

15F021

3 ECTS

Derivatives and Risk Management

Professor: Manuel Moreno

Professor e-mail: Manuel.Moreno@uclm.es

Introduction

The course is focused on the area of financial risk management with special emphasis on financial derivatives. This type of assets represents one of the key components of modern financial markets. The mere size of derivatives markets (futures, options, swaps, etc) dwarfs that of any other type of markets in existence and is measured in thousands of trillions of U.S. dollars. The key reason is that financial assets allow astute investors to easily change risk exposure of their investment portfolios and, thus, tailor them to their particular needs.

In this course we depart from the design, pricing and valuation of financial derivatives and we aim to understand how such contracts are used in the management practice around the world. While pricing of derivatives can be rather technical and complex, the fundamental economic reasoning behind derivatives pricing methods is quite simple. In our approach we aim to always give first the “big picture” and motivation and only then dwell into technical details but only to the extent that it is necessary from the practical applications point of view. At the end of the course you should be able to understand the structure of the main types of derivative contracts, how to price these derivatives and, even more important, thoroughly understand how these assets can be used to manage the exposure to a certain risk.

We will review some of the most commonly used pricing methods and techniques for measuring and managing risk and, then, we will move to the understanding of the use of financial instruments to manage risk.

This part will involve the understanding of international financial markets for interest rates, equity and derivatives. The emphasis here will be in the applications of derivative instruments for pricing and risk management by corporations. We will also review examples throughout the course in which financial engineering of corporate risks was crucial for the success (and failure) of a company’s strategy.

Objectives

The goal of the course is to study the fundamentals of financial risk management using in most of the situations derivatives assets. The course has three main objectives:

- To understand the role of financial risk management as well as the techniques available for its measurement in financial and non-financial corporations.
- To review the set of financial instruments available in modern financial markets as well as the strategies that a firm can use to optimise the management of the risks this company is faced to, and
- To build a framework that will help integrate financial risk management into an overall corporate strategy.

In summary, the main objective of this course is to present an overview of the different potential applications for risk management of derivative assets. Potential applications of derivatives that can also be covered are, for

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instance, a) speculation in markets (how to get money departing from a certain guess on future movements in markets) and b) design of (arbitrage) strategies to make risk-less profit from observed arbitrage opportunities.

Required Background Knowledge

The course will cover some financial instruments and strategies which could be quite complex. The course assumes that students have no prior knowledge about how derivative instruments work and one of the main objectives of the course is to guarantee that students finish with a good handle on the mechanics of these instruments. As most of these instruments are quantitative in essence, familiarity with quantitative and analytical techniques is strongly recommended.

Learning Outcomes

As stated before, at the end of the course, the student should be able to understand the structure of the main types of derivative contracts, how to price these derivatives and, even more important, thoroughly understand how these assets can be used to manage the exposure to a certain risk. In this way, the review of the pricing methods and the techniques for measuring and managing risk will help to understand the use of financial instruments to manage risk. This knowledge will be especially useful to apply derivatives for pricing and risk management by corporations.

Methodology

Every lecture will typically contain some of the following 3 elements:

- a) Presentation and discussion of a reading set.
- b) Case presentation and discussion
- c) Lecturing (theory concepts).

The recommended dynamic for the student is **to work on the readings set or case before the corresponding session**, attend the session and participate actively in the readings or case discussion. Then read the corresponding chapters / readings (if additional details are needed) and work on the suggested problems (or questions or ...) after the session.

The Course Schedule below includes a detailed list of all the readings sets, cases and lecture topics that will be covered through the course. In what follows you will find a description of each of these elements, the class dynamics, and the grading criterion.

Cases

Several of the lectures include a "Case Discussion". The cases are meant to summarize and exercise the concepts studied in the lecture/s. As a way to introduce the case and structure its analysis a set of questions will precede the

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case. All the students are expected to read the cases with the questions in mind in order to contribute to the class discussion. This will be graded through case discussion.

Every case will be assigned to a particular group of students who will be in charge of

1. Introducing the topic during approximately the first part of the class
2. Leading the discussion (extra material, complementary questions, ...)

These tasks will be graded. The average will constitute the case discussion grade for the particular students (in case of group work, all the students will obtain the same grade except the group *unanimously* decides otherwise).

