FIN-619

Financial Econometrics and Machine Learning

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Cursus	Sem.	Type
Finance		Opt.

Language of teaching	English
Credits	3
Session	
Exam	Project report
Workload	90h
Hours	**64**
Lecture	24
Exercises	40
Number of positions	

Remark

If you would like to attend this course, please send an email to: edfi@epfl.ch to register

Summary

This course consists of three parts: an introduction to financial time series data characteristics and analysis, a discussion on econometrics techniques (eg, GARCH models, cointegration, extreme values, truncation), and an exploration of machine learning tools, including Natural Language Processing.

Content

This course has several parts. In a first part doctoral students are provided with a comprehensive understanding of the characteristics, modeling, and analysis of financial time series data. In the second part we will discuss pitfalls of econometrics: co-integration, the impact of extreme values, the consequences of truncation, Galton's fallacy, nuisance parameters in switching regressions. In the last part, we discover basic machine learning tools and methodology. The focus will be on Natural Language Processing.

The Financial Econometrics and Machine Learning course containts several parts. In a first part, taught by Prof. Jondeau, it is designed to provide doctoral students with a comprehensive understanding of the characteristics, modeling, and analysis of financial time series data. In a second part, taught by Prof. Rockinger it aims to alert participants to various pitfalls they may encounter in their empirical work. This part will also provide an introduction to text analysis. The course is structured into several modules.

The first module, introduces the foundational concepts of financial time series, focusing on asset returns. Students learn about the properties of log-returns, including their distribution and time dependency. Key statistical tests are discussed for assessing normality and temporal properties.

The second module delves into the Generalized Autoregressive Conditional Heteroskedasticity (GARCH) model, which captures time-varying volatility in financial returns. The course covers the theoretical foundation of GARCH models, parameter estimation, and interpretation. Students explore higher moments like unconditional kurtosis, understanding how GARCH models can reflect the fat-tailed nature of financial returns even under the normal innovation assumption.

The third module addresses the limitations of normal distribution assumptions by introducing non-normal conditional distributions. Students study the Quasi Maximum Likelihood Estimation (QMLE) method for parameter estimation when the true distribution is non-normal. The session also explores non-parametric methods, series expansions, and parametric distributions to model the higher moments observed in financial data.

The fourth module focuses on the analysis of multiple time series simultaneously. Students learn about the multivariate GARCH models and multivariate distributions and copulas. These tools are essential for capturing the dynamic relationships between different financial time series and for conducting comprehensive risk management and portfolio optimization analyses.

The fifth module discusses various pitfalls. These are a) running regressions on non-stationnary time series, b) running regressions on data contaminated by extreme values, c) running regressions when one truncates some of the variables

without taking this censoring into account, d) running tests on switching regressions ignoring the fact that the null hypothesis can be formulated in many different manners and e) Galton's falacy who discovered that large parents tend to have significantly smaller children than themselves.

The sixth module discusses how to analyze text. We will discuss topics such as cleaning the data, how to remove stopwords and eventually we will discuss idf-tf, naive bayesian classifiers and neural-network techniques.

Throughout the course, practical applications are emphasized, and students are encouraged to apply these techniques to real-world financial data. By the end of the course, students will be equipped with advanced quantitative tools to analyze, model, and interpret financial time series, crucial for academic research and professional practice in finance. This course combines theoretical rigor with practical application, preparing students for academic research in financial econometrics

Keywords

Properties of Financial Returns, Volatility Modeling, Non-Normal Distributions, Multivariate Analysis

Learning Prerequisites

Required courses

Econometrics

Assessment methods

Project Report

Resources

Moodle Link

- https://go.epfl.ch/FIN-619