

15.437 - Options and Futures Markets

A. Course Description

This is a course about financial derivatives. Special emphasis will be given to options and futures. The course will have a mixture of lectures and case discussions. The lectures will emphasize fundamental economic principles. The cases provide an opportunity to apply the principles in a variety of situations.

B. Prerequisites

The prerequisite for 15.437 is any one of the following courses: 15.401, 15.411, 15.414, or 15.415.

C. Materials

The text for the course is the ninth edition of *Options, Futures, and Other Derivatives* by John Hull. It is available in the bookstore. Please make sure that your book provides a way to obtain the DerivaGem software. Suggested readings in the text are given in the course outline. *Derivatives Markets* by Robert McDonald is on reserve in the library as an additional reference.

The cases are included in the course reader. The reader also contains suggested study questions for the cases. Copies of materials used in class will be posted on the course website.

D. Exams

There will be two exams. Each will count for 40% of the final grade. The first exam will be given in class on Wednesday, October 19. The second exam will be given in class on Wednesday, December 7. Both exams will be open book and open notes.

E. Other Course Requirements

1. *Case Preparation.* You should read each case and think carefully about the suggested study questions. The cases will be reviewed in class.
2. *Problem Sets.* Problem sets and their solutions will be posted on the course website throughout the semester. You should work the problems first and then compare your answers to the solutions. The problem sets are an important part of preparing for the exams.
3. *Quizzes.* Two short quizzes will be posted on the course website during the semester, one before the first exam and one after the first exam. They will be due one week after they are posted. Each quiz will count for 5% of the final grade.
4. *Project.* A project assignment will require you to prepare a thorough analysis of a financial product. The project will count for 10% of the final grade. You may work on the project with up to three other people. The project will be distributed after the first exam and will be due on Wednesday, December 14.

F. Academic Honesty and Course Requirements

During the semester you will be asked to do some assignments entirely on your own or only with a small group of classmates. Please read carefully the Academic Honesty section of Sloan Values. It will be posted on the course website.

G. Pass-Fail and Listener Policies

Graduate students may use their P/D/F option if they wish to do so. Listeners are welcome if they have permission and sufficient space is available.

H. Teaching Assistant and Office Hours

The teaching assistant for the course is Valere Fourel. His email address is vfourel@mit.edu. His office hours will be announced in class. He will be giving regular review sessions of the material presented in class. Professor Cox will be available after class and by appointment.

Course Outline

I. Introduction

- A. Types of Financial Derivatives
- B. The Economic Role of Derivatives
- C. Arbitrage and the Creation of New Financial Products

II. Forward and Futures Contracts

- A. How Forwards and Futures are Used
- B. Determinants of Forward and Futures Prices
- C. Synthetic Asset Creation with Forwards and Futures

Reading: Hull, Chapter 5

III. Valuing Asset-Linked Revenue Streams

Case: The Richmond Charitable Trust

IV. Interest Rate Swaps

- A. Definitions and Pricing
- B. Variations on the Standard Swap
- C. Duration of Swaps
- D. Currency Swaps

Reading: Hull, Chapter 7

V. Equity and Commodity Swaps

VI. Introduction to Options

- A. Put and Call Options
- B. The Relation between Options and Forwards
- C. Profit and Loss Diagrams for Elementary Strategies

Reading: Hull, Chapters 10 and 12

VII. Fundamental Properties of Options

- A. Determinants of Option Value
- B. The Relation between Puts and Calls
- C. General Arbitrage Relations for Puts and Calls

Reading: Hull, Chapter 11

VIII. Using the Information Contained in Option Prices

Case: The Dutch Guilder Case (A)

IX. Forward Contracts with Embedded Options

Case: The Dutch Guilder Case (B)

X. Valuation Methods for Equity, Currency, and Commodity Derivatives

- A. The Binomial Option Pricing Model
- B. How to Choose the Step Sizes
- C. The Black-Scholes-Merton Formula
- D. Sensitivities for Option Value
- E. Optimal Exercise of American Options
- F. Options on Forwards and Futures

Reading: Hull, Chapters 13, 15, 17 - 19

XI. Exotic Options

- A. Barrier Options
- B. Asian Options
- C. Digital Options
- D. Forward Start Options
- E. Ladder Options
- F. Exchange Options
- G. Other Exotic Options

Reading: Hull, Chapter 26

XII. Advanced Hedging Techniques

- A. Potential Hazards in Dynamic Hedging
- B. Gamma Neutral Portfolios
- C. Static Hedging

Case: Portfolio Insurance

XIII. Volatility Skews and Smiles; Alternative Valuation Models

Reading: Hull, Chapter 20

XIV. Interest Rate Derivatives

- A. Swaptions
- B. Cancelable Swaps and Extendible Swaps
- C. Caps and Floors; Variance Swaps
- D. Valuation Methods

Reading: Hull, Chapters 29, 31, and 32

XV. Employee Stock Options

Case: Valuing Stock Options in a Compensation Package

Reading: Hull, Chapter 16

XVI. Designing and Launching a New Product

Case: Goldman, Sachs & Co.: Nikkei Put Warrants

Preliminary Schedule for 15.437

9/7	Introduction to Derivatives
9/12	Arbitrage and the Creation and Pricing of New Derivative Products
9/14	Forward Rate Agreements; Forwards and Futures
9/19	Forwards and Futures
9/21	Richmond Trust Case: valuing asset linked revenue streams, using forwards to monetize a revenue stream
9/26	Introduction to Interest Rate Swaps
9/28	Interest Rate Swaps and Currency Swaps
10/3	Equity and Commodity Swaps; Introduction to Options
10/5	The Determinants of Option Value
10/10	Holiday
10/12	Relations between Calls, Puts, and Forwards
10/17	Arbitrage Restrictions on Option Value
10/19	First Exam
10/24	SIP Week
10/26	SIP Week
10/31	Dutch Guilder Case: extracting information from option prices, the relation between foreign and domestic options, structured products with embedded options
11/2	Valuation of Equity, Currency and Commodity Options: the binomial model, applications to general derivatives
11/7	Option Valuation continued: the Black-Scholes-Merton formula, sensitivities of option values, optimal exercise of American options
11/9	Option Valuation continued: options on forwards and futures

- 11/14 Exotic Options: barrier options, Asian options, digital options, lookback options, exchange options, other exotic options
- 11/16 Portfolio Insurance Case: hazards of dynamic replication, gamma neutral portfolios, advanced hedging techniques
- 11/21 Volatility Smiles and Skews; Alternative Valuation Models
- 11/23 Holiday
- 11/28 Swaptions
- 11/30 Caps and Floors; Variance Swaps
- 12/5 Valuation of Interest Rate Derivatives
- 12/7 Second Exam
- 12/12 Sally Jameson Case: employee stock options, applications of exotic options
- 12/14 Goldman Sachs Case: development of a new financial product