	Day 13	Lecture 12	Current Trends in Financial Forecasting	Recommended Reading Materials Provided in Class
	Day 14	Guided Revision		

	Day 15	Final Exam
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Note: Students will be notified if the schedule of the field trip changes according to the situation.

Grading Policy

Method	Percentage
Participation	10%
Mid-semester Test	15%
Group Assignment	35%
Final Exam	40%
Total	100%

Participation: Students are expected to attend all course sessions punctually. Absences will impact the attendance grade. We will have some case studies, topic discussion and group discussion in class and the performance will be considered as partial attendance points or bonus.

Mid-Semester Test: The test will span a duration of 2 hours and will assess students on the material covered in the first half of the course. Students are expected to demonstrate their knowledge and analytical skills through this examination.

Group Assignment: Students will work in groups and be required to write a report. Each group is expected to submit both the report and any relevant data analysis outputs, demonstrating a thorough understanding of quantitative analysis concepts and techniques.

Final Exam: The final exam will be a comprehensive assessment encompassing all course content. This exam will have a duration of 3 hours, and students will be evaluated on their understanding and application of the material covered throughout the course.

Academic Honesty

Academic honesty is not only a fundamental part of learning and teaching, but also a core value that this course embraces. Behaviors of academic dishonesty, as outlined hereinafter, are unacceptable and will be penalized:

- a) Plagiarism where students present work for assessment, publication or otherwise that is not their own, without appropriate attribution or reference to the original source. Plagiarism can include:
 - i) paraphrasing or copying published and unpublished work without a reference;

- ii) adopting the ideas or concepts of others, including the structure of an existing analysis without due acknowledgement by way of reference to the original work or source.
- b) Collusion, where students present work as independent work when it has in fact been produced in whole or in part with others unless prior permission for joint or collaborative work has been given by the Course Coordinator. Collusion can include:
 - i) a student inappropriately assisting with or accepting assistance with the production of an assessment task;
 - ii) submitting work which is the same or substantially similar as another student's work for the same assessment task.
- c) Cheating, where a student acts in such a way as to seek to gain unfair advantage or assist another student to do so. Cheating can include:
 - i) submitting falsified, copied or improperly obtained data relating to results of practicum, field trips or other work as if they were genuine; submitting an assessment task with the intention of deceiving or misleading the instructor about the student's contribution to the work;
 - ii) submitting an assessment task written or answered for the student by another person or which the student has copied from another person;
 - iii) submitting the same or a substantially similar piece of work for assessment in two different courses (except in accordance with approved study and assessment schemes);
 - iv) a student falsely indicating that they have been present at an activity where attendance is required;
 - v) completing an assessment task outside the conditions specified for that task.
- d) Cheating in Examinations means engaging in dishonest practice or breaching the rules regarding examinations, which can include:
 - i) communicating in any way during an examination with any person who is not an examination supervisor inside or outside the examination venue;
 - ii) giving or accepting assistance from any person who is not an examination supervisor whilst in the examination venue;
 - iii) reading, copying from or otherwise using another student's work in an examination or knowingly allowing a student to do so;
 - iv) possessing, referring to or having access to any material or device containing information directly or indirectly related to the subject matter under examination, other than that explicitly approved by the Course Coordinator;
 - v) acquiring, or attempting to acquire, possess or distribute examination materials or information without approval;
 - vi) permitting another person to attend an examination on a student's behalf or attending an examination on behalf of another student;
- e) Other dishonest acts including but not limited to:
 - i) altering or falsifying any document or record for the purposes of gaining academic advantage;
 - ii) offering or giving money or any item or service to a University staff member or any other person to gain academic advantage for the student or another person;
 - iii) inventing references.