Summary
The aim of the course is to apply the theory of martingales in the context of mathematical finance. The course provides a detailed study of the mathematical ideas that are used in modern financial mathematics. Moreover, the concepts of complete and incomplete markets are discussed.

Content

• Discrete time models and the Fundamental Theorem of Asset Pricing
  - Fundamental results
  - Binomial- and trinomial model
  - The Snell envelope, optimal stopping, and American options

• Geometric Brownian motion and the Black-Scholes model
  - Option pricing and hedging
  - Exotic options

• On the theory of (no-)arbitrage in continuous time

• Selected topics on
  - Local- and stochastic volatility models
  - Stochastic interest rates
  - Lévy driven models
  - New trends in financial mathematics

Keywords
martingales, financial mathematics, theory of (no-)arbitrage

Learning Prerequisites

Recommended courses
Stochastic calculation

Important concepts to start the course
Learning Outcomes

By the end of the course, the student must be able to:

- Explore in detail the use of martingales in financial mathematics.
- Prove a criteria for absence of arbitrage in a model based on a finite probability space and state an analogous general result.
- Prove a criteria for completeness of a viable market modeled based on a finite probability space and state an analogous general result.
- Explain the difference and the resulting consequences between claims and American options.
- Derive prices for some financial derivatives based on several different models.
- Derive different hedging strategies for some financial derivatives based on several different models.
- Analyze the choice of asset price models according to different criteria.
- Optimize chosen asset price models.
- Optimize the calibration of chosen asset price models.

Assessment methods

Exam oral
Dans le cas de l’art. 3 al. 5 du Règlement de section, l’enseignant décide de la forme de l’examen qu’il communique aux étudiants concernés.

Supervision

Office hours: Yes
Assistants: No
Forum: No
Others: Office hours: Friday, 13:00-14:00

Resources

Virtual desktop infrastructure (VDI)
No

Bibliography


Ressources en bibliothèque

- Introduction to Stochastic Calculus Applied to Finance / Lamberton
- Change of Time and Change of Measure / Barndorff-Nielsen
- Essentials of Stochastic Finance / Shiryaev