NEW YORK UNIVERSITY

Leonard N. Stern School of Business

Advanced Futures and Options
FINC-GB.3340.01
Fall 2013

Professor Marti G. Subrahmanyam
Teaching Assistant: Matteo Crosignani

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 part 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 second part 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*, 8th edition, Prentice-Hall, 2011. (H)

Optional: R. Sundaram and S. Das, *Derivatives: Principles and Practice*, McGraw-Hill/Irwin, 2011.

FINCAD Analytics Suite 2013 for Excel

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 more recentbook by Das and Sundaram is more intuitive, and has a more detailed discussion of credit derivatives. FINCAD is a widely used software 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. 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%
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	l00%

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 10.30 am. They should sit in the same place each class, as per the seating chart circulated in the first session. Students who come in late should enter from the side door of the classroom and 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, quizzes are scheduled 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:

Tuesdays, 12 noon – 1 p.m.,
Thursdays, 12 noon – 1 p.m.,
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:	Matteo Crosignani	Tel: X80329	e-mail: mcrosign@stern.nyu.edu

COURSE OUTLINE

Date	Sess. No.	Subject	Chapter or Source
09/03	I	Introduction and Review	
		* Definition of the Contracts	H, Ch. 1 (review)
		* Payoff Diagrams	
		* Basic Option Trading Strategies	H, Ch. 11 (review)
		* Reverse Engineering of Option Payoffs	
09/05		No class (Stern Calendar)	
09/10	II	Introduction and Review (Contd.)	
		* No-arbitrage Restrictions	H, Ch. 10 (to p. 220)
		* Early Exercise of American Options	H, Ch. 10 (pp. 224-231)
09/12	III	Introduction and Review (Contd.)	
		* Put-Call Parity	H, Ch. 10 (pp. 221-224)
		The Binomial Model	
		* Single-stage Model	H, Ch. 12 (to p. 259)
		* Riskless Hedge	
		* Replication	

Problem Sets

 # 1 and # 2

Payoff Diagrams, Reverse Engineering and No-Arbitrage Restrictions

Date	Sess. No.	Subject	Chapter or Source
09/17	IV	The Binomial Model (Contd.)	
		* Risk-Neutral Probability	H, Ch. 12 (p. 229-273) R. Sundaram
		* Multiple Stages	
		* American Options	
		* Dynamic Hedging	
		Problem Set **# 3** **Put-Call Parity**	
09/19	V	The Binomial Model (Contd.)	
		* The Limiting Case	
		* Construction of Binomial Lattices	H, Ch. 20
09/24	VI	The Black-Scholes-Merton Model	
		* Intuitive Interpretation of Volatility	H, Ch.14
		* Simple Proof of the Model	
		Problem Set **# 4** **Binomial Model**	

Date	Sess. No.	Subject	Chapter or Source
09/26	VII	The Black-Scholes-Merton Model (Contd.)	
		* Alternative Proofs (Intuition)	H, Ch.14
		* Computational Issues	
		* Extensions: Futures (Black)	H, Ch.17
		* Stock Indices, Dividends, Foreign Exchange	H, Ch.16
10/01	VIII	The Black-Scholes Model (Contd.)	
		* Alternative Assumptions	
		* Hedge Ratio	H, Ch.18 (pp. 380-387)
		* Implied Volatility	M. Brenner/ M. Subrahmanyam (1)
		* Measurement of Volatility	H, Ch. 22 (skim)
		* Empirical patterns of volatility: smile, mean-reversion	
10/03	IX	Valuation and Hedging of American Options	
		* The Early Exercise Decision	H, Ch.12 (after p. 263)
		* Binomial Method	
		* Trinomial Method	H, Ch.20 (pp. 442-466)
		* Monte Carlo Method	
		* Finite Difference Method	
		* Geske-Johnson Approximation	R.Stapleton/ M. Subrahmanyam (1)

Date	Sess. No.	Subject	Chapter or Source
10/08	X	Sensitivity Analysis I (Option Values)	
		* Option Delta	H, Ch.18 (to p. 396)
		* Option Theta, Vega (Kappa)	
10/10	XI	Sensitivity Analysis II (Option Hedge Ratios)	
		* Option Gamma	H, Ch.18 (after p. 396)
		* Option Omega	Brenner/ Subrahmanyam (2)

