

NEW YORK UNIVERSITY

Leonard N. Stern School of Business

Advanced Futures and Options
FINC-GB.3340.01
Fall 2015

Professor Marti G. Subrahmanyam
Teaching Assistant: Heebum Lee
KMC 2-80: MW 9-10.20 am

Course Description:

This course consists of three parts. The first section of the course is a detailed examination of the pricing and hedging of option contracts, with particular emphasis on the application of these concepts to the design of derivatives instruments and trading strategies. The first half of this section is a review and re-examination of materials covered in the basic course, but with greater rigor and depth of coverage. The emphasis in the latter half of this first section is on trading applications and risk management. The second section of the course is designed to provide a broad exposure to the subject of interest rate derivative products, both swaps and options. The last section of the course deals with recent innovations in the derivatives markets such as exotic options, credit derivatives and catastrophe derivatives.

In the first section of the course, the discussion of trading strategies is in the context of the management of the risk of a derivatives book. Although the principles developed in this course are relevant to the pricing and hedging of any derivative asset, their applications to the specific cases of options on stocks, stock indices, foreign exchange, futures contracts and interest rate instruments are analyzed.

The topics covered in the second part of the course include the relationship of swaps to other fixed income contracts such as futures contracts and forward rate agreements, valuation and hedging of swaps, building the yield curve, and valuation and hedging of interest rate options, with particular reference to caps, floors and swaptions, and modeling the term structure of interest rates. The application of these concepts to foreign exchange and commodity derivatives is also discussed in this section.

The third section of the course deals with non-standard option contracts such as exotic options and options on new underlying instruments such as credit, weather and insurance derivatives. Although the discussion of exotic options is fairly broad, some exotic instruments such as barrier options, Asian options and hybrid (correlation) products will be analyzed in more detail. Credit derivatives, with particular reference to credit default swaps and collateralized debt obligations, will be the focus of attention in the second part of this section.

The pedagogy is a combination of lectures/discussions and PC-based problem solutions. The course is intensive and requires a fair amount (~ 6-8 hours) of homework each week, in addition to preparation for class. The orientation of the course is the *practical* application of option concepts, rather than a discussion of option theory by itself. However, since option concepts are somewhat mathematical, a strong quantitative background, though not required, would be an advantage.

Required/Recommended Textbooks/Software:

- Recommended: J.C. Hull, *Options, Futures and other Derivative Securities*, 9th edition, Prentice-Hall, 2015. (H)
- Optional: R. Sundaram and S. Das, *Derivatives: Principles and Practice*, 2nd edition, McGraw-Hill/Irwin, 2013.

The book by Hull is probably the most comprehensive derivatives textbook available today. We will use it as background, but will not follow it closely. The relevant chapters from the book are listed in the course outline. The more recent book by Das and Sundaram is more intuitive, and has a more detailed discussion of credit derivatives. There are several software packages available for pricing and hedging of derivatives. Of these, FINCAD[©] is a widely used package that has pricing and hedging models for a wide range of derivatives instruments with Excel add-ins. It has a free demo version that can be used for a limited period of time.

Other Materials:

- Copies of overhead transparencies: Books I to VI. [To be handed out in class. Also, available on the course website on NYU Classes.]
- Problem sets and computer exercises. [To be handed out in class. Also, available on the course website on NYU Classes.]
- Option pricing/hedging software. [Available on the course website on NYU Classes.]

Instructions:

Students in the course are expected to study the readings and problem sets prior to the assigned dates and come prepared to discuss them in class. The following outline represents the topics, readings, assignments and dates for discussion. The reference dates noted are *rough* estimates for the time allotted to each subject area. Any modifications of the schedule will be announced in class.

There are several problem sets – roughly one per week throughout the course - to be worked out in groups of three. In many instances, students are required to use PC-based software for the solution of the problem sets. Students should work on the problem sets in *groups of three*. *No exceptions to this rule will be permitted without the permission of the instructor*. Solutions to the problem sets should be worked out, *printed* and handed in prior to class on the dates they are due. Hand calculators will be necessary for problem sets and examinations. The lectures and reading materials assigned will, in many instances, provide an appropriate format for analysis and solution of the problem sets.

