1 The Course

What you will learn

- The sources of value of various derivative securities. You will form the correct intuition and avoid common mistakes.

- Solid understanding of the math language used to describe the derivative securities’ models.

- Practical implementation of models - numerical techniques.

The course has four parts:

I. INTRODUCTION TO THE MATHEMATICS OF CONTINUOUS TIME FINANCE

II. DERIVATIVES ON EQUITY

III. FIXED INCOME - INTEREST RATE MODELS

IV. CREDIT RISK

However, we will focus on I. and II., as they form the foundations for more specialized fields of financial modeling like III. and IV.
The structure of the course (preliminary and subject to change (!) - the pace of the course and the extent of its coverage will be adjusted to optimally suit your needs!)


2. Trading strategies and accumulated portfolio gains - Itô integral; Itô (stochastic) calculus; language of SDEs.


7. American derivative securities: possibility of early exercise. [Third computer assignment (part 1): numerically solution of pricing PDEs]
8. The smile. Local volatility surface: mere tool for studying models or a consistent pricing mechanism? Discussion: excesses of calibration. [Third computer assignment (part 2): incorporating LVS.]


2 Grading

The final grade will be the result of (a weighted average of):

- home assignments (each home assignment receives either 0 (fail) or 1 (pass)) and brief quizzes (designed to test your understanding of the basic concepts taught during the previous lectures) [weight - 30%]

- computer assignments designed to teach you the numerical implementation of the models and provide a ‘practical feel’ for the models [weight - 40%]
• final exam: two parts - fundamental and advanced. The exam material will be covered in the lecture notes and in the book by Shreve (see Literature below) [attention! possible minimum requirements based on the fundamental part of the exam; weight - 30%]

3 Literature

The course will utilize numerous textbooks and articles. Here I list the most important sources.

The lecture notes will be as self-contained as possible. But for the purely theoretical aspects of the course I will also rely heavily on:


ONLY THE BOOK by Shreve and the lecture notes are obligatory reading! The rest is for your information and advanced studies.

The following are the additional textbooks that I will draw upon:

Volatility smile:


Monte Carlo pricing:


Finite Difference Approach:


Interest rates and credit risk:
• Damiano Brigo and Fabio Mercurio. Interest Rate Models - Theory and Practice: With Smile, Inflation and Credit (Springer Finance).

Credit risk:


4  A Word of Advice

The course will be quite intensive and will require concentration and discipline. I have prepared home assignments and quizzes to ensure that nobody falls behind. Every lecture builds upon the material of the preceding lectures. The grading system is designed to stimulate continuous effort during the whole course. The final exam may contain a set of fundamental questions that MUST be answered in a satisfactory manner to pass the course. (More precise information will be provided as the course progresses.)