

# **Options and Futures**

## **Fall 2016**

### **Professor Alessio Saretto**

Office: JSOM 14.407

Office hours: Monday 15:45 to 17:00, Thursday 18:00 to 19:00, and by appointment.

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Phone: (972)-883-5907

Class hours: M 13:00 to 15:45 in JSOM 1.102

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## **Course Description**

This course is designed to improve the student's understanding of financial derivatives with some accent to the energy market industry. The emphasis of the course is on developing the analytical skills necessary to utilize the basic mathematical models which are most commonly used to price derivatives. Besides the technical aspects that characterize the pricing of derivative securities, various institutional details relative to the energy markets will be presented.

After completion of this course, students will have acquired the tools needed to price basic derivatives and to use these financial instruments in the context of managing investments by energy firms. There is a long list of applications suitable to the basic concepts that will be introduced in the class, for example: pricing of basic energy options, hedging market, credit and currency risk, evaluating financing alternatives (such as convertible debt or debt with warrants attached), evaluating tax arbitrage strategies (such as converting short term gains to long term gains by "locking in" positions with a hedge strategy), investing cash in various short term instruments (such as asset backed securities with prepayment options), valuation of alternatives for financing acquisitions (such as a stock for convertible bond swap).

This course assumes that this is the students' first in-depth course in analysis and use of derivative securities. However, the course is fairly quantitative and the students should be familiar with the basic concepts of financing decision making, calculus, probability and statistics (for example basic statistics such as mean, variance, and correlation, and how to interpret regression analysis). Students should also be comfortable using data analysis packages such as Excel, Matlab or equivalent.

## Course grades will be determined as follows

Midterm I	20%
Midterm II	20%
Midterm III	20%
Assignments	30%
Class participation	10%

Final grades will be given on a curve, according to official University guidelines.

## Exams

Midterm I and II are closed book and will be held in class. These tests will be a combination of true/false, short answer essays, and simple problems. You must take the exams at the scheduled times. I expect that you arrive on time, exit quietly, and conduct yourself properly during the exams. Midterm III will be a take home test and will be due on the last day of class.

## Assignments

There will be 5 short on-line quizzes in the form of multiple choice questions. The link to the on-line quizzes will be available on the course web-page. Each of these quizzes will have questions that cover material presented in the previous class. Furthermore, you will have to complete 5 homework assignments and hand them in to be graded. These assignments are to be done individually. All assignment are due before the beginning of class as indicated below in the course outline. Each assignment has an equal weight towards the 30% of the grade.

## Academic Integrity

The University of Texas at Dallas administers student discipline within the procedures of recognized and established due process. Procedures are defined and described in the Rules and Regulations, Series 50000, Board of Regents, The University of Texas System, and in Title V, Rules on Student Services and Activities of the university's Handbook of Operating Procedures. Copies of these rules and regulations are available to students in the Office of the Dean of Students, where staff members are available to assist students in interpreting the rules and regulations (SU 1.602, 972-883-6391) and online at <http://www.utdallas.edu/judicialaffairs/UTDJudicialAffairs-HOPV.html>.

Scholastic Dishonesty: Any student who commits an act of scholastic dishonesty is subject to discipline. Scholastic dishonesty includes but is not limited to cheating, plagiarism, collusion, submitting for credit any work or materials that are attributable in whole or in part to another person, taking an examination for another person, or any act designed to give unfair advantage to a student or the attempt to commit such acts.

## Attending the Class

The class is mainly structured as a series of lectures. Since the topic is a bit technical there is a lot of material that I need to cover. That does not mean that there will not be any class discussion, nonetheless you should perhaps expect less than what is typical in other classes. Please be in class before the lecture starts. If, by some serious reason, you are late, enter the classroom from the back door. You are not allowed to use any computer, personal data assistant, and/or smart phone while in class. You should, however, bring a scientific calculator that you will use to solve problems in class. Note that I will not take attendance and therefore class participation points will be awarded only based on active participation during class.

## Students with disabilities

Any student with a documented disability who requires academic accommodations should contact Office of Student AccessAbility at (972) 883-2098. Faculty are not required to provide accommodations without an official accommodation letter from the Office. Please notify me as quickly as possible if the material being presented in class is not accessible (e.g., instructional videos need captioning, course packets are not readable for proper alternative text conversion, etc.). Contact Office of Student AccessAbility at (972) 883-2098 or reference the website for more disability-related information: <http://www.utdallas.edu/studentaccess/>.

## Readings

The required textbook for the course is:

Hull, John, *Options, Futures, and Other Derivatives*, Prentice Hall, 9th edition, 2014.

I will also provide a set of lecture notes before class. The lecture notes will be also posted on the course website. These notes are *not* a substitute for attending classes since the class discussion will add value to the notes.

## Hours

The class is scheduled to meet every Monday from 13:00 to 15:45 in JSOM 1.102. I will have office hours on Monday 15:45 to 17:00, Thursday 18:00 to 19:00, and by appointment. An email will be sufficient to schedule a visit.

## Course outline

This is a tentative outline of the topics that will be covered. There might be some slight variation due to time constraints. You are expected to read the material in the text (all chapters refer to the required textbook, unless otherwise noted) prior the relevant lecture.