There will be two *take-home* quizzes and a final examination in the course. Grading for the course will be based approximately on the following weights:

Problem Sets and Assignments	20%
Class Participation	20%
Quizzes	20%
Final Examination	40%

	100%

The overall grade distribution in the course will be approximately as follows:

A	10-15%
A-	10-15%
B+	15-25%
B	15-25%
B	15-25%
C+	10-15%
≤ C	0% (hopefully)

All class sessions will be videotaped and webcast. However, viewing these recordings is meant to be a supplement and not a substitute for attending class sessions. Based on past experience, much of the learning in the course is from participating in the class discussions.

Classroom Etiquette and Related Matters:

Students registered in the course are expected to attend all sessions and be in class by 8.55 am. They should sit in the same place each class. Students who come in late should take their places on the last row, as quietly as possible. Since class participation is assessed and forms part of the grade in the course, regular class attendance is required. In line with school policy, the use of laptop computers, cellular phones and mobile communication devices, and other electronic equipment is not allowed during class sessions.

In order to use the class sessions more efficiently, one quiz will be administered in class and the other to be taken at home. It is to be understood that students take quizzes *without any external help from others*. Any breach of this rule will be taken seriously. Students should adhere to the MBA Honor Code and every student is obligated to report to the instructor any suspected violation of the code that he or she has observed. Further instructions are available at

<http://www.stern.nyu.edu/UC/CurrentStudents/CodeofConduct/index.htm>

Students with disabilities are advised to meet the instructor to make arrangements for appropriate help after consulting with the Moses Center for Students with Disabilities (CSD, X 8-4980).

Course Prerequisite:

Pricing of Options, Futures and Other Contingent Claims: FINC-GB.3335 (B40.3335)

Students who have not taken the prerequisite are *required* to take the permission of the instructor before taking the course.

Office Hours:

Mondays: 10.30 – noon,

Thursdays: 10.30 – noon,

and by appointment. (Please call Ms. Hakema Zamdin at X 8-0301 for an appointment.)

In addition, there will also be office hours in an internet chat-room, approximately every other week. Details will be announced in the second week of class.

Office: Room 9-68, KMC Tel: X80348 e-mail: msubrahm@stern.nyu.edu

Tutor: Room 9-175B Tel: X80316 e-mail: h11384@stern.nyu.edu

COURSE OUTLINE

Date	Sess. No.	Subject	Chapter or Source
09/02	I	Introduction and Review	J. de la Vega U. Schaeede
		* Definition of the Contracts	H, Ch. 1 (review)
		* Payoff Diagrams	
		* Basic Option Trading Strategies	H, Ch. 12 (pp. 256-271)
		* Reverse Engineering of Option Payoffs	
09/07		No class (Stern Calendar)	
09/09	II	Introduction and Review (Contd.)	
		* No-arbitrage Restrictions	H, Ch. 11 (to p. 241)
		* Early Exercise of American Options	H, Ch. 11 (pp. 244-250)
09/14		No class (Stern Calendar)	
09/16	III	Introduction and Review (Contd.)	
		* Put-Call Parity	H, Ch. 11 (pp. 241-244)
		The Binomial Model	
		* Single-stage Model	H, Ch. 13 (to p. 280)
		* Riskless Hedge	
		* Replication	

Problem Sets # 1 and # 2

**Payoff Diagrams, Reverse Engineering and No-Arbitrage
Restrictions**

Date	Sess. No.	Subject	Chapter or Source
09/21	IV	The Binomial Model (Contd.)	
		* Risk-Neutral Probability	H, Ch. 13
		* Multiple Stages	R. Sundaram
		* American Options	
		* Dynamic Hedging	
<div style="border: 1px solid black; padding: 10px; margin: 10px auto; width: fit-content;"> <p>Problem Set</p> <p># 3</p> <p>Put-Call Parity</p> </div>			
09/23		No class (Stern Calendar)	
09/28	V	The Binomial Model (Contd.)	
		* The Limiting Case	
		* Construction of Binomial Lattices	H, Ch. 21
09/30		No class (to be rescheduled)	
10/05	VI	The Black-Scholes-Merton Model	
		* Intuitive Interpretation of Volatility	H, Ch.15
		* Simple Proof of the Model	

