# Introduction to quantitative finance

## Prof. Andrea Tarelli

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

This course provides the students with key quantitative tools for the analysis of financial transactions and for the study of optimal decisions made by rational agents.

By the end of the course, a student will be able

* to evaluate financial transactions by calculating the present value and the internal rate of return;
* to determine the value of fixed income instruments and to build financial immunization strategies;
* to construct the term structure of spot and forward market interest rates;
* to implement portfolio strategies based on mean-variance criteria.

***COURSE CONTENT***

1. Basic theory of interest: principal and interest, present and future values, annuities, loans and mortgages, internal rate of return, evaluation criteria.

2. Fixed-income securities: fixed-income market, bonds, bond yield, duration, immunization, convexity.

3. Term structure of interest rates: yield curve, spot rates, forward rates, term structure explanations and expectation dynamics, duration and immunization.

4. Fundamentals of mean-variance portfolio theory: asset returns, random variables and returns, portfolios of assets, global minimum variance portfolio, mean-variance efficient portfolio.

***READING LIST[[1]](#footnote-1)***

Lecture notes made available on *Blackboard*.

D. G. Luenberger, *Investment Science,* Oxford University Press, International Edition, 2009.

***TEACHING METHOD***

The course is based on frontal teaching with classroom applications of the theory covered.

***ASSESSMENT METHOD AND CRITERIA***

The mark is based on a final written exam. The exam is made of open and/or multiple-choice questions, aimed at assessing the understanding of the theory and the applications of the topics studied. The score awarded for each question is specified in the text of the exam. A mock exam representing the format of the final exam is published on Blackboard.

***NOTES AND PREREQUISITES***

Students should be acquainted with:

Mathematics: fundamentals of continuous functions; matrix calculus and linear algebra; determination of minimum/maximum of a real function;

Statistics: random variables and the features of their probability distributions (mean, variance, and standard deviation), as well as the features of joint distributions (covariance and correlation); characteristics of Gaussian distributions.

If restrictions related to the COVID-19 pandemics are in place, the course will be imparted with modalities that will be timely communicated to the students.

*Office hours*

Information on the instructor’s office hours are published on his institutional web page.

1. I testi indicati nella bibliografia sono acquistabili presso le librerie di Ateneo; è possibile acquistarli anche presso altri rivenditori. [↑](#footnote-ref-1)