Summary
The objective of this course is to present and study some topics of financial econometrics, and to apply the corresponding techniques and concepts.

Content
1. Introduction: Describing financial time series
2. Overview of estimation techniques and applications
   • Ordinary least squares, maximum likelihood and generalized method of moments, pseudo likelihood estimator.
   • Applications: CAPM, factor models, predictive regressions.
3. An introduction to financial time series analysis:
   • Stationarity/non stationarity
   • Characterization of time series
   • Class of ARIMA(p,d,q) processes
4. Multivariate time series analysis
   • Vectorial autoregressive models (VAR)
   • Cointegration and VECM
   • Statistical arbitrage
5. Modeling volatility
   • Measuring volatility
   • ARCH models
   • GARCH models and extensions
6. Multivariate GARCH models and Dynamic (conditional) correlation models
7. Forecasting volatility
8. Risk management

Keywords
Econometrics Empirical finance

Learning Prerequisites
Required courses
Econometrics

Introduction to finance

Recommended courses
Stochastic calculus

Important concepts to start the course
In order to follow this course the student needs to have taken an introduction to finance as well as an introduction to econometrics. Some foundations in stochastic calculus and portfolio allocation could be useful for certain lectures.

Learning Outcomes
By the end of the course, the student must be able to:
- Formulate, explain, analyze and interpret the multiple linear regression model.
- Work out / Determine in practise whether the assumptions of estimation techniques (ordinary least squares, maximum likelihood, generalized method of moments) hold true and propose some solutions otherwise.
- Apply the estimation methods in different situations as for instance portfolio allocations and discretized (univariate) diffusion processes.
- Elaborate robust regression methods
- Formulate, develop and analyze a forecasting problem.
- Identify and explain the main concepts of financial time series (stationarity, order of integration, autocorrelations, partial autocorrelations, cointegration).
- Model financial time series.
- Apply cointegration techniques in the context of statistical arbitrage models.
- Define and understand the concept of volatility (and correlation) from a statistical point of view.
- Implement and estimate a (multivariate) GARCH model. Interpret the results.
- Conduct a forecasting exercise for volatility.
- Formulate and analyze a problem of risk management.
- Interpret results
- Choose appropriate methods in different contexts

Transversal skills
- Give feedback (critique) in an appropriate fashion.
- Evaluate one's own performance in the team, receive and respond appropriately to feedback.
- Identify the different roles that are involved in well-functioning teams and assume different roles, including leadership roles.
- Negotiate effectively within the group.
- Resolve conflicts in ways that are productive for the task and the people concerned.
- Assess one's own level of skill acquisition, and plan their on-going learning goals.
- Demonstrate the capacity for critical thinking
- Demonstrate a capacity for creativity.
- Manage priorities.
- Continue to work through difficulties or initial failure to find optimal solutions.
- Take feedback (critique) and respond in an appropriate manner.
• Use both general and domain specific IT resources and tools
• Write a scientific or technical report.
• Write a literature review which assesses the state of the art.
• Make an oral presentation.
• Collect data.
• Summarize an article or a technical report.

Teaching methods
Lectures and exercise sessions

Expected student activities
• Participate in lectures
• Participate in exercises sessions
• Solve the problem sets
• Write a midterm exam
• Write a final exam

Assessment methods
50% project
50% final exam

Supervision
Office hours Yes
Assistants Yes
Forum No

Resources
Bibliography
Other references will be provided for each lecture.

Ressources en bibliothèque
• Market risk analysis I / Alexander
• Market risk analysis II / Alexander
• The Econometrics of financial markets / Campbell
• Financial modeling under non-gaussian distributions / Jondeau
• Analysis of financial time series / Tsay

Prerequisite for
• Advanced topics in financial econometrics
• All courses using statistical (quantitative) techniques