Derivative Securities pricing

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COURSE AIMS

The course provides students with an in-depth knowledge of derivative securities. We will cover the pricing of several types of options (on stocks, stock indices, currencies, futures) and interest rate derivatives (bond options, interest rate caps and floors, swaptions). The course includes tutorials to apply the concepts outlined during the lectures. At the end of this course, attending students will be able to apply the main models used to price derivative securities.

COURSE CONTENTS

Prerequisites

Before entering the course, the student should:

- Possess a basic knowledge of futures, options and swaps.
- Be able to use continuously compounding interest rates.

Course outline and detailed learning goals

1. Options on stocks
   
   At the end of this section of the course, the student will be able to:
   
   - Understand the stochastic behaviour of stock prices.
     * Estimate the expected stock price at a future point in time.
   
   - Apply the Black-Scholes-Merton model to price European options on non-dividend and dividend paying stocks.
   
   - Use the Black's method to approximate the value of an American-style call option on stocks.

2. Options on stock indices, currencies and futures
   
   At the end of this section of the course, the student will be able to:
   
   - Use index options to limit portfolio downside risk.
   
   - Price European stock index options.
   
   - Price European currency options.
   
   - Price futures options using binomial trees.
● Price European futures options using the Black's model.

3. **Greek letters.**
   At the end of this section of the course, the student will be able to:
   ● Understand the mechanics of delta hedging.
   ● Understand and estimate delta, gamma, theta, rho, vega.

4. **Volatility smile.**
   At the end of this section of the course, the student will:
   ● Know how traders use the Black-Scholes model.
   ● Know how traders use the volatility surfaces as pricing tools.

5. **Numerical procedures.**
   At the end of this section of the course, the student will:
   ● Know the underlying logic of the Monte Carlo simulation.
   ● Know how to run basic Monte Carlo simulations.

6. **Volatility estimation.**
   At the end of this section of the course, the student will:
   ● Know how to estimate volatility based on rolling standard deviation of historical data.
   ● Know autoregressive models to estimate volatility.

7. **Exotic options.**
   At the end of this section of the course, the student will:
   ● Know several types of exotic options.
   ● Be able to apply numerical procedures to price exotic options.

8. **Interest rate derivatives.**
   At the end of this section of the course, the student will:
   ● Know the mechanics of bond options, interest rate caps and floors, swaptions.
   ● Be able to price interest rate derivatives based on several pricing models.
     * The Standard Market Model.
     * Models of the Short Rate.

**READING LIST**


Supplementary material (e.g., slides) will be posted on the class Blackboard website, available at [http://blackboard.unicatt.it](http://blackboard.unicatt.it).
TEACHING METHOD

This course will use lecturing for 70% and tutorials for 30%.

ASSESSMENT METHOD

Written exam. Usually the test consists of 4 questions, with three to four sub-questions. The questions will refer to the concepts, the examples, the models dealt in this course and may also require a solution to a numerical exercise.

NOTES

Place and time of consultation hours

Office hours are held once a week. Further information can be found on the instructor's webpage at http://docenti.unicatt.it/eng/giovanni_petrella.