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### WEEK 1

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<b>Monday August 22:</b>	<b>Course Outline and Introduction</b>
Readings:	Chapter 2 - Mechanics of futures markets Chapter 5 - Determinants of forward and futures Chapter 7 - Swaps Chapter 10 - Mechanics of options markets
Goal:	Introduction to derivative contracts (forward, futures, swaps and options). Understand the common uses of derivatives (hedge, speculate and lock in arbitrage) and the main idea behind the law of one price.

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### WEEK 2

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<b>Monday August 29:</b>	<b>Interest Rates</b>
Readings:	Chapter 4 - Interest rates
Goal:	Review of the basic mechanics of interest rates markets
Assignment:	Quiz 1 (link on eLERNING) is due by 1:00pm.

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### WEEK 3

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<b>Monday September 5:</b>	<b>No Class today</b>
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### WEEK 4

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<b>Monday September 12:</b>	<b>Forward and Futures</b>
Readings:	Chapter 5 - Determinants of forward and futures
Goal:	To understand the basic functioning of a forward and futures contract and its application to energy commodities.
Assignment:	Quiz 2 (link on eLERNING) is due by 1:00pm.

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WEEK 5

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**Monday September 19: Options and Swaps**

Readings:

Chapter 7 - Swaps

Chapter 10 - Mechanics of options markets

Chapter 11.1, 11.4 - Properties of Stock Options

Chapter 12 - Trading Strategies Involving Options

Goal:

To understand the basic functioning of a swap contract and its application to energy commodities. To understand the basic properties of options; the basic pricing relationships and the possible payoffs that can be obtained combining different options.

Assignment:

Quiz 3 (link on eLERNING) is due by 1:00pm.

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WEEK 6

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**Monday September 26: Value at Risk**

Readings:

Chapter 22 - Value at risk

Goal:

To understand how to construct a measure of worst case scenario in a probabilistic way.

Assignment:

Quiz 4 (link on eLERNING) is due by 1:00pm.

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WEEK 7

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**Monday October 3:****Midterm I**

Reading:

Study!

Goal:

Do as well as you can!

Note:

Please bring a scientific calculator. No food is allowed during the exam. If you finish early, please, gather your things quickly and exit the room quietly.

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WEEK 8

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**Monday October 10:****Introduction to Stochastic Behavior of Prices (Black and Scholes)**

Readings:

Chapter 14 - Wiener process and Ito's lemma

Chapter 15 - The Black-Scholes-Merton model

Goal:

To understand the rationale behind a very useful valuation method called Monte Carlo simulation. To understand the basic working of the Black and Scholes pricing formula.

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WEEK 9

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<b>Monday October 17:</b>	<b>Binomial Trees – I</b>
Readings:	Chapter 13 - Binomial Trees Chapter 21 - Binomial Trees
Goal:	To understand how to price an option by setting it equal to the value of a portfolio that replicates the value of the option at any point in time.
Assignment:	Homework 1 (file on eLERNING) is due in class.
Assignment:	Quiz 5 (link on eLERNING) is due by 1:00pm.

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WEEK 10

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<b>Monday October 23:</b>	<b>Binomial Trees – II</b>
Readings:	Chapter 13 - Binomial Trees Chapter 21 - Binomial Trees
Goal:	To understand how to price an option by setting it equal to the value of a portfolio that replicates the value of the option at any point in time.
Assignment:	Homework 2 (file on eLERNING) is due in class.

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WEEK 11

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<b>Monday October 31:</b>	<b>Trinomial Trees</b>
Readings:	Chapter 21.4 - Alternative Procedures for Constr. Trees Chapter 31.7 - A General Tree-Building Procedure
Goal:	To extend the binomial tree pricing method to take into account of mean-reversion in prices.
Assignment:	Homework 3 (file on eLERNING) is due in class.

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WEEK 12

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<b>Monday November 7:</b>	<b>Volatility Estimation</b>
Readings:	Chapter 19 - Volatility smiles
Goal:	To understand how to calculate the volatility of an asset from historical observations of price changes.

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WEEK 13

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<b>Monday November 14:</b>	<b>Midterm II</b>
Reading:	Study!
Goal:	Do as well as you can!
Note:	Please bring a scientific calculator. No food is allowed during the exam. If you finish early, please, gather your things quickly and exit the room quietly.
Assignment:	Homework 4 (file on eLERNING) is due in class.

WEEK 14

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**Monday November 21:** No class today

WEEK 15

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**Monday November 28:** **Intro to Models with Stochastic Volatility**

Readings: Chapter 20 - Volatility smiles  
Chapter 23 - Estimating volatilities and correlations

Goal: Introduction to stochastic volatility. To understand how to price an option with stochastic volatility by Monte Carlo Estimation.

Assignment: Homework 5 (file on eLERNING) is due in class.

WEEK 16

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**Monday December 5:** **Credit Derivatives and Structured Finance**

Readings: Chapter 8 - Securitization and the credit crisis  
Chapter 24 - Credit risk  
Chapter 25 - Credit derivatives

Goal: To understand how firms can protect themselves from credit risk by taking hedging against changes the credit quality of its creditors. To understand how lenders can protect themselves from credit risk by sharing and packaging loans.

Assignment: Midterm III due in class.

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