The Wharton School Financial Derivatives (206/717) Mr Krishna Ramaswamy Spring 2008

Financial Derivatives

FNCE [206]-001: MonWed 10:30am, JMHH 240
 FNCE [717]-001: TueThu 09:00am, SHDH 350
 FNCE [206/717]-401: TueThu 10:30am, SHDH 350

1 Course Description

Over the last 35 years there has been phenomenal growth in the markets for exchange-traded Options and Futures contracts on financial assets (foreign exchange, fixed income and equity securities, and stock indices) and on commodities. These *derivative securities* are used by individuals and by institutions to meet a variety of objectives. For example, the markets in options on stock indices and in futures contracts on Treasury securities allow managers to control the risk of their portfolios and alter the distribution of the returns on their portfolios. And options and futures contracts on interest rates, currencies and commodities permit corporate treasurers to manage risk.

The growth in exchange-traded options and futures has been accompanied by innovation in over-the-counter "derivatives" (especially in contracts such as currency and interest-rate swaps). For example, in corporate credit markets these securities have been pooled into portfolios and claims against the portfolio resold to other investors. Most features of the "new" financial contracts are almost always equivalent to bundled portfolios of options, futures and their underlying securities. A solid grasp of options and futures helps us to understand these (more complex) objects.

While the techniques for the valuation of options and futures might at first glance appear advanced and difficult, they are easily and conceptually digestible. And in the process of learning these valuation techniques we will uncover many practical aspects of the use of options and futures.

The purpose of this course is to provide the student with the necessary skills to value and to employ options, futures, and related financial contracts. In order to provide a useful treatment of these topics in an environment that is changing rather rapidly, it is necessary to stress the fundamentals and to study some important applications. The topics that will be covered are

- Futures Markets & Their Applications, including the pricing and use of futures contracts on stock indices, on commodities, and Treasury instruments;
- Options Markets & Their Applications, covering the valuation and use of options, including a discussion of the empirical evidence and dynamic asset allocation strategies;
- Swaps, Complex Derivatives, Structured Securities including several cases, and the use (and misuse) of derivatives in the context of corporate applications.

I expect that a third of the course will be devoted to options, slightly less than a third to futures, and the remainder to more complex derivatives — although many applications are included in the coverage of options and futures markets, the final part of the course will employ several cases.

Pre-requisites: Basic knowledge of statistics from the core course is expected. I recommend that you should have had Core finance; but if you're willing to put in the hours to learn the relevant ideas of risk and return and the minimum understanding of institutional arrangements necessary to follow the class, you can enroll in the course without my permission. Advanced Placement (High School) math including its calculus exposure would be nice. **Auditors** need to check with me on the first day of class.

Syllabus

2 Office Hours

Office: 3259 SHDH; 'phone 898-6206.

Office Hours: My posted hours are on

Tuesdays 1:30-3pm Wednesdays 2:00-3:30pm

I'll *almost always* in (I may have stepped out but only for 5 mins) at these times. I have an open door policy otherwise but it's wise to call (215 898 6206) just before if you intend to come by.

Please note that I am *unavailable* (a) TuThu 9:00am-12pm & MonWed 10am-12pm when I am teaching you all; (b) TueThu 3-4:30pm when I am in a departmental seminar.

Dial-a-Question: Call 898-6206 for answers to brief questions: I might be able to save you some time in making a trip in to campus.

Weekly TA Office Hours: Indraneel Chakraborty is the designated TA for this course; he will conduct review sessions, and along with the other TAs, hold office hours. Locations and time-slots for the TAs office hours will be announced in the second week of class, and included each week in the Weekly Memo (see below) you'll receive as an e-mail every Thursday.

