

DERIVATIVES PRICING THEORY

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Prof. Olivier Scaillet, is professor of finance and statistics at the Geneva Finance Research Institute of the University of Geneva and has a senior chair at the Swiss Finance Institute. He holds both a master and a Ph.D. from University Paris IX Dauphine in applied mathematics. Professor Scaillet's research expertise is in the area of derivatives pricing, econometric theory and econometrics applied to finance and insurance. He has published several papers in top journals in econometrics and finance, and co-authored a book on financial econometrics. He has been one of the winners of the bi-annual award for the best paper published in the Journal of Empirical Finance on the topic of quantitative risk management and of the Banque Privée Espirito Santo award prize, on the topic of mutual fund performance. He is associate editor of several leading academic journals in econometrics, statistics, banking and finance. He is a long-term advisor for the research teams of BNPParibas.

Course Outline

This course is an introduction to the theory of derivatives pricing. It thoroughly covers the Black-Scholes model as the limit of the discrete time binomial model and in a continuous time framework. It introduces all the necessary tools to work with derivatives pricing models such as Ito's lemma (single and multivariate), Girsanov's change of measure theorem, martingales and change of numeraire theorem. Concepts such as self-financing strategies, complete / incomplete markets and the fundamental theorems of asset pricing are thoroughly covered.

At the end of the course, Participants will be able to:

- Solid understanding of derivatives valuation theory and its necessary mathematical tools
- Value derivatives based on no-arbitrage arguments
- Value derivatives by applying Ito's lemma
- Derive and use the Black-Scholes option pricing formula
- Use the Binomial option pricing model

Course Structure

Introduction and Definitions

- a option definitions
- b valuation / hedging

Put-Call Parity

- a No-arbitrage
- b Replication

Black-Scholes model

- a Black-Scholes continuous time option pricing model
- b Derivation

Black-Scholes and the Binomial model

- a Limit of binomial model

Discrete time models

- a Rigorous mathematical derivations of discrete time models
- b First Fundamental Theorem of Asset Pricing
- c Self-financing strategies
- d Arbitrage and martingales

Continuous Time model

- a Ito's lemma in Finance
- b Multi-variate Ito's lemma
- c Numeraires / Girsanov's theorem

Term Structure models

- a Gaussian models
- b Forward measure / numeraires
- c Trinomial trees