Lecturing

As a general rule, most of the lectures will introduce new concepts and theory. The objective is to make it as participative and dynamic as possible. Therefore, students are encouraged to intervene with clarifying and constructive questions or remarks anytime during the lecture.

The material covered in every lecture is contained in the recommended readings. The specific material is mentioned opportunely in the course schedule. Due to the obvious time constraint, class slides will only cover the main aspects of every topic. A successful preparation for the exam requires reading the corresponding material and working on the suggested problems (if any) after every session.

Suggested problems

Some lectures may include a suggested set of problems from the recommended readings. These problems are designed to help you understand and digest the course material and serve as a self-guide of your progress and as preparation for the final exam. Students are encouraged to work regularly on the suggested problems and check personally with the instructor any question/doubt. Some sessions can focus on discussing / solving some of these problems, especially those that elicit questions/doubts from a sufficiently large number of students.

Evaluation

The grade is based on preparation of readings or cases, problems resolution, and a final exam.

Students will be evaluated on the basis of the following criteria:

1. Case discussion and problems resolution (40 points). Students will be required to discuss and/or present the cases involved in the course. The students will be assigned a certain case. Their discussions / presentations should help to form an opinion about a certain firm's strategies. In general terms, the grade will depend on how you arrived at your conclusions regardless your opinion agrees with mine. Problems resolution is also included in this item.

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2. Final exam (60 points). You are allowed to bring in one page (written on both sides) including the material (mathematical expressions, graphs,...) you feel convenient.

Course contents

I. INTRODUCTION

IDENTIFYING, MEASURING, AND HEDGING THE EXPOSURE TO FINANCIAL RISKS

SESSIONS 1 & 2

Introduction: Course overview, description, and work plan.

Reasons and Incentives for Financial Risk Management (FRM)

Reading:

Introduction to derivatives

Hull, Chapter 1

II. THE BUILDING BLOCKS OF RISK MANAGEMENT SYSTEMS

SESSIONS 3 & 4

Derivatives: forwards and futures

Readings:

Mechanics of forward and futures markets

Hedging strategies using futures

Hull, Chapters 2 and 5

SESSIONS 5 & 6 & 7

Derivatives: options and option-like instruments

Readings:

Mechanics of options markets

Properties of stock options

Hull, Chapters 9 and 10

III. OPTION PRICING

SESSIONS 8 & 9 & 10

Binomial pricing and replicating portfolio

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Black-Scholes option pricing and practical applications

Reading:

Option pricing

Hull, Chapter 12, 14 and 18

IV. APPLICATIONS OF FINANCIAL RISK MANAGEMENT

SESSION 11

Derivatives: forward and futures for speculation

P.C.: Speculation in the Financial Futures Market: A Local Tries to Break the Bund (London Metropolitan University 299-009-1)

Reading:

Determination of forward and futures prices CAMPUS ONLINE

Hull, Chapter 3

SESSION 12

Cross-Hedging Basis Risk and application of basis risk

P.C.: Metallgesellschaft AG (HBS 9-194-097)

P.C.: Metallgesellschaft AG (IMD 3-0613)

SESSION 13

Derivatives: Potential applications for speculation / hedging. Combining options to achieve optimal risk / payoff strategies

P.C.: The Collapse of Barings (London Business School 401-020-1)

P.C.: The Collapse of Barings (London Business School 401-021-1)

Readings:

Hedging / speculative strategies involving options

Hull, Chapter 11

SESSION 14

Pricing of exotic options and hedging with these instruments

Practical applications: Standard and compound options

Asian, barrier, chooser and look-back options

SESSION 15

Using options to limit your risk

P.C.: Pine Street Capital (HBS 9-201-071)

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SESSION 16

An application of FRM

P.C.: American Barrick Resource Corporation: Managing Gold Price Risk (HBS 9-293-128)

Bibliography

The course will use class materials including handouts, cases, and some other readings. There exist many very good books that review the basic financial instruments and tools commonly used in derivatives pricing and financial risk management.

In short, the course will use material extracted from the following books:

- Chance, D. (2003). "Analysis of Derivatives for the CFA Program". AIMR.

This book is the classical reference for applications of derivatives (trading, pricing, valuation, and risk management) for preparation for the CFA exam (levels I, II, and III).

