Advanced derivatives

Academic Year: (2020 / 2021)   Review date: 13-10-2020

Department assigned to the subject:

Coordinating teacher: MORENO MUÑOZ, JESUS DAVID

Type: Electives ECTS Credits : 3.0

Year : 1 Semester : 2

REQUIREMENTS (SUBJECTS THAT ARE ASSUMED TO BE KNOWN)

Students are expected to have completed the basic course of Fixed Income (First Term) and Derivatives (Second Term).

Professor:
Arturo Labanda - Market Risk Models. Head of Valuation Methodologies (Santander Bank)

OBJECTIVES

This course consists of three parts. The first part refers to fixed income derivatives: we will study interest rate swaps, plain vanilla options (caps and floors) and swaptions. Also we will study complex payoffs as Constant Maturity Swaps, quanto options and we will review the Monte Carlo engine: Hull-White or Libor Market Model. The second part studies equity derivatives using the Black-Scholes-Merton option pricing framework for pricing non-vanilla options and Monte Carlo methods for pricing exotic options (path-dependent) and their use to design structured products. The third part covers the impact in the valuation techniques due to the changes in the market: OIS discounting, counterparty issues, funding cost, negative rates and the topics where the regulators put the focus: observability of inputs, levelling, etc.

DESCRIPTION OF CONTENTS: PROGRAMME

Part 1. Interest rate derivatives

1.   Valuation of interest rate swaps
-       Types of swaps
-       IRS vanilla: fixed vs floating, floating vs floating
-       Cross currencies swaps: vanilla and Mark To Market (resetteable) cross currency swaps
-       Constant Maturity Swaps
2.   Options on interest rates
-       Volatility surfaces
-       Caps and Floors
-       Swaptions
-       Swaps with embedded options
-       Convexity and quanto adjustments
3.   Models for exotic payoffs: HJM, LMM and HW models

Part 2. Equity derivatives

1.   Trading strategies with options: spreads, butterflies, straddles and strangles
2.   Exotic options using Black-Scholes framework
-       Asian options
-       Barrier and binary options
-       Chooser options
-       Cliquet options
-       Lookback options
-       Exotic options on two assets
3.   Structure products: the combination of fixed income and equity derivatives
4.   Monte Carlo simulation
-       Standard Monte Carlo simulation
-       Monte Carlo simulation for two or more assets

Part 3. Changing in models due to changes in Markets

1.   OIS discounting: impact in curves construction and valuation
2.   Credit and funding issues
3.   Rates below 0: from lognormal to shifted lognormal or normal model
4.   Fair Value Adjustments (FVAs)
5.   Prudent Value Adjusments (AVAs)
6.   Observability and Levelling for asset and liabilities

LEARNING ACTIVITIES AND METHODOLOGY

Students will work with Excel. They will be asked to solve different problems during the course. Firstly, they will have to price interest rate options and swaps. The second practical exercise will be to price exotic path-dependent options using Monte Carlo simulation. Students will be asked to price barrier options, lookback options and/or Asian options and comparing the results with Black-Scholes framework formulas. A third activity will be the design of a real structured product (a guarantee investment fund really offered by an investment company). To this end, the students will have to combine and price different path-independent options (digital options, asset-or-nothing options, gap options, etc.) with standard options.

Students will be allowed to work on these activities alone, although it will be encouraged to work in small teams (2 or 3 people). Previously to each activity, the professor will explain in class the theoretical background needed to perform each task and will provide hints to work on the activities in an efficient way. After handing-in each exercise, in a weekly basis, it will be discussed in class the difficulties that students have found to do the activity and the correct way to do it.

ASSESSMENT SYSTEM

The grade will be based on a final exam (60% of the final grade; minimum punctuation 4/10), homework (40%)

All students must obtain at least 4 out of 10 points in the final exam to take into account the 40% of the grade from the exercises. Otherwise, the final grade will completely be based on the final exam.

Students that do not meet the minimum passing grade should retake the subject. If the resit is taken, the above grade criteria also apply

% end-of-term-examination:	60
% of continuous assessment (assigments, laboratory, practicals…):	40

BASIC BIBLIOGRAPHY

- Espen Gaarder Haug The Complete Guide To Option Pricing Formulas, McGraw-Hill, 2010

- Hull, J.C. Options, Futures, and other Derivative Securities, 9th Edition, Prentice-Hall, Englewood Cliffs, New Jersey., 2015

ADDITIONAL BIBLIOGRAPHY

- Chance, D.M. and R. Brooks An Introduction to Derivatives and Risk Management, 8th Edition, Thomson South-Western, Mason, Ohio., 2010
- Jarrow, R. and S. Turnbull Derivative Securities, 2nd Edition, South-Western College Publishing, Cincinnati., 1999