3 Department of Notifications

- 1. Weekly Memos. I send e-mail late each Thursday night to give directions on what to read for the following week, as well as sample problems, Answers to Frequently Asked Questions regarding the Projects, Reminders and such. These e-mails will have a subject heading that begins with "FINDERIVS!!" Please read them carefully.
- 2. Web Café: I make pretty extensive use of the web-Café. All handouts (other than the coursepack), project descriptions, Sample Problem Sets and Exams, Examples I worked out in class, and other class-related material will be available here.
- 3. *E-Mails*: When sending me e-mail, please use

krishna@wharton.upenn.edu

and do avoid hitting the *Reply to All* button to a general e-mail that I have sent to all students, for obvious reasons.

You should be on the class e-mail list-server very shortly after you register. If you drop the course, please send me an e-mail so you can be dropped from the list and shielded from the dreadful stuff I send your former classmates: that may take a few days, so please be patient.

- 4. *Non-Whartonites*: If you're not from Wharton, then please do let me know your e-mail address so I can get you on the list-server asap.
- 5. Seating Plan : After the first class, stick to the seat you choose for the remainder of the semester. And please do plant your name-cards on your desk... it helps me.

4 Text

Required Text: MacDonald, Robert, *Derivatives Markets*, Pearson Addison-Wesley Second Edition. This is what I would recommend, its explanations, examples, and coverage are good, but its notation is reprehensible, and the organisation of the book is haphazard.

The following points are noteworthy: (a) I do not follow the text *in seriatim* chapter and verse; I use its examples at times, and **refer in class** to it at others. (b) In my lecture outline below I show MacDonald's chapters and sections (**outline-referenced**) that contain similar material, some of which will fall short and other parts go beyond my lecture material. (c) You're recommended to read these chapters and sections. (d) But my midterms and final will draw on my in-class notes and the parts of MacDonald I **refer to in class**, see (a) immediately above! (e) This will relieve you of memorizing two sets of formulas; it will make you skilful in following the ideas and concepts – what could be more important? – and overcome the rather minor differences in notation. (f) By following my class material, and then reading the book's parts referred to in class and in the outline, you will learn a lot indeed.

Here are some other recommended books:

1. Hull, John, *Fundamentals of Futures & Options Markets*, Prentice-Hall, Fifth Edition. It covers both futures and options and their applications. On the plus side, all the topics that I cover are discussed here, and it is a decent reference source. However, it is weak on intuition, and its treatment of markets and derivative strategies is not deep.

Please note that Hull has a more advanced text called *Options, Futures and Other Derivatives*. It is also published by Prentice-Hall and the current edition is I think 5th. Students who have a quantitative background and prefer a technical exposition, or those who intend to take Financial Engineering next Spring may find this book useful; on the plus side, it is a complete reference source, but unhappily, it is even shorter on intuition than the "Fundamentals" version. I recommend this book for the Financial Engineering Seminar.

- 2. Cox, John C and Mark Rubinstein, *Options Markets*, Prentice-Hall, 1985. This is an excellent book after all these years, its ideas are as clear as freshly-formed dew around which the treatment of options in this course is designed. A well-thumbed copy belongs on every finance major's bookshelf. It doesn't have chapter-ending problems. But it does have the most useful treatment of the basic ideas of finance corporate finance, even that you will find anywhere. Scrimp and save but buy it and read it.
- 3. Rubinstein, Mark, *Derivatives: A PowerPlus Picture Book*, a CD-ROM based, PowerPoint-employing, hyperlinked, spreadsheet-firing book which covers almost everything we'll do in the first two-thirds of the course. It is available directly from the author from

www.in-the-money.com,

where you can examine a few pages. Mark's book provides excellent intuition (as does his book co-authored with John Cox) and it is quite thorough. If you're keen on the subject, if you'd like a slightly more technical exposition from a very knowledgeable author, and if you like to work through a CD-ROM workbook, this is a fine source.

