15F020

Pricing Financial Derivatives I

3 ECTS

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Introduction

This course gives an introduction to one of the branches of finance that requires advanced quantitative techniques which is derivatives pricing. Taking observed market prices as input we will introduce and use the mathematical tool of Itô calculus to obtain the corresponding value of derivatives of the stock. The main model is Black-Scholes model.

Objectives

The main purpose of this course is to introduce the machinery of Itô calculus and show how it can be applied to solve the problem of pricing and hedging financial derivatives on continuous and discrete time models, such as options contracts.

Requirements

This course is only recommended for students enrolled in the Master of Finance, Data Science or MRES, since it requires a good quantitative background, programming skills, and a previous Matlab course (or similar software such as R, etc.).

Learning Outcomes

By the end of the course, the students will be able to use the machinery of Itô calculus, and be capable to evaluate the price of current financial derivatives and construct the hedging portfolio. Practitioners from banks will be invited to give seminars to students.

Methodology

Slides containing all the material will be exposed in class and completed with explanations in the white board. There will be a list of exercises for each session that will be solved during the TA sessions.

Evaluation

Homework assignments (40%) and final exam (60%). The homework assignments are done in groups of 2-3 students and contain numerical exercises to be done in Matlab (or similar software such as R or Python). The final exam will contain theoretical exercises similar to those done during the TA classes.

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Course contents

Mainly chapters 1- 7 of Joshi's and chapters 2-10 of Wilmott's book (see references below).

Specify a description, materials and cases that will be worked in class:

Session	Title, materials and cases
1	Introduction
2	Pricing methodology and arbitrage
3-5	Option pricing with trees (binomial model)
6	Black Scholes model
7-9	Itô stochastic calculus
10	Practical pricing, the greeks, Delta hedhing

Bibliography

Joshi, M.J. The Concepts and Practice of Mathematical Finance 2n Edition Cambridge University Press, 2008

Paul Wilmott introduces quantitative finance, Wiley, second edition, 2007

Professor's Biography

Eulalia Nualart has a Tenured Associate Professor position at the Department of Economics of the University Pompeu Fabra since 2012. Before she had a permanent research and teaching position at the Department of Mathematics of the University of Paris 13, after doing a PostDoc at the University of Paris 6, with a research fellowship from the National Swiss Foundation. She earned her PhD in Probability from the École Polytechnique Fédérale de Lausanne in 2002. She broadly works in the field of stochastic analysis and its applications to stochastic differential equations and stochastic partial differential equations.