UNIVERSITY of STIRLING

Management School

**ACCOUNTING AND FINANCE DIVISION**
**(www.accountingandfinance.stir.ac.uk)**

***MSc in Finance***
***MSc in Investment Analysis***
***MSc in Banking and Finance***
***MSc in Computing for Financial Markets***
***MSc in International Accounting and Finance***

# INVP10: DERIVATIVES

# SPRING 2015

## 1. AIMS

The module provides an understanding of the uses and the valuation of the main derivative financial instruments: futures, swaps and options. It covers the trading mechanisms used on derivative markets and explains the fundamental principles underlying the pricing of derivative instruments and their use in portfolio management. Particular attention is paid to the practicalities of using derivative instruments for risk management purposes. The module also provides an introduction to the working of the foreign exchange market and the instruments traded thereon. Related institutional aspects are introduced where necessary.

## 2. LEARNING OUTCOMES

By the end of the semester students should be able to:

1. Define a derivative and differentiate between exchange-traded and over-the-counter derivatives.
2. Discuss the purposes and criticisms of derivative markets.
3. Explain the concept of arbitrage and the role it plays in determining prices and in promoting market efficiency.
4. Define futures and forward contracts.
5. Define the terms futures price, long position and short position, open interest, price limit, and position limit.
6. Explain how futures and forwards can be used by hedgers and speculators.
7. Describe how marking to market and margin accounts work.
8. Explain the difference between futures and forward contracts.
9. Describe how futures and forwards can be used in risk management.
10. Outline the main arguments in favour of and against hedging.
11. Explain the concept of basis risk.
12. Explain how cross hedging works and calculate the minimum variance hedge ratio.
13. Describe how to use stock index futures to hedge an equity portfolio.
14. Explain the differences between investment and consumption assets.
15. Describe the mechanics of short selling.
16. Calculate forward prices for investment assets with and without income.
17. Calculate the value of a forward contract.
18. Explain the pricing of futures contracts on commodities. Show the difference between pricing futures on investment and consumption commodities.
19. Discuss the concept of convenience yield and the cost of carry model.
20. Explain the relation between futures prices and expected spot prices.
21. Define a swap contract and explain how the swap market works.
22. Show how interest rate swaps may be used to transform a liability or an asset.
23. Describe the role of a financial intermediary in a swap.
24. Discuss the comparative advantage argument in favour of interest rate swaps and explain why it is flawed.
25. Perform valuation of an interest rate swap.
26. Explain how to use currency swaps and the comparative advantage argument.
27. Perform valuation of a currency swap.
28. Explain the credit risk problem in the case of swaps.
29. Describe other types of swaps.
30. Understand the organisation of the foreign exchange market.
31. Understand the difference between the spot and forward foreign exchange markets.

32. Discuss the concepts of foreign exchange risk and cross exchange rates.
33. Explain how triangular arbitrage works in foreign exchange markets.
34. Explain the law of one price and purchasing power parity.
35. Describe interest rate parity and the main reasons for deviations from interest rate parity.
36. Define the basic characteristics of equity option (put and call) contracts.
37. Explain the differences between purchasing and writing option contracts.
38. Define the terms European option, American option, moneyness, payoff, intrinsic value and time value.
39. Describe how options can be used for speculating on price changes and for hedging price risk.
40. Explain how option payoffs are determined.
41. Identify the minimum and maximum values of European options and American options.
42. Describe the relationship between options that differ only by exercise price.
43. Explain how option prices are affected by the time to expiration, the price of the underlying instrument, volatility and the market rate of interest.
44. Explain the relationship between American options and European options in terms of the lower bounds on option prices and the possibility of early exercise.
45. Explain the use of a variety of option trading strategies such as short straddles and long butterflies
46. Apply hedging techniques to simple situations.
47. Determine the value at expiration, the profit, the maximum profit and loss, the breakeven price at expiration, and the general shape of the graph of the strategies of buying and selling calls and buying and selling puts, and explain each strategy's characteristics.
48. Determine the value at expiration, the profit, the maximum profit and loss, the breakeven price at expiration, and the general shape of the graph of the straddle strategy, strips and straps, strangles, the bull spread strategy, the bear spread strategy, the butterfly spread strategy, the collar strategy, and explain each strategy's characteristics.
49. Determine the value at expiration, the profit, the maximum profit and loss, the breakeven price at expiration, and the general shape of the graph of the covered call strategy and the protective put strategy, and explain each strategy's characteristics.
50. Understand how synthetic securities may be created how they may be used.
51. Understand the derivation of the put-call parity theorem.
52. Apply the put-call parity theorem.
53. Calculate the fair value of a call option contract using the simple binomial option pricing model.
54. Explain the assumptions underlying the Black–Scholes–Merton option pricing model and their limitations.
55. Calculate the fair value of a call option contract using the Black–Scholes–Merton option pricing model.
56. Explain how an option price, as represented by the Black–Scholes–Merton model, is affected by each of the input values (the option 'Greeks').
57. Explain how the Black–Scholes–Merton option price is affected by the payment of dividends.
58. Explain the delta of an option and demonstrate how it is used in dynamic hedging.
59. Understand the difference between historical volatility and implied volatility.