There are a couple of other books that you may find useful as references, although I may distribute copies of certain chapters from these books. They are:

4. Arditti, Fred, *Derivatives*, HBS Press, 1996. It is good on intuition, and it has good discussion of applications and on all major derivatives, including swaps and mortgage derivatives. Unfortunately, it doesn't have problems and examples worked out, as it is intended to be for practitioners.

- 5. Siegel, Daniel R and Diane F Siegel, *Futures Markets*, The Dryden Press, 1990. I have placed several copies on Lippincott reserve, and interested students can come by my office to borrow a copy. Very dated but an excellent book which I would recommend to anyone who goes into the futures business. My notes will draw on some material from this book.
- 6. Looking for a practitioner-oriented book? Read Chew, Lilian, *Managing Derivatives Risks*, Wiley, 1996.
- 7. Feel it's all gambling and speculation and connected to Vegas, and want a complete, fun and strongly analytical treatment of every game of chance? See Epstein, Richard, *The Theory of Gambling and Statistical Logic*, Academic Press, 1977.

5 Course Requirements



2. Two Group Projects dealing with the Futures Hedging and with the Valuation and Use of Options contracts. The projects are to be done in groups of no more than 3 people: *there will be no exception to this rule*. Groups may be formed across registered sections.

Descriptions of projects' requirements and the data will be distributed later. It involves minor data collection — to start now, form your group to follow the options on a stock of your choice — but no programming skill is needed. You can use the software package provided with MacDonald's book (or you can use the computer programmes I place in the web-Café) to assist your analysis. You can use Excel to do the work (even the programming!) if you like.

Weight, 30%

3. One final exam — very basic and conceptual questions on all the material, some true false and multiple choice; designed so that in calmly reviewing your material it you will solidify your understanding. It can only help improve your grade if you clear this certification hurdle!

Weight 20%

4. Four short individual assignments, Homework if you will; problems that will be good practice for the exam. If you turn in a complete effort on time, you'll get the full point credit, and nothing otherwise.
Weight, 4%

6 Mark Your Calendars/Organizers

Exam dates are given below in the Lecture Sequence section. All exam-related absences must now receive prior approval from the Grad Division for MBAs; or from the UnderGrad advisors and me, for UGs. All requests for regrades — even discussions of the grading — should be directed ONLY to me within a week after the graded item is returned, in my Office Hours, and *not* to my TAs.

7 Course-pack

A course-pack will be available from Wharton Reprographics – they need a day's notice to run one off for you. I urge you to order it: the alternative is to print this huge beast off the web-café and remember to bring the relevant part to class! It contains a copy of my class-notes, as well as additional readings. The course-pack cost includes a charge for additional pages which I distribute in class.

Your bursar's bill will be charged automatically for the actual cost of reproducing in-class handouts. My current estimate is that the total won't exceed 600 pages.

8 Review Sessions for Doubt-Clearing

Weekly review sessions are so sparsely attended that I've decided that the TA and I will hold them just prior to the mid-terms and the final. Occasionally, though, I will hold an extended Friday review session just after some material that more than a few students find difficult So please use our office hours and call me with any questions you have. The TAs and I will hold Office Hours throughout each week, so you should have ample opportunities for doubt-clearing. And we will help you work through problems posted (with solutions) in the course down-load area of the web-café.

9 Guest Lecture(s)

I expect to arrange for one guest lecturer in mid April, probably at 5 pm, unhappily ruining the *apéritif* hour; the material covered in these lectures is an important and integral part of this course. I'll have it taped if there's demand.

10 Readings

As indicated in the first class, one must get more technical here than in the average Finance course if one is to provide a useful and correct treatment. Your approach to the readings, therefore, is very important. You should read with a view to grasping the concepts being discussed, and work through some problems.

My Weekly Memo will direct you to do the readings and work at some problems. In general, it is best to read the text once *before* you see the material in the lecture, and afterwards review the material and try the problems.

I will hand out readings in addition to the lectures: these handouts will be clearly marked as "Class Handouts" and dated in the top margin. Most readings and lecture notes will be handed out on Tuesdays.

