Summary

[Derivative Instruments (Advanced Course) (Management of banks and insurances)](#_Toc50712228)

[Prof. Paolo Gualtieri 1](#_Toc50712229)

Derivatives Instruments (Finance and Finance - Corporate advisory)

[Prof. Giovanni Petrella 4](#_Toc50712230)

# Derivative Instruments (Advanced Course) (Management of banks and insurances)

Prof. Paolo Gualtieri

***COURSE AIMS AND INTENDED LEARNING OUTCOMES***

The course aims to provide students with an in-depth knowledge of derivative instruments, with a focus on pricing and risk management models related to derivative positions.

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

– manage the analytical and theoretical tools that are necessary to understand how derivative financial instruments work;

– properly apply the main evaluation models of derivatives written on shares, stock market indexes, currencies, interest rates, futures, and credit derivatives;

– become familiar with the estimation method of the inputparameters of the most relevant evaluation models;

– recognise the risks behind the use of derivative instruments and develop the skills to properly manage them, both statically and dynamically.

***COURSE CONTENT***

1. *Stock price variation model*

* stochastic processes, with continuous variable and continuous-time, referring to stock prices.

1. *Black-Scholes model*

* the main features and basic concepts of the Black-Scholes model;
* the evaluation formulas of this model;
* volatility calculation based on historical data;
* current implied volatility in stock prices based on the model.

1. *Stock index, currency, and future options*

* stock index, currency, and future options;
* the prices of stock index, currency, and future options.

1. *Greek letters*

* The different dimensions of option position risk.

1. *Volatility smile*

* the so-called “volatility smile” graphs representing option implied volatility according to exercise prices;
* the link between volatility smiles and the probability distribution assumed for the underlying price.

1. *Volatility and correlations estimation*

* the models explaining volatility and correlation variations over time;
* the main volatility estimation models: the exponential weighted moving average model, GARCH, ARCH, maximum likelihood estimations.

1. *Numerical procedures*

* the numerical procedures used when closed formulas for derivative evalution are not available.

1. *Exotic options*

* the main features of the different kinds of exotic options;
* exotic options evaluation methodology;
* unbundling and assessment of structured products.

1. *Interest-rate derivatives: standard market models*

* the main features of the most widespread optional products traded in over the counter markets: bond options, caps, floors, interest rate collars, and swaptions;
* the standard models adopted by the market to assess these products.

1. *Interest-rate derivatives: short-rate models*

* short-rate models;
* term structure models.

1. *Credit derivatives*

* the different types of credit derivatives;
* credit derivative assessment methodology.

***READING LIST***

J. Hull, *Opzioni, futures e altri derivati,* Pearson, 10th ed. (chapters 14-15, 17-21, 23-26, 29-32).

During the course, any additional bibliographic source will be reported.

***TEACHING METHOD***

Frontal lectures with slides; some lectures will be specifically focused on applications.

***ASSESSMENT METHOD AND CRITERIA***

The exam consists of a written test on the topics explained during the course. It will be composed of open-ended questions and short problems, all rated with the same number of points. If students obtain an insufficient mark in one of the answers, they will fail the whole exam. Assessment criteria will take into account the following factors: answer relevance, proper use of financial jargon, argument skills, correct execution of the exercises.

If students obtain a positive mark in the written test, they can choose for an additional oral assessment on the same topics in order to increase (or decrease) the final mark.

The assessment might also take into account the marks obtained with assignments over problems raised during the lectures.

***NOTES AND PREREQUISITES***

It is highly recommended that students possess a deep understanding of:

– the methodological tools for the use of the main derivative financial instruments (forwards, futures, swaps, and options);

– the main features of the previously mentioned instruments, as well as their influence on price formation;

– the use of derivative instruments (arbitrage, speculation, and cover). For this reason students are strongly advised to pass the exam Derivative Instruments I (or a similar one) during their bachelor’s degree program.

In case the current Covid-19 health emergency does not allow frontal teaching, remote teaching will be carried out following procedures that will be promptly notified to students.