Problem Set

 # 5

Sensitivity Analysis:
Option Values and Hedge Ratios

10/15 XII

Review Session

10/17 XIII

Quiz

#1

Date	Sess. No.	Subject	Chapter or Source
10/22	XIV	Option Position Analysis	
		* Position Delta	
		* Position Gamma	
		* Position Theta	
		* Position Vega	
10/24	XV	Value at Risk	H, Ch. 21
		* 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.
10/29	XVI	Basics of Interest Rate Swaps and FRA's	H, Ch. 7 (to p. 159) 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. 29 (to p. 674)

Date	Sess. No.	Subject	Chapter or Source
10/31	XVII	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. 32

Problem Set

 # 6

Position Analysis

11/05	XVIII	Building the Yield Curve	
		* Zero Curves versus Forward Curves	
		* 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
11/07	XIX	Interest Rate Option Pricing/Hedging	H, Ch. 28 (to p. 652)
		* 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	
11/12	XX	Interest Rate Caps and Floors	H, Ch. 28 (pp. 653-659)
		* Valuation Using the Black-Scholes Model	R.Stapleton and M.Subrahmanyam (3)
		* Valuation Using the Black Model	
		* Hedging With Forwards/Futures Contracts	

Problem Set

 # 8

Building the Yield Curve

11/14	XXI	Interest Rate Swaptions	H, Ch. 28 (after p. 659)
		Valuation Using the Black Model	

Problem Set

 # 9

Interest Rate Caps/Floors

Date	Sess. No.	Subject	Chapter or Source
11/19	XXII	Forward/Spot Models of the Term Structure	H, Ch. 31 (to p. 694)
		* 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 (skim)

Problem Set

 # 10

Interest Rate Swaptions

Quiz

 # 2

11/21	XXIII	Exotic Options	H, Ch. 25 (to p. 575)
		Features of exotics	
		* Main types	
		* Binomial model of valuation/hedging	
		* Uses of exotic options	

Date	Sess. No.	Subject	Chapter or Source
		Barrier options	H, Ch. 25 (pp. 575-581)
		* Knock-out, knock-in options	
		* "In-the-money" versus "out-of-the-money" knock-out options	
		* Problems of valuation/hedging	
11/26	XXIV	Exotic Options (Contd.)	H, Ch. 25 (after p. 561)
		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	

Problem Set

 # 11

Barrier Options

Date	Sess. No.	Subject	Chapter or Source
12/03	XXV	New Derivative Instruments: Credit	H, Ch. 24
		* Credit Derivatives: Products	
		* Credit Default Swaps	
		* Collateralized Debt Obligations	

Problem Set

 # 12

Asian Options

12/05	XXVI	New Derivative Instruments: Credit (Contd.)	
		* Credit Derivatives: Pricing	H, Ch. 24

Case

Nexgen: Structured Collateralized Debt Obligations (CDOs)

Date	Sess. No.	Subject	Chapter or Source
12/10	XXVII	**Extra Session**	
12/11	XXVII I	**Extra Session**	
12/12	XXIX	Examination	
		Final Examination	

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B40.3340
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Instructions for the First Three Classes

1. Get course materials [textbook (recommended, not required), case] 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

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Some interesting websites on derivatives

There are several websites that offer useful information on derivatives securities and markets. Listed below are some important sites that would be of interest to any student in this area.

1. www.optionmetrics.com

This website has a rich dataset and real-time data on US and some European and Asian equity derivatives. (More detailed historical data are also available to the Stern community in a separate database.) It was put together by one of my former Ph.D. students and is used by many of the major industry players in the area of equity derivatives.

2. http://www.optionseducation.org/quotes.html?quote=Quotes
   http://www.cmegroup.com/trading/equity-index/us-index/sandp-500.html
   http://www.nasdaq.com/symbol/spy/option-chain
   http://www.cboe.com/DelayedQuote/DQBeta.aspx

These are the websites of the main derivatives exchanges and an industry group that aggregate data in the US. Apart from price and volume data in real-time with a slight delay, some of them also display options Greeks for the various contracts.