- Hull, J. (2011) "Options, Futures and other Derivatives" Prentice Hall, 8th edition.

This book will be referred in this course as "Hull". It is a classical reference in this area. It was chosen in 2003 as the "most influential book" on the financial area as a result of a worldwide survey among practitioners and academics. This book is the extended version of the following one:

- Hull, J. (2010) "Fundamentals of Futures and Options Markets" Prentice Hall, 7th edition.

READINGS

1. Introduction to derivatives
2. Mechanics of forward and futures markets
3. Determination of forward and futures prices
4. Hedging strategies using futures
5. Mechanics of options markets
6. Properties of stock options
7. Hedging / speculative strategies involving options
8. Option pricing
9. Pricing of exotic options and hedging with these instruments

CASES

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1. American Barrick Resource Corporation: Managing Gold Price Risk (HBS 9-293-128)
2. Metallgesellschaft AG (HBS 9-194-097)
3. Metallgesellschaft AG (IMD 3-0613)
4. Pine Street Capital (HBS 9-201-071)
5. Speculation in the Financial Futures Market: A Local Tries to Break the Bund (London Metropolitan University 299-009-1)
6. The Collapse of Barings (London Business School 401-020-1 and 401-021-1)

TENTATIVE SCHEDULE

1. Introduction: Course overview, description, and work plan. Reasons and Incentives for Financial Risk Management (FRM)
2. Introduction to derivatives
3. Derivatives: forwards and futures (I)
4. Derivatives: forwards and futures (II)
5. Derivatives: options and option-like instruments (I)
6. Derivatives: options and option-like instruments (II)
7. Derivatives: options and option-like instruments (III)
8. Binomial pricing and replicating portfolio (I)
9. Binomial pricing and replicating portfolio (II)
10. Black-Scholes option pricing and practical applications
11. Derivatives: forward and futures for speculation
12. Cross-hedging basis risk and application of basis risk
13. Derivatives: Potential applications for speculation / hedging. Combining options to achieve optimal risk / payoff strategies
14. Pricing of exotic options and hedging with these instruments
15. Using options to limit your risk
16. An application of FRM

Professor's Biography

Professor Moreno holds a Ph. D. in Economics by University Carlos III de Madrid and a B. Sc. in Mathematics by Universidad Complutense de Madrid. He is currently Associate Professor of Finance at Universidad Castilla-La Mancha, Adjunct Professor at the IE Business School, and Associate Editor of the journal *Studies in Economics and Finance*. He is also coordinator of the Official Master in Banking and Quantitative Finance and of the Ph. D. Program in Quantitative Finance and Economics), and director of the Course on Advanced Financial Advice and Planning, all of them at Universidad de Castilla-La Mancha.

He has previously held teaching and research positions at the Financial Option Research Centre (Warwick Business School), IESE Business School, Universidad Carlos III (Madrid) and Universidad Pompeu Fabra (Barcelona). In the past, he was the Founder and Co-Director of the Master Sc. in Finance at Universidad Pompeu

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Fabra (Barcelona), Associate Editor of *Revista de Economía Financiera* and Co-President of the Scientific Committee at the XIV Meeting of the Spanish Finance Association. Instructor in several "in company" courses in institutions, as for instance, Caixa Catalunya, Endesa or Banco Popular.

He has received several prizes for his research activity as, for instance, the *Barclays Global Investors Australia Research Award* or the prize *Mutua Pelayo* in the *IX Italian-Spanish Congress on Financial and Actuarial Mathematics*. He has also published extensively in leading scientific journals as, for example, *Australian Journal of Management*, *Energy Economics*, *European Journal of Operational Research*, *Journal of Banking and Finance*, *Journal of Futures Markets*, *Physica A*, *Quantitative Finance*, or *Review of Derivatives Research*, as well as in several professional volumes.

Finally, he has been awarded different prizes to his teaching skills including the distinction "Jaume Vicens Vives" to the University teaching quality, awarded by the Government of Generalitat de Catalunya, being nominated for "Best Professor of the Year IE Business School Prize 2011" in full-time Masters. Included in the Top 3 of the professors in the course 2010-11, and thirteen Prizes of Teaching Excellence in Instituto de Empresa Business School.