The above learning outcomes encompass learning outcomes from levels I, II and III of the CFA® Program Candidate Body of Knowledge.

## 3. TRANSFERABLE SKILLS

It is expected that the module will provide an opportunity to develop, inter-alia, the following personal transferable skills: analytical thinking and problem-solving; interpreting statistical information; condensing information; methodical work through planning and prioritisation and listening skills. Students will be required to actively participate in the module.

## 4. READING

Required Reading
The following textbook is required reading:

Hull, J., *Options, Futures and Other Derivatives: Global Edition, 8*th edition, 2012, Prentice Hall.

The *Solutions Manuals* that accompanies this textbook contains brief solutions to the end of chapter problems and can be used for additional practice, although it is not required reading.

Chapter 30 of the following textbook (used on INVP01: Corporate Finance last semester) will also be used:

Hillier, D., Ross, S. A., Westerfield, R. W., Jaffe, J., and Jordan, B. D., *Corporate Finance*, 2nd European edition, 2013, McGraw-Hill.

Supplementary Reading
There are many other derivatives textbooks that students can use for supplementary reading. Two such recommended textbooks are listed below:

Kolb, R.W. and Overdahl, J.A., *Futures, Options, and Swaps,* 5th edition, 2007, Blackwell Publishing.

McDonald, R.L., *Derivatives Markets,* 3rd edition, 2013, Pearson International edition.

## 5. MODULE ORGANISATION

### Teaching Staff

The following staff will teach the module:


Dr Lazaros Symeonidis Room 4B115 lazaros.symeonidis@stir.ac.uk
Professor Alan Fox (Coordinator) Room 4B115 alanffox@hotmail.com

**Format**

The module comprises Formal Lectures (FLs) in a two hour block, a one hour Problem Solving Lecture (PSL) and a one hour Drop-in Session (DIS). The Drop-in Sessions are optional.

**Timetable**

Formal Lectures (from Monday 12 January):

Monday 09:00 – 11:00 Lecture Theatre C.LTB4

Problem Solving Lectures (from Monday 19 January):

Monday 12:05 – 13:00 Lecture Theatre C.LTB4

Drop-in Sessions (from Monday 19 January):

Monday 09:00 – 11:00 Lecture Theatre C.LTB4

**Formal Lectures (FLs)**

The purpose of the formal lectures is to help you understand the topics that comprise the module. The textbook will be used extensively and you are advised to read the designated textbook chapters in advance.

**Problem Solving Lectures (PSLs)**

The Problem Solving Lectures (PSLs) are based on the material covered in the lectures in the previous week. You are expected to attempt the designated end-of-chapter problems from the module textbook prior to attending the PSLs. Although primarily structured as lectures to demonstrate solutions to problems, we encourage interaction wherever possible. Details of the end-of-chapter problems to be tackled in the PSLs are provided on the final page of this document. All of them should be attempted before attending the PSLs. Solutions to the end-of-chapter problems will be uploaded to Succeed after each PSL.

**Drop-in Sessions**

In addition to the Formal Lectures and the Problem Solving Lectures we also offer weekly Drop-in Sessions in which students can ask questions about the lecture content (e.g. they can ask the instructor to explain a part of the lecture again) and about the problems discussed in the PSLs.

**Communication**

Email and Succeed (see over) are official means of communication within the University. The University will only use a student's official University account. Private

email address will not be used. Correspondence with instructors through e-mail should be limited to urgent issues requiring their attention.

**Succeed**

Succeed will also be used as a communication medium. Copies of lecture material and links to other useful learning resources will be posted to the INVP10 folder on Succeed. Students are expected to print off lecture material in advance and bring them along to the Formal Lectures. Succeed may be accessed from the University portal or from: *http://succeed.stir.ac.uk/*

**Regulations on coursework, attendance and assessment**

The University/Divisional regulations on coursework, attendance and assessment apply to this module. Students are responsible for noting these regulations.

## 6. ASSESSMENT

The module will be assessed as follows:

(i) A **test** of one hour's duration will take place during the lecture slot on **Monday 2 March** between in **computer labs C.2A15, C.2A17, C.2Y8, and C.2A21**. The test will have a multiple choice format, will last for 50 minutes, and be based on all materials covered in the first **three** FLs and **three** PSLS, and will account for 20 per cent of the marks. The student allocation to computer labs and the times of the test will be posted on Succeed prior to the test.

(ii) The **final examination**, accounting for 80 per cent of the marks, will take place in April or May 2015. The final exam will contain both detailed numerical questions and descriptive/discursive questions based on module materials (textbook chapters and lecture materials).

The 2013 and 2014 past examination papers are available on Succeed, along with outline solutions.

There will be one resit examination for those students who do not pass the module after the main examination.