Further information can be found on the lecturer's webpage at http://docenti.unicatt.it/web/searchByName.do?language=ENG or on the Faculty notice board.

**Derivatives Instruments (Finance and Finance – Corporate advisory)**

## Prof. Giovanni Petrella

***COURSE AIMS AND INTENDED LEARNING OUTCOMES***

The course provides students with the skills required in three main areas: option pricing of different underlying assets (shares, stock market indexes, currencies, futures), pricing of interest-rate derivatives (bond options, caps, floors, swaptions) and credit derivatives pricing. The course includes practical exercises aimed at the application of the concepts studied in the theoretical lectures. At the end of the course, students will be able to know and understand the assumptions, as well as to apply the main models that are generally used for derivative assessment.

***COURSE CONTENT***

Educational objectives that students are expected to achieve during the course

1. *Stock options.*

At the end of this part of the course, students will be able to:

– Understand the stochastic trend of stock prices.

\* Estimate the expected future price of a stock.

– Apply the Black-Scholes-Merton model for the evaluation of European stock options (with or without dividends).

– Use the Black model to approximate the value of an American call option on stock.

2. *Options on equity indexes, currencies, and futures.*

At the end of this part of the course, students will be able to:

– Use options on equity indexes to contain the risk of loss in a portfolio.

– Evaluate the European options on equity indexes.

– Evaluate the European options on currencies.

– Evaluate the European options on futures by using binomial trees.

– Evaluate the European options on futures by using the Black model.

3. *Greek letters.*

At the end of this part of the course, students will be able to:

– Understand the delta hedging mechanism.

– Understand and estimate the delta, gamma, theta, rho, vega.

4. *Volatility smile.*

At the end of this part of the course, students will be able to:

– Understand how the traders use the Black-Scholes model in order to extracts volatility singnals.

– Understand how traders use the volatility smile in pricing.

5. *Numerical procedures.*

At the end of this part of the course, students will be able to:

– Understand the functioning of the Monte Carlo simulation.

– Perform simple Monte Carlo simulations.

6. *Estimating expected volatility*.

At the end of this part of the course, students will be able to:

– Estimate the volatility based on the rolling standard deviation of historical returns.

– Understand autoregressive models to forecast volatility.

7. *Exotic options.*

At the end of this part of the course, students will:

– know the different types of exotic options.

– be able to apply the numerical procedures to valuate some types of exotic options.

8. *Energy derivatives.*

At the end of this part of the course, students will:

– know the main derivatives written on energy.

– know the patterns for commodity prices.

***READING LIST***

J.C. Hull, *Opzioni,* *futures e altri derivati*, Pearson, Milano, (chapters 14, 15, 17, 18, 19, 20, 21, 25, 26, 29, 31, 35), 2021, 11th edition.

Supplementary material (slides, additional documentation, etc.) will be made available to students on the Blackboard platform.

***TEACHING METHOD***

Frontal lectures (70% of the course) and practical exercises (30%).

***ASSESSMENT METHOD AND CRITERIA***

As regards the assessment methods, the examination of students’ competence will be based on a written test, which generally consists of three open questions structured in sub-questions.

As regards the assessment criteria, there will be a partial grade given to each answer. The final grade will be an average of the partial grades. There is no oral exam planned.

Written test, usually consisting of 4 questions and lasting 60 to 90 minutes. The questions refer to concepts, examples, and models covered in the course and may require solving numerical exercises.

***NOTES AND PREREQUISITES***

*Prerequisites*

Educational objectives that students are expected to have achieved before attending the course:

– a basic knowledge of futures, options, and swaps.

– a basic knowledge of inferential statistics.

In case the current Covid-19 health emergency does not allow frontal teaching, remote teaching will be carried out following procedures that will be promptly notified to students.

Further information can be found on the lecturer's webpage at http://docenti.unicatt.it/web/searchByName.do?language=ENG, or on the Faculty notice board.