NEW YORK UNIVERSITY

Leonard N. Stern School of Business

B40.3340   Professor Marti G. Subrahmanyam
Advanced Futures and Options   Fall 2000

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 second part of the course is designed to provide a broad exposure to the subject of interest rate derivative products, both options and swaps. The last part of the course deals with recent innovations in the derivatives markets such as exotic options and credit 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 application 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 third section of the course deals with non-standard option contracts such as exotic options and options on new underlying instruments such as credit 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.

The pedagogy is a combination of lectures/discussions and PC-based problem solutions. The course is intensive and requires a fair amount of homework for each session. 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 quantitative background, though not required, would be an advantage.

Required/Recommended Textbooks/Software:

Recommended: J.C. Hull, *Options, Futures and other Derivative Securities*, 4th edition, Prentice-Hall, 1999. (H)

Optional: S. Figlewski, W.L. Silber and M.G. Subrahmanyam (eds.), *Financial Options: From Theory to Practice*, 2nd edition, Business One-Irwin, 1992. (FSS)

                           R. Jarrow and S. Turnbull, *Derivative Securities*, 2nd edition, South-Western, 2000. (JT)

                           FinancialCAD Software, Glassco-Park Inc., 2000.

The book by Hull is probably the most comprehensive derivatives textbook available. We will use it as background, but will not follow it closely.

Other Materials:

-- Copies of overhead transparencies. [Available in the bookstore.]

-- Problem sets and computer exercises.

-- Option pricing/hedging software.

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 will be several problem sets to be worked out in groups. In many instances, students are required to use PC-based software for 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, *typed* and handed in prior to class on the dates they are due. Hand calculators will be necessary for problem sets and examinations. Students are urged to bring calculators to all sessions. 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 three 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%

Prerequisite:

Pricing of Options, Futures and Other Contingent Claims (B40.3335)
(or with the permission of the instructor.)

Office Hours:

Tuesdays, 10 a.m. - 12 noon,
Thursdays, 10 a.m. - 12 noon,
and by appointment. (Call Ms. Hakema Zamdin at 998-0301 for an appointment.)

In addition, there will also be office hours in an internet chat-room, details of which will be announced in the first class.

Office: Room 9-15, Tisch Hall, Tel: X80348, e-mail: msubrahm@stern.nyu.edu

Tutor: Paolo Pasquariello, Tel: X80369, e-mail: ppasquar@stern.nyu.edu

COURSE OUTLINE

Date	Sess. No.	Subject	Chapter or Source
09/07	I	Introduction and Review	
		* Definition of the Contracts	H, Ch. 1 (review) JT, Ch.1 (review)
		* Payoff Diagrams	
		* Basic Option Trading Strategies	H, Ch. 8 (review)
		* Reverse Engineering of Option Payoffs	
		* No-arbitrage Restrictions	H, Ch. 7 (to p.174) JT, Ch. 3 (to p. 78)
09/12	II	Introduction and Review (Contd.)	
		* Early Exercise of American Options	H, Ch. 7 (after p.174) JT, Ch. 7 (to p. 187)
		* Put-Call Parity	JT, Ch. 3 (after p. 79)
09/14	III	The Binomial Model	
		* Single-stage Model	H, Ch. 9 (to p. 206) JT, Ch. 5 (to p. 119)
		* Riskless Hedge	
		* Replication	

Problem Sets

 # 1 and # 2

Date	Sess. No.	Subject	Chapter or Source
09/19	IV	The Binomial Model (Contd.)	
		* Multiple Stages	H, Ch. 9 (after p. 206)
			JT, Ch. 5 (pp. 120-133)
		* Risk-Neutral Probability	R. Sundaram
		* American Options	
		* Dynamic Hedging	
		* The Limiting Case	
		* Construction of Binomial Lattices	H, Ch. 16 (to p. 406)
			JT, Ch. 5 (pp.133-136)

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|          Problem Set              |
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|            # 3                    |
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Date	Sess. No.	Subject	Chapter or Source
09/21	V	The Black-Scholes Model	
		* Intuitive Interpretation of Volatility	H, Ch.11 (to p. 244)
			JT, Ch. 5 (pp. 137-150)
		* Simple Proof of the Model	JT, Ch. 6 (skim)
		* Alternative Proofs (Intuition)	JT, Ch. 8 (to p. 217)

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|          Problem Set              |
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|            # 4                    |
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Date	Sess. No.	Subject	Chapter or Source
09/26	VI	The Black-Scholes Model (Contd.)	H, Ch.11 (after p. 244)
			H, Ch. 19 (skim)
		* Computational Issues	
		* Extensions: Futures (Black)	
		* Dividends, Foreign Exchange	H, Ch. 12
			JT, Ch. 9
		* Alternative Assumptions	JT, Ch. 11
09/28	VII	The Black-Scholes Model (Contd.)	
		* Hedge Ratio	H, Ch.13 (to p. 319)
		* Implied Volatility	M. Brenner/
			M. Subrahmanyam (1)
		* Measurement of Volatility	H, Ch. 15, (skim)
			JT, Ch. 8 (after p. 218)
		* Empirical patterns of volatility: smile, mean-reversion	
10/03	VIII	Valuation and Hedging of American Options	
		* The Early Exercise Decision Options	H, Ch.16 (after p. 425)
		* Binomial Method	H, Ch.16(Appendix 16A)
		* Trinomial Method	JT, Ch. 7 (after p.187)
		* Finite Difference Method	R.Stapleton/
			M. Subrahmanyam (1)
		* Geske-Johnson Approximation	

