Course Syllabus
Financial Derivatives

Course Description

This course covers one of the most exciting yet fundamental areas in finance: derivative securities. In the modern financial architecture, financial derivatives can be the most challenging and exotic securities traded by institutional specialists, while at the same time, they can also be one of the most basic securities commonly traded by retail investors such as S&P 500 Index Options. Beyond trading, the basic ideas of financial derivatives serve as building blocks to understand a much broader class of financial problems, such as complex asset portfolios, strategic corporate decisions, and stages in venture capital investing.

The global derivatives market is one of the most fast-growing markets, with over $600 trillion notional value in total. It is as important as ever to understand both the strategic opportunities offered by these derivative instruments and the risks they imply.

The main objective of this course is to help students gain the intuition and skills on (1) pricing and hedging of derivative securities, and (2) using them for investment and risk management. In terms of methodologies, we apply the non-arbitrage principle and the law of one price to dynamic models through three different approaches: the binomial tree model, the Black-Scholes-Merton option pricing model, and the simulation-based risk neutral pricing approach.

We discuss a wide range of applications and real-life cases, including the use of derivatives in asset management, the valuation of corporate securities such as stocks and corporate bonds with embedded options, interest rate derivatives, credit derivatives, as well as crude oil derivatives and currency derivatives. In addition to theoretical discussions, we also emphasize practical considerations of implementing strategies using derivatives as tools, especially when no-arbitrage conditions do not hold.

Pre-requisites

There are no formal prerequisites for this course. However, basic knowledge to linear algebra, calculus, statistics, and probability is expected. The introductory finance courses can also be helpful. Thus, if any, the following courses are recommended but not required: FNCE 100, FNCE 101, STAT 101-102.

Course Materials

Lecture Notes & Readings:

They will be posted on CANVAS (https://canvas.upenn.edu/) before each class. I will also post additional reading materials on CANVAS, including research papers and newspaper articles, which can provide useful background knowledge or add depth to the materials covered in lectures. I will not distribute hardcopies of lecture notes in classes except the first class.
Readings and practice problems will be regularly assigned from textbook (M). Neither Book (M) nor book (H) is cheap, but they have become standard references among wall-street practitioners, and thus they can be valuable long-term investments.

**Required Textbook:**


**Recommended Textbook:**

(H) Hull, *Options, Futures and Other Derivatives*, 8th ed. (7th also works), Pearson Prentice Hall 2011.

**Some Optional Materials:**


**Course Requirements**

**Lecture Participation:**
TR 1:30 - 3:00 p.m. SHDH 211

**Assignments:**
There are six group problem sets. These problem sets should be done in groups of 2-4 students with group discussions. But you are required to write down your own solutions and submit individual paper copy of solutions separately. No electronic submission is acceptable.

Please put down the names of your teammates clearly at the beginning of each submission. You must submit at the **beginning** of the session you have enrolled in.

Each problem set is graded up to 10 points for timely submission, correctness of your derivations and solutions, and clarity of your explanations. If you really wish to submit a spreadsheet, please make label entries clearly and explain them carefully.

Please do not be late for your problem set solution submission; otherwise, at least 4 points out of 10 have to be deducted, and no submission is acceptable 24 hours after the corresponding deadline. The following are the strict deadlines for all problem sets:

- Problem set 1: Tuesday, September 19th
- Problem set 2: Tuesday, October 3rd
- Problem set 3: Tuesday, October 24th
- Problem set 4: Tuesday, November 14th
- Problem set 5: Tuesday, November 28th
- Problem set 6: Tuesday, December 12th

The graded solutions will be returned and students should be able to find them in a file cabinet in the Finance department. I will post the grade and the solution for each problem set on CANVAS. Please find me if you feel there are any potential grading errors within two weeks of the problem set’s due date. It’s unfair to consider any inquiries afterwards.
Exams:

There are two exams: midterm and final.

The midterm exam takes place on **Tuesday, October 31st, in class.** All students have to take the exam in the session they are registered for. The exam is a closed-book and closed-notes one. However, students can bring in an 8.5”-by-11” (A4-letter) cheat sheet. Students are not allowed to use cell phones, touchpads, or laptops during the exam.

The final exam takes place on **Wednesday, December 20th, 6:00-8:00 p.m.** The exam is also a closed-book and closed-notes one. Students can also bring in an 8.5”-by-11” (A4-letter) cheat sheet. No cell phones, touchpads, or laptops are allowed during the exam.

Re-grading must be applied to all questions, if requested. No re-grading inquiries will be considered a week after solutions and grades are returned.

Students who are unable to take the exam during the given time periods must petition their dean’s office for a makeup exam.

Both exams are based only on materials covered in lectures and problem sets.