If you miss a lecture, then

- 1. the *quickest* way to get the supplemental in-class hand-out (if any) in that class is to get it from a colleague and xerox it; or
- 2. the next best way is to look for that handout, whose date will appear in its file-name, in the course web-Café. Whenever possible, I will create a PDF version that you can double-click on and print; or

3. you can drop by during my office hours and pick up a copy. If I've run out of copies, I'll print one for you.

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 $Files: \verb+spec08a+adm+syllabus08a.T_{E}X$

Lecture Sequence

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Financial Derivatives

FNCE [206]-001: MW 10:30am, JMHH 240
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Lecture Outline (Spring 2008)

Lecture	Day/Date	Topics	Remarks (McDonald Chs)
1	W1/16, Th1/17	Introduction	
2 *	T1/22	More Apps and Discussion	McD 1, 2 To be taped
			Also Fire Drill 10am
2	W1/23, Th1/24	Forward Contracts and	McD 5
		Futures Trading	
3	M1/28, T1/29	Futures Pricing (Financials)	McD 5
4	W1/30, Th1/31	Synthetics+Overlays	HW 1 Due
5	M2/4, T2/5	Futures Pricing (Commodities)	McD 6
6	W2/6, Th2/7	Hedging with Futures	McD 4.2,4.5,pp197-8
7	M2/11, T2/12	Interest Rate Futures	McD 7.2,7.4
8	W2/13, Th2/14	Swaps $(IRS + Commodity)$	McD 8, $HW 2 Due$
9	M2/18, T2/19	Review+Problems	
EXAM	Tuesday FEB 19 6-8pm	Midterm 1	Rooms TBA
10	W2/20, Th2/21	Options Strategies	McD 3
11	M2/25, T2/26	Conversion+Exercise	McD 9
12	W2/27, Th2/28	Binomial Pricing	McD 10, 11
13	M3/3, T3/4	More on Pricing	McD 11 Grouproj-Fut Due
14	W3/5, Th3/6	Examples+Applications	
15	M3/17, T3/18	The Black-Scholes Model	McD 12
16	W3/19, Th3/20	Volatility and All That	McD 12.5 HW 3 Due $$
17	M3/24, T3/25	Option Greeks and	McD 13
18	W3/26, Th3/27	Empirical Evidence	
19	M3/31, T4/1	Project Team Time	NO CLASS
20	W4/2, Th4/3	Review+Problems	
EXAM	Thursday APRIL 3 6-8pm	Midterm 2	Rooms TBA
21	M4/7, T4/8	Exotic Options	McD 14
22	W4/9, Th4/10	Corporates+Convertibles	Notes TBD
23	M4/14, T4/15	Applications 1	HW 4 Due
Extra	T 4/15, 5-6pm	Guest Lecture	*Attendance Reqd
24	W4/16, Th4/17	Applications 2	
25	M4/21, T4/22	Applications 3	
26	W4/23, Th4/24	Applications 4	Grouproj-Opt due
27	M4/28, T4/29	Final Review	
EXAM	Monday MAY 5, 3-5pm	Final	

Grouproj-Fut and Grouproj-Opt are the two Group Projects due Mar 4 & Apr 24.

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Required Reading

NOTES

- 1. Exam dates are *lapidary* carved in stone. Please put them in your calendars.
- 2. Midterms 1 and 2 account for 45% in total, are Closed Book, Closed Notes, one sheet of paper permitted.
- 3. Final Exam (accounts for 20%) concepts-based, multiple choices plus a few true false, Closed Book, Closed Notes, only mental arithmetic required, only elementary school (4 function) calculators please!
- 4. Four individual HWs (4%) will be collected and recorded for one point if complete effort turned in on time; zero otherwise.
- 5. Group work: Futures Hedging Project and Option Valuation and Hedging Project; they will account for 30% total.