Advanced Econometric Models for Finance

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Overview

This course provides a broad introduction to the theory and empirical analysis of advanced econometric models to financial applications such as optimal portfolio construction, performance evaluation and forecasting financial time series. The course introduces the class of multivariate multifactor models, which can be used to model the expected returns of financial time series, and the class of multivariate heteroskedastic models, which can be used to model the covariances/correlations of financial returns. Illustrative examples applying these advanced econometric models/techniques to actual financial data are also presented using the statistical package R. The empirical analysis consists of (a) constructing optimal portfolios of financial series, e.g. stocks and/or indices, (b) evaluating the performance of different mutual fund or hedge fund investments, (c) forecasting financial series e.g. stock returns.

Key Outcomes

By completing the course, students will be able to:

- interpret the concepts of return and risk in financial markets
- model the expected returns of financial assets
- model the variances and covariances/correlations of financial returns
- use advanced econometric tools to analyze models used in financial applications
- forecast financial returns
- assess the performance of portfolio managers
- understand modern portfolio theory
- solve mean-variance optimization problems

Requirements and Prerequisites

The students should have a basic quantitative background. Specifically, basic knowledge in the fields of statistics and time series analysis will be necessary for this course.

Books

Recommended textbooks:

- Elton, E.J., Gruber, M.J., Brown, S.J., and Goetzmann, W.N. *Modern Portfolio Theory and Investment Analysis*. 8th edition, Wiley, 2014.
- Tsay, R.S. *Analysis of Financial Time Series*. New York: Wiley, 2010.
- Vrontos, I. *Advanced Econometric Models for Financial Applications*. Lecture Notes, 2016.
- Selected papers (this material will be given during the course)

Software/Computing requirements

The computational aspects of this course will be implemented in R, a free software environment for econometric and time series models. R can be downloaded at https://www.r-project.org and installed on all types of environments (Windows, Mac, UNIX). We will make use of the data sets available in the “datasets” library of R. Other data sets that will be used in class and/or assignments will be available in the eclass page of this course.

Grading

There will be a total of 3 homework assignments (given at the units 2, 4, and 5) that will contribute 30% in the final grade. The remaining 70% will be determined by the in class final exam. Please note that one needs to pass the final exam (independently of the grades in the homework assignments) in order not to fail the course.

Course Syllabus

The course comprises of five units of three hours each.

Unit 1: Introduction and Portfolio construction

Return and risk. Portfolio diversification. Construction of optimal portfolios. Portfolio performance measures. Empirical application of portfolio construction using R to financial data sets. Example 1: Minimum variance portfolio construction, example 2: Mean-variance portfolio construction. Comparison and useful conclusions.

Unit 2: Performance Evaluation of Financial Assets

Capital asset pricing model. Performance measures: Treynor measure, Sharpe measure, Jensen's alpha. Multifactor models. Alternative measures. Empirical application of performance evaluation using R to financial data sets. Example 1: Performance evaluation of mutual fund investments, example 2: Performance evaluation of hedge fund investments. Interpretation and useful conclusions.

Unit 3-4: Multivariate Factor and Multivariate Heteroskedastic Models

Multivariate Factor models: Single index models, general multivariate multifactor models. Multivariate Heteroskedastic models: Multivariate ARCH/GARCH models, Constant conditional correlation models. Empirical application of portfolio construction based on multivariate factor and multivariate heteroskedastic models using R to financial data sets. Revisit Example 1: Minimum variance portfolio construction, revisit example 2: Mean-variance portfolio construction. Comparison and useful conclusions.

Unit 5: Forecasting Financial Time series

Regression models. Complete subset regression models. Forecast combinations. Forecast evaluation measures. Empirical application on forecasting financial time series using R. Example 1: Modeling and forecasting S&P 500 monthly returns. Comparison and useful conclusions.

Participation

In-class participation and contribution is a very important part of the educational process with many benefits:

- Better understanding of the topic under consideration.
- Advancing the discussion by contributing insightful comments and questions.

Please arrive to class on time and stay to the end of the class period. Chronically arriving late or leaving class early is unprofessional and disruptive to the entire class. Turn off all electronic devices prior to the start of class. Cell phones, tablets and other electronic devices are a distraction to everyone.

Assignments

Late assignments will either not be accepted or will incur a grade penalty unless due to documented serious illness or family emergency. Exceptions to this policy for reasons of civic obligations will only be made available when the assignment cannot reasonably be completed prior to the due date, you make suitable arrangements, and give notice for late submission in advance.

Attendance Requirements

Class attendance is essential to succeed in this course and is part of your grade. An excused absence can only be granted in cases of serious illness or grave family emergencies and must be documented. Job interviews and incompatible travel plans are considered unexcused absences. Where possible, please notify the instructor in advance of an excused absence. Students are responsible for keeping up with the course material, including lectures, from the first day of this class, forward. It is the student's obligation to bring oneself up to date on any missed coursework.

Code of Ethics

Students may not work together on individual graded assignments unless the instructor gives express permission. Exercise integrity in all aspects of one's academic work including, but not limited to, the preparation and completion of all other course requirements by not engaging in any method or means that provides an unfair advantage. In any case of doubt, students must be able to prove that they are the sole authors of their work by demonstrating their knowledge to the instructor. Clearly acknowledge the work and efforts of others when submitting written work as one's own. Ideas, data, direct quotations (which should be designated with quotation marks), paraphrasing, creative expression, or any other incorporation of the work of others should be fully referenced. No plagiarism of any sort will be tolerated. This includes any material found on the internet. Reuse of material found in question and answer forums, code repositories, other lecture sites, etc., is unacceptable. You may use online material to deepen your understanding of a concept, not for finding answers. Please report observed violations of this policy. Any violations will incur a fail grade at the course and reporting to the senate for further disciplinary action.