# Derivatives

## Prof. Giulio Anselmi

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

The course aims to describe the characteristics of main financial derivatives instruments (forwards, futures, swaps and options), the pricing process and the elements useful for the relative evaluation (forward-rates, zero-rates, bootstrap method). Special attention will be paid to the ways derivatives instruments are used (arbitrage, speculation, and hedging).

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

To attend the course, students are expected to:

– be able to calculate present and future values based on a discrete and continuous capitalisation scheme for a single cash flow as well as for an annuity;

– learn the main applications of financial mathematics, for the discrete and continuous time, with reference to bond instruments *duration, convexity*;

– learn the concept and calculation of the term structure of yields;

– learn the main characteristics of the functioning of secondary markets.

*Intended learning outcomes*

At the end of the course students will be familiar with the main features of the derivatives market and the types of forwards, futures, swaps, and options, and they will also be able to use these instruments for arbitrage, speculation and hedging purposes; furthermore, they will be able to estimate the price in the absence of arbitrage opportunities.

***COURSE CONTENT***

Educational objectives that students are expected to achieve during the course

*Introduction to derivatives*

After completing the analysis of this topic, students will be able to:

– know the main characteristics of the financial derivatives category and, more specifically, of forwards, futures and options;

– understand the purposes of hedging, speculation, and arbitrage associated with the use of derivatives instruments. Special focus will be given to hedging the risk of changes in interest rates, in exchange rates, in equity prices and commodities.

– understand the role of CCPs and the function of margins to reduce the counterparty risk.

*Forwards and futures*

After completing the analysis of this topic, students will be able to:

– know the technical details of forward and futures contracts;

– know the margin system of futures contracts;

– understand the fundamentals of hedging using future contracts;

– calculate the prices of forward contracts based on underlying assets that do not provide incomes, that provide known incomes in absolute value, that provide known incomes in percentage;

– calculate the value of forward contracts;

– perform a comparison between the futures and the forwards markets (IDEM, OTC and clearing houses).

*Interest rate markets*

After completing the analysis of this topic, students will be able to:

– calculate forward rates;

– know the characteristics of the forward rate agreement (FRA);

– calculate the FRA rate and the value of FRA contracts;

– know the technical details of interest rate futures contracts, the concept of conversion factor, the concept of cheapest-to-deliver security;

– define a hedging strategy for a bond portfolio through futures contracts and change portfolio duration through futures;

– define a hedging strategy for an equity portfolio through futures contracts and change the zero-beta portfolio through futures.

*Swap*

After completing the analysis of the topic, students will:

– know the technical characteristics of interest rates and currencies swaps;

– know how to use swaps on interest rates and currencies;

– be able to calculate the swap rate;

– be able to calculate the swap value on interest rates and currencies.

*Options*

After completing the analysis of the topic, students will be able to:

– know the contractual specifications of options and the terminology of option trading;

– understand the factors affecting option prices;

– understand the payoff function of options;

– calculate the upper and lower bounds of options;

– apply put-call and implement hedging strategies, or speculation through option portfolios;

– calculate the price of options with the binomial tree technique.

***READING LIST***

J.C. Hull, *Opzioni,* *futures e altri derivati*, Pearson Prentice Hall, Milano, latest edition (Chs 1-7; 10-13).

Supplementary material (slides, excel files, additional documentation related to the practical exercises, exercises already carried out and *mock exams*) will be made available on the Blackboard platform.

***TEACHING METHOD***

Frontal lectures and practical exercises (to be carried out during class time).

***ASSESSMENT METHOD AND CRITERIA***

The 90-minute written test consists of 4 open-ended questions (with possible division into into sub-points). The questions refer to concepts, examples, models discussed in the course and in most cases (70%) require the solution to numerical problems. Each question is aimed at verifying the students’ preparation on the concepts and examples addressed in the classroom, as well as their ability to solve new exercises. For each question the score obtained also depends on the distribution of the answers to the same question given by other students.

At the discretion of the professor, it is possible for students, on a voluntary basis, to participate in a group assignment to be discussed at the end of the course in front of the class.

***NOTES AND PREREQUISITES***

Students must have basic knowledge of the concepts of financial mathematics.

*Office hours*

Prof. Giulio Anselmi receives students at Ed. Franciscanum, Room 407. The day and time of the reception are indicated on the lecturer's webpage at http://docenti.unicatt.it/web/searchByName.do?language=ENG, or on the Faculty notice board.