Date	Sess. No.	Subject	Chapter or Source

10/05   IX   Sensitivity Analysis I (Option Values)

                    * Option Delta   H, Ch.13 (p. 319-325)
                                                            JT, Ch. 8 (p. 235-237)
                    * Option Theta, Vega (Kappa)

10/10   X

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│   **Quiz**   │
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│   **# 1**   │
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10/12   XI   **No class – to be rescheduled**

10/17   XII   Sensitivity Analysis II (Option Hedge Ratios)

                    * Option Gamma   H, Ch.13 (after p. 325)
                                                            JT, Ch.10
                    * Option Omega   Brenner/
                                                            Subrahmanyam (2)

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│   **Problem Set**   │
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│   **# 5**   │
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Date	Sess. No.	Subject	Chapter or Source
10/19	XIII	Option Position Analysis	
		* Position Delta	
		* Position Gamma	
		* Position Theta	
		* Position Vega	
		Value at Risk	H, Ch. 14
		* Basic Concepts	
		* Measurement Issues	
		* BIS Requirements	
10/24	XIV	Futures and Forward Contracts	H, Ch. 1 (review)
			H, Ch. 2 (review)
		* Definitions and Basics of Pricing	H, Ch. 3 (skim)
			JT, Ch. 2 (skim)
		* Over-the-Counter and Exchange-Traded Products	
		Basics of Interest Rate Swaps and FRA's	H, Ch. 4
			R. Stapleton/
			M. Subrahmanyam (2)
		* Relationship between FRA's and Swaps	JT, Ch.13 (skim)
10/26	XV	* Relationship between Swaps and Bonds	
		* Spot - Forward Parity, Pricing of FRA's	
		* Convexity Differences between FRA's and Futures	
		* Adjusting for Convexity	

Date	Sess. No.	Subject	Chapter or Source
10/31	XVI		

Problem Set

 # 6

Quiz
 # 2

Date	Sess. No.	Subject	Chapter or Source
11/02	XVII	Pricing, Valuation and Hedging of Swaps	H, Ch. 5

* Valuation of Interest Rate Swaps: Principal and   JT, Ch. 14
  Forward Methods

* PVBP Analysis and Hedging of a Swap Portfolio

* Other Swaps: Currency, Equity, Commodity etc.,

* Building the Yield Curve

* Zero Curves versus Forward Curves

* Using Money Market Rates and Swap Rates to Build the Yield
  Curve

* Interpolation and Bootstrapping Methods

* Using Futures Prices

Problem Set

 # 7

Date	Sess. No.	Subject	Chapter or Source

Date   Sess. No.   Subject   Chapter or Source

11/07   XVIII   Building the Yield Curve

* Smoothing the Zero Bond Curve - Spline Methods

* Application to FRA's and Swaps

* Bucketing Procedures

* PVBP and Hedging a Swap Portfolio: Concepts and Techniques

11/09   XIX   Interest Rate Option Pricing and Hedging   H, Ch. 20 (to p.536)
                                                                          JT, Ch. 15

* 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

11/14   XX   Interest Rate Caps and Floors

* Valuation Using the Black-Scholes Model   R.Stapleton and
                                             M.Subrahmanyam (3)
* Valuation Using the Black Model   H, Ch. 20 (pp. 537-542)
                                             JT, Ch. 17
* Valuation Using the S-S Model

* Hedging With Forwards/Futures Contracts

Problem Set

 # 8

Date	Sess. No.	Subject	Chapter or Source
11/16	XXI	Interest Rate Swaptions	H, Ch. 20 (after p.543)
		Valuation Using the Black Model	

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Case Discussion

 # 1

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Date	Sess. No.	Subject	Chapter or Source
11/21	XXII	Interest Rate Options: Alternative Models	
		* Arbitrage-Free Term Structure	H, Ch. 21
			JT, Ch. 16
		* Ho-Lee Model	
		* Black-Derman-Toy Model	
		* Heath-Jarrow-Morton Model (intuition)	

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Quiz
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Date	Sess. No.	Subject	Chapter or Source
11/28	XXIII	Exotic Options	H, Ch. 18 (pp. 458-474)
			JT, Ch. 20 (to p. 635)
		* Features of exotics	
		* Main types	
		* Problems of valuation/hedging	

Date	Sess. No.	Subject	Chapter or Source
11/30	XXIV	Exotic Options (Contd.)	H, Ch.18 (p. 475-481)
			JT, Ch. 20 (pp. 635-646)
		* Clients' Perspective	
		* Barrier Options: Knock-out, Knock-in Options	

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│         Problem Set             │
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Date	Sess. No.	Subject	Chapter or Source
12/05	XXV	Exotic Options (contd.)	H, Ch.18 (after p. 482)
		* Asian Options	JT, Ch. 20 (after p. 647)
		* General Path-Dependent Structures	
		* Static Options Replication	
12/07	XXVI	Exotic Options (contd.)	
		* Hybrid (Correlation) Products	
		* Quanto Options	

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│         Problem Set             │
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│         Case Discussion         │
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│            # 2                  │
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Date	Sess. No.	Subject	Chapter or Source
12/12	XXVII	New Derivative Instruments	H, Ch. 23
		* Credit Derivatives	JT, Ch. 18
		* Insurance Derivatives	
		* Emerging Market Derivatives	

12/12 XXVIII

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|          Extra Session: Review          |
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12/13 XXIX

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|          Extra Session: Review          |
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12/14

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|         Final Examination         |
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Stern School of Business

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Instructions for the First Three Classes

1. Get course materials (textbook, course package) from the bookstore.

2. Do Problem Sets 1 and 2.