<p>Problem Set</p> <p># 4</p> <p>Binomial Model</p>
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Date	Sess. No.	Subject	Chapter or Source
10/07	VII	The Black-Scholes-Merton Model (Contd.)	
		* Alternative Proofs (Intuition)	H, Ch.15
		* Computational Issues	
		* Extensions: Futures (Black)	H, Ch.18
		* Stock Indices, Dividends, Foreign Exchange	H, Ch.17
10/12	VIII	The Black-Scholes Model (Contd.)	
		* Alternative Assumptions	
		* Hedge Ratio	H, Ch.19 (pp. 402-409)
		* Implied Volatility	M. Brenner/ M. Subrahmanyam (1)
		* Measurement of Volatility	H, Ch. 23 (skim)
		* Empirical patterns of volatility: smile, mean-reversion	
10/14	IX	Valuation and Hedging of American Options	
		* The Early Exercise Decision	H, Ch.13
		* Binomial Method	
		* Trinomial Method	H, Ch.21
		* Monte Carlo Method	
		* Finite Difference Method	
		* Geske-Johnson Approximation	R.Stapleton/ M. Subrahmanyam (1)

Date	Sess. No.	Subject	Chapter or Source
10/19	X	Review Session	
10/21	XI	Quiz #1	
10/26	XII	Sensitivity Analysis I (Option Values)	
		* Option Delta	H, Ch.19 (to p. 411)
		* Option Theta, Vega (Kappa)	
10/28	XIII	Sensitivity Analysis II (Option Hedge Ratios)	
		* Option Gamma	H, Ch.18 (after p. 411)
		* Option Omega	Brenner/ Subrahmanyam (2)

Problem Set

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**Sensitivity Analysis:
Option Values and Hedge Ratios**

Date	Sess. No.	Subject	Chapter or Source
11/02	XIV	Option Position Analysis	
		* Position Delta	
		* Position Gamma	
		* Position Theta	
		* Position Vega	
11/04	XV	Value at Risk	H, Ch. 22
		* Basic Concepts	
		* Measurement Issues	
		* BIS Requirements	
		Futures and Forward Contracts	H, Ch. 2 (review) H, Ch. 3 (skim)
		* Definitions and Basics of Pricing	
		* Over-the-Counter and Exchange-Traded Products	
		* Forward Rate Agreements	Acharya et al.
11/09	XVI	Basics of Interest Rate Swaps and FRA's	H, Ch. 7 R. Stapleton/ M. Subrahmanyam (2)
		* Relationship between FRA's and Swaps	
		* Relationship between Swaps and Bonds	
		* Spot - Forward Parity, Pricing of FRA's	
		* Convexity Differences between FRA's and Futures	
		* Adjusting for Convexity	H, Ch. 30

Date	Sess. No.	Subject	Chapter or Source
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11/11	XVII		
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Pricing, Valuation and Hedging of Swaps

* Valuation of Interest Rate Swaps: Principal and Forward Methods H, Ch. 7

* PVBP Analysis and Hedging of a Swap Portfolio

*Other Swaps: Currency, Equity, Commodity etc., H, Ch. 33

Problem Set

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Position Analysis

11/16	XVIII		
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Building the Yield Curve

* Zero Curves versus Forward Curves H, Ch. 4

* Using Money Market Rates and Swap Rates

* Interpolation and Bootstrapping Methods

Problem Set

7

FRA's and Swaps

Date	Sess. No.	Subject	Chapter or Source
11/18	XIX	Interest Rate Option Pricing/Hedging	H, Ch. 29 (to p. 684)
		* European Options on Bonds and Interest Rates	
		* Option Payoffs and Strategies for Interest Rate Options	
		* Classification of Interest Rate Options Products	
		* No-Arbitrage Relationships: Caplets, Bond Options, Swaptions	
11/23	XX	Interest Rate Caps and Floors	H, Ch. 29
		* Valuation Using the Black-Scholes Model	R.Stapleton and M.Subrahmanyam (3)
		* Valuation Using the Black Model	
		* Hedging With Forwards/Futures Contracts	

Problem Set

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Building the Yield Curve

11/25		No class (Stern Calendar)	
11/30	XXI	Interest Rate Swaptions	H, Ch. 29 (after p. 684)
		Valuation Using the Black Model	

Problem Set

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Interest Rate Caps/Floors

Date	Sess. No.	Subject	Chapter or Source
12/02	XXII	Forward/Spot Models of the Term Structure * Pros And Cons Of Forward Versus Spot Models * Spot Rate Models * Black-Karasinski, Hull-White models * Forward Rate Models: Ho-Lee, Heath-Jarrow-Morton, Libor Market Model (Brace-Garatek-Musiela)	H, Ch. 31,32 H, Ch. 31 (skim)