Final Grades:
The final grade is based on the performance on participation, problem sets, and exams. It is a weighted average of each performance evaluations with a full score of 100. The more favorable weighting scheme is picked for each student between the following two:

<table>
<thead>
<tr>
<th></th>
<th>Weighting 1</th>
<th>Weighting 2</th>
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</thead>
<tbody>
<tr>
<td>Participation</td>
<td>10%</td>
<td>10%</td>
</tr>
<tr>
<td>Assignments</td>
<td>20%</td>
<td>20%</td>
</tr>
<tr>
<td>Midterm</td>
<td>30%</td>
<td>10%</td>
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<tr>
<td>Final</td>
<td>40%</td>
<td>60%</td>
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Office Hours and Review Sessions

Office Hours: Fridays 4:00 – 5:30 p.m. or by appointment
TA Office Hours: Fridays 2:00 – 3:30 p.m.
Review Sessions: Location will be announced on the course website.

Contact Information

Instructor: Winston Dou
Office: SHDH 2318
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Phone: 215-746-0005

Teaching Assistant: Xiang Fang
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**Academic Integrity**

University of Pennsylvania’s Code of Academic Integrity. A copy can be found at

http://provost.upenn.edu/policies/pennbook/2013/02/13/code-of-academic-integrity

**Classroom Policy**

- Zero participation score if late for classes more than twice.
- Please do not surf the web since it is distracting for students seating around.
- Please do mute your cell phone in lectures.
- Please do not leave the classroom to take a phone call.
- Please do not chat around during lectures.
- Please do plant your name cards on your desk so that I could learn you and have ideas about your participation.

**Mark Your Calendar**

- **Thursday, August 31st, First Class**
- **Tuesday, October 31st, Midterm Exam**
- **Tuesday, December 12th, Last Class**
- **Wednesday, December 20th, Final Exam**

**Course Schedule (Tentative)**

<table>
<thead>
<tr>
<th>Class</th>
<th>Date</th>
<th>Topic</th>
<th>Reading (M)</th>
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</thead>
<tbody>
<tr>
<td>1</td>
<td>08/31</td>
<td>Introduction to Derivative Securities &amp; Syllabus</td>
<td>Ch. 1</td>
</tr>
<tr>
<td>2</td>
<td>09/05</td>
<td>Forward Contracts on Financial Assets and Indices</td>
<td>Ch. 5, 7</td>
</tr>
<tr>
<td>3</td>
<td>09/07</td>
<td>Future Contracts on Financial Assets and Indices</td>
<td>Ch. 5, 7</td>
</tr>
<tr>
<td>4</td>
<td>09/12</td>
<td>Forward Contracts on Commodities</td>
<td>Ch. 6</td>
</tr>
<tr>
<td>5</td>
<td>09/14</td>
<td>Future Contracts on Commodities</td>
<td>Ch. 6</td>
</tr>
<tr>
<td>6</td>
<td>09/19</td>
<td>Forward and Futures Contracts on Currency</td>
<td>Ch. 5.6, 5.7</td>
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<tr>
<td>7</td>
<td>09/21</td>
<td>Forward and Futures Contracts on Interest Rates</td>
<td>Ch. 7</td>
</tr>
<tr>
<td>8</td>
<td>09/26</td>
<td>Swaps: Total Return Swaps, Commodity Swaps, Variance Swaps</td>
<td>Ch. 8.1, 8.4, 8.5, 8.6</td>
</tr>
</tbody>
</table>
9 09/28 Currency Swaps and Interest Rate Swaps: Applications
   Examples: Greece currency swaps and interest rate swaps with
   Goldman Sachs
Ch. 8.2, 8.3

10 10/03 Other Popular Swaps
Ch. 8

11 10/10 Introduction to Options
   Examples: short sales constraints and synthetic stocks, Collar strategies,
   and Barring/Leeson
Ch. 9

12 10/12 Option Trading Strategies
Ch. 9

13 10/17 Binomial Trees and Risk Neutral Pricing
Ch. 10.1

14 10/19 Binomial Trees: Two-Period Model
Ch. 10.2, 10.3

15 10/24 Binomial Trees: Multi-Period Model
   Examples: option prices around FDA approvals, implied binomial trees
Ch. 10.2, 10.3

16 10/26 The Black-Scholes-Merton Formula
Ch. 12

17 10/31 Midterm Exam (in class)

18 11/02 Options’ Greeks and Dynamic Replications
   Examples: replicating the S&P 500 index option, portfolio insurance,
Ch. 12.3, 13

19 11/07 Delta-Gamma Hedging and Option Returns
Ch. 12.3, 13

20 11/09 Limitations and Extensions of The Black-Scholes-Merton Model
Ch. 20.8, 21.5

21 11/14 American Options
Ch. 9.3, 10.4, 11.1

22 11/16 Exotic Options: Examples
Ch. 14

23 11/21 Pricing with Monte Carlo Simulations: A Simple Study
Ch. 19

24 11/28 Introduction to Interest Rate Derivatives
   Examples: callable bonds, mortgage-backed securities
Ch. 25

26 11/30 Introduction to Credit Derivatives
   Examples: KMV Model, credit default swaps, collateralize debt
   obligations, copula, Amherst, AIG, Paulson’s “Big Short”
Ch. 27

27 12/05 Default and Credit Risk
Ch. 16, 17

28 12/07 Theory v.s. Reality: Failures of Non-Arbitrage Conditions
   Examples: TIPs arbitrage, Chinese warrants, convertible arbitrage,

29 12/12 Class Wrap-up