3. www.msci.com/products/risk_management_analytics/riskmanager/demos.html

This website is a good source of data and research materials on derivatives and risk management. It was spun off by JP Morgan many years ago and was a pioneer in the area of tools and techniques of risk management. It is now part of MSCI. It continues to be a useful source of data and concepts on many aspects of risk management.

4. www.bis.org

This is the official website of the Bank for International Settlements (BIS). This organization is the "central bankers' bank" and has been the coordinator for many of the important recent regulatory initiatives of the world's central banks, which regulate financial institutions and markets around the world. They compile and publish several databases on the global derivatives industry.

5. www.isda.org

This is the website of the International Swaps and Derivatives Association, the trade body for the over-the-counter derivatives market, which handles a substantial proportion of all traded derivatives. It has a wealth of information on various aspects of derivatives markets including the details of the standard contracts for many of these products in the areas of interest rates, foreign exchange, commodities, credit etc.

6. www.cme.com

This is the website of the only major US exchange that trades futures and options contracts on a wide range of underlying assets from equities to interest rates to weather. It provides contract details and real-time quotations on most of the major contracts that are traded on exchanges, other than options on individual stocks.

7. www.cboe.com
   www.globalderivatives.nyx.com/en/trading
   www.iseoptions.com

These are the official websites of the three major US exchanges for equity and stock index options. They provide a plethora of information on individual option contracts, although www.optionmetrics.com consolidates all this information in a more "user-friendly" format. The second of these is the NYSE Euronext platform, which links to several European and US derivatives markets.

8. www.riskcenter.com/

This is an interesting website containing links to various interesting articles, news items and reports on various aspects of derivatives contracts and markets.

9. www.risk.net/

This is the website of *Risk* magazine, the leading industry publication in the area of derivatives. This magazine has news about the business, recent trends in the industry and a few technical articles on concepts and models that are of interest to practitioners. This is a great resource for anyone involved with the derivatives industry.

10. www.moodys.com
    www.standardandpoors.com
    www.fitchratings.com

These are the websites of the three major credit rating agencies. They present information about the criteria for ratings as well as the ratings for several issues. The sites contain a mass of statistics about credit risk at the macro and micro levels.

11. www.dtcc.com
    www.markit.com

These two websites relate to OTC derivatives. The Depository Trust and Clearing Corporation is one of the several new OTC clearing houses established in recent years. Markit is a leading data vendor, providing a ranging of pricing services for derivatives.

12. www.cftc.gov/LawRegulation/DoddFrankAct/index.htm
    http://www.sec.gov/spotlight/dodd-frank.shtml

These are the links to the Commodities and Futures Trading Commission's and Securities and Exchange Commission pages on the Dodd-Frank bill, the comprehensive bill on regulation of financial instruments, markets and institutions, passed in July 2010. It also provides information on the progress towards the implementation of the bill, in rulemaking groups, which will affect virtually every major company in the US, particularly those in the financial services industry.

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Some interesting websites for derivatives quotes and risk metrics

As may be expected, there are several websites that offer useful information on the prices of derivatives securities. While real-time information from sources such as Bloomberg and Reuters would be more comprehensive, there are several websites that offer quotes on the major derivatives markets. Some important examples for the US markets are listed below:

Stock Option quotes, Greeks and implied volatilities

http://www.888options.com/quotes/default.jsp?ReferredBy=SEM_Goo_0490_A_30&gclid=CL6HztjiwY4CFRqsOAodi3bMxA

http://www.ivolatility.com/options.j

http://finance.yahoo.com

Eurodollar and Fed Funds Futures quotes

http://www.cme.com/trading/dta/del/delayed_quote.html?ProductSymbol=ED&ProductFoiType=FUT&ProductVenue=G&ProductType=itr

Swap and Libor quotes

http://b2b.thefinancials.com/us_interest_rates.asp

Credit Derivative Index quotes

http://www.markit.com/markit.jsp?jsppage=indices.jsp