Problem Set

10

Interest Rate Swaptions

Quiz

2

12/07	XXIII	Exotic Options Features of exotics * Main types * Binomial model of valuation/hedging * Uses of exotic options	H, Ch. 26
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Date	Sess. No.	Subject	Chapter or Source
		Barrier options * Knock-out, knock-in options * “In-the-money” versus “out-of-the-money” knock-out options * Problems of valuation/hedging	H, Ch. 26 (pp. 604-605)
12/08	XXIV (Extra Session)	Exotic Options (Contd.) Asian options * Effect of averaging: valuation/hedging * General path-dependent structures * Problems of valuation/hedging Hybrid (Correlation) products * Quanto options * Problems of valuation/hedging * Volatility/Variance Swaps * Static options replication	H, Ch. 26 (after p. 609)

Problem Set

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Barrier Options

Date	Sess. No.	Subject	Chapter or Source
12/09	XXV	New Derivative Instruments: Credit * Credit Derivatives: Products * Credit Default Swaps * Collateralized Debt Obligations	H, Ch. 25

**Problem Set
12
Asian Options**

12/09 XXVI
(Extra Session)

Review Session

12/10 XXVII

Final Examination

NEW YORK UNIVERSITY

Stern School of Business

B40.3340
Advanced Futures and Options

Professor Marti G. Subrahmanyam
Fall 2015

Instructions for the First Three Classes

1. Get course materials [textbook (recommended, not required)] from the bookstore.
2. Pick up other materials [course package, readings, problem sets] in the first class.
3. Do Problem Sets 1 and 2.

DEFAULT POLICIES FOR STERN COURSES-Revised February 2011

The following are policies students should assume are in force in their Stern courses, unless their instructors explicitly establish different policies:

Laptops, Cell Phones, Smartphones, Recorders & Other Electronic Devices

May not be used in class.

Attendance

Required and part of grade.

Faculty will excuse absences and entertain requests to change exam and assignment due dates only in cases of documented serious illness, family emergency, religious observance, or civic obligation. If you will miss class for religious observance or civic obligation, you must inform your instructor no later than the first week of class. Recruiting activities, business trips, and vacation travel, and club activities are not acceptable reasons for absences or requests to schedule exams and assignments.

If a student is absent from the first day of an intensive course, the instructor may request that the student be removed from the course.

Arriving Late, Leaving Early, Coming & Going

Students are expected to arrive to class on time and stay to the end of the class period.

Arriving late or leaving class early will have impact on the course grade.

Students may enter class late only if given permission by the instructor and can do so without disrupting the class.

(Note that instructors are not obliged to admit late students or readmit students who leave class or may choose to admit them only at specific times.)

Late Submission of Assignments

Late assignments will either not be accepted or will incur a grade penalty unless due to documented serious illness or family emergency. Instructors will make exceptions to this policy for reasons of religious observance or civic obligation only when the assignment cannot reasonably be completed prior to the due date and the student makes arrangements for late submission with the instructor in advance.

Note that the following policies are in force for all Stern classes:

General Behavior

Students will conduct themselves with respect and professionalism toward faculty, students, and others present in class and will follow the rules laid down by the instructor for classroom behavior. Students who fail to do so may be asked to leave the classroom. (NYU Stern Code of Conduct, Stern policy)

Collaboration on Graded Assignments

Students may not work together on graded assignment unless the instructor gives express permission. (NYU Stern Code of Conduct)

Grading

No more than 35% of students will receive grades of A or A- in MBA core courses. (Stern policy)

MBA students who do not submit Course Faculty Evaluations by the deadline will not have access to their final grades until the grade release date, which is determined by program. Faculty are requested not to release final grades to students who fail to submit evaluations and students should not ask. (Stern policy)

Recording Classes

At any time, your classes may be recorded for educational purposes. (Stern policy)

Endorsed by:

MBA Core Course Committee, July 9, 2007

Vice Deans, July 13, 2007

Academic Programs & Teaching Resources Committee of Faculty Council, August 1, 2007

Revision approved by Core Course Committee and program Vice Deans, February, 2011