## 7. OTHER ISSUES

### Use of Dictionaries / Calculators in tests and exams

Only the approved calculators (see Divisional website) may be used in tests and examinations.

Electronic dictionaries are not permitted in tests or examinations. Along with mobile phones, they constitute unauthorised material. Paper English/foreign language dictionaries may be used and will be subject to inspection by invigilators. If any notes or other material are found, these will be confiscated and an Academic Misconduct report will be sent to the University Examinations Officer.

All forms of calculator instruction manual, operating guide or aide memoire are also prohibited in tests and examinations.

### Absence

In accordance with University procedures a medical certificate is required to cover absences from the class test and the final examination. The module coordinator should be informed of the reason for any absence well before the due date of an assessment.

## 8. CLASS SCHEDULE

### Formal Lectures

| Date (Lecturer) | Topic | Reading |
|---|---|---|
| 12 January 2015 (LS) | Introduction to derivatives<br>Mechanics of Futures Markets | Hull Chapter 1<br>Hull Chapter 2 |
| 19 January 2015 (LS) | Futures markets: Hedging | Hull Chapter 3 |
| 26 January 2015 (LS) | Futures Pricing | Hull Chapter 5 |
| 2 February 2015 (LS) | Swaps<br>Foreign exchange market | Hull Chapter 4: 4.1- 4.7<br>Hull: Chapter 6: 6.1<br>Hull Chapter 7 (except Section7.3 and pages 162-164 Valuation in Terms of FRAs)<br>HRWJJ Chapter 30, Sections 30.1 – 30.4 |
| 9 February 2015 (AFF) | Mechanics of Options Markets | Hull Chapter 9<br>Hull Chapter 4: 4.1- 4.7 |
| 16 February 2015 | **MID-SEMESTER BREAK** | |
| 23 February 2015 | **MID-SEMESTER BREAK** | |
| 2 March 2015 | **CLASS TEST** | |
| 9 March 2015 (AFF) | Option trading strategies & the use of options in hedging portfolio risk | Hull Chapter 11 |
| 16 March 2015 (AFF) | Hedging (continued) &<br>Properties of stock options<br>Options Valuation I: The binomial option pricing model | Hull Chapter 10<br>Hull Chapter 12: 12.1-12.9<br>Hull Chapter 16: 16.1 |
| 23 March 2015 (AFF) | Options Valuation II: The Black-Scholes-Merton Model option pricing model and its applications | Hull Chapter 10<br>Hull Chapter 14<br>Hull Chapter 15 |
| 30 March 2015 (AFF) | Advanced issues in risk management: “The Greeks” | Hull Chapter 18<br>Hull Chapter 19: 19.3 |
| 6 April 2015 | **Easter Monday Break** | |
| 13 April 2015 (AFF) | Revision | |

HRWJJ = Hillier, Ross, Westerfield, Jaffe & Jordan

**Problem Solving Lectures**

| Dates | Book / Chapter / Problems |
|---|---|
| 12 January 2015 | **NO PROBLEM SOLVING LECTURES** |
| 19 January 2015 (LS) | Hull / Chapter 1: 1.2, 1.8<br>Hull / Chapter 2: 2.3, 2.11, 2.15, 2.21, 2.23 |
| 26 January 2015 (LS) | Hull / Chapter 3: 3.6, 3.7, 3.16, 3.18 |
| 2 February 2015 (LS) | Hull / Chapter 5: 5.3, 5.4, 5.9, 5.12, 5.14, 5.15 |
| 9 February 2015 (AFF) | Hull / Chapter 7: 7.1, 7.2, 7.3, 7.9, 7.10<br>HRWJJ / Chapter 30: 23, 32 |
| 16 February 2015 | **MID-SEMESTER BREAK** |
| 23 February 2015 | **MID-SEMESTER BREAK** |
| 2 March 2015 (AFF) | Hull / Chapter 9: 9.1, 9.2, 9.4, 9.9, 9.10, 9.13, 9.14 |
| 9 March 2015 (AFF) | Hull / Chapter 11: 11.4, 11.6, 11.7, 11.10, 11.12<br>Note: you should also illustrate your answers by depicting the profit patterns for each option trading strategy. |
| 16 March 2015 (AFF) | Hull / Chapter 10: 10.7, 10.14<br>Hull / Chapter 12: 12.1, 12.4, 12.5, 12.6 |
| 23 March 2015 (AFF) | Hull / Chapter 10: 10.2, 10.3, 10.11, 10.16<br>Hull / Chapter 14: 14.2, 14.4, 14.5, 14.13, 14.14, 14.25 |
| 30 March 2015 (AFF) | HRWJJ / Chapter 30: 24, 33, 36<br>Hull / Chapter 9: 9.12, 9.15 |
| 6 April 2015 | **Easter Monday Break** |
| 13 April 2015 (AFF) | Hull / Chapter 16: 16.1<br>Hull / Chapter 18: 18.2, 18.6<br>Hull / Chapter 19: 19.8 |