



SCHOOL OF BUSINESS AND SOCIAL SCIENCES  
AARHUS UNIVERSITY

## Syllabus 4388: Derivatives and Risk Management Fall 2016

### Instructor

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### Administrative info

Office Hours:

- By appointment (e-mail)

Lectures:

- Wednesdays, 16:00 - 18:00 in 2628 - 209 (M209).
- Fridays, 14:00 - 16:00 in 2628 - 104 (M104).

### Course description

The course introduces both the theory and the application of derivatives markets and their uses in portfolio allocation and risk management. The students will learn the fundamental concepts of derivative pricing and hedging and apply them to a variety of financial instruments. We will focus on the dynamic aspects of modeling financial markets, both in discrete and continuous time. A large variety of derivatives will be considered including forwards, futures, swaps, options and credit derivatives. The course is relevant for managing assets and liabilities of private enterprises, banks, insurance companies, pension funds, and

other financial institutions. The course is also highly relevant for students considering a PhD degree in economics and finance.

### Course subject areas

- Markets and instruments: forwards, futures, swaps, bonds, stocks, options
- Dynamic asset pricing models in continuous and discrete time, stochastic processes
- Derivative pricing, replicating portfolios, risk-neutral valuation, Black-Scholes, Binomial lattice, Numerical methods
- Derivative strategies and hedging, put-call parity, the Greeks
- Historic and implied volatility
- Value-at-risk
- Interest rate models
- Credit risk and credit derivatives

### Learning objectives:

After having followed the course activities the student will be able to:

- Understand the meaning of forwards, futures, and swap contracts and determine their prices.
- Describe and analyze the price on options using the binomial framework, the Black-Scholes framework, and various extensions hereof. This includes so basic knowledge of stochastic processes and various methods for pricing financial products.
- Apply option pricing on known and partly unknown cases, and reflect on the appropriateness of the considered option pricing model in various settings.
- Describe and apply tools for hedging risk, measuring risk, and controlling risk.
- Obtain some knowledge of numerical methods in finance, for instance to approximate option prices.
- Apply methods to estimate the yield curve and derive the evolution of the yield curve from various dynamic term structure models.

**Textbook:**

**[H]** Hull, John C. (2012): *Options, Futures, and other Derivatives*. 8th Edition (Global Edition). Prentice Hall. (ISBN-10: 0273759078 | ISBN-13: 9780273759072)

The book gives a straightforward explanation of options, futures, swaps, and exotic derivatives (collectively called financial derivatives). The valuation of these securities, the mechanics of trading, and the use of financial derivatives in managing risk are all discussed in detail.

**[M]** Munk, Claus. (2011): *Fixed Income Modeling*. Oxford University Press. (ISBN: 9780198716440)

We will use Chapters 2 and 3 from Munk's book. You can simply print these two chapters of the book using its e-version available via our library. Use the link: [Electronic-Version](#).

**Lecture notes:**

Lecture notes in the form of slides will be posted online on Blackboard. Material contained in the lecture notes is not a summary of the book and may provide additional perspectives, examples and structure of the key concepts in the course.

**Assignments:**

Before taking the exam, the student has to pass three out of five assignments. The assignments are only offered in the term the course is being taught. The assignments are to be solved individually or in a group of two students. The assignments are evaluated internally on a pass/fail basis. The purpose of the assignments is to prepare the student for the written exam and to test the learning objectives in topics less suited for written examination.

Wei Ruen Leong ([wei.leong@econ.au.dk](mailto:wei.leong@econ.au.dk)) will hold Café study-sessions in the dates indicated in the course outline. During the Café sessions, he will solve problems from the assignments and solve questions students may have.

**Exam:**

At the end of the semester, the students who have passed at least three of the assignments will attend a 4 hours written exam that assess the main learning objectives of the course. All examination aids allowed (except for any means of electronic communication including calculators, mobile phones and PCs. A simple calculator will be available for the students in the examination hall).

### Course Outline / Schedule (subject to changes)

Week	Day	Topic	Reading	Nr.
36	W	Introduction, futures	[H] Ch. 1, 2	1
	F	Forwards, Futures and Hedging	[H] Ch. 2, 3, 5	2
37	W	Interest rates, swaps	[H] Ch. 4, 6, 7	3
	F	Interest rates, swaps	[H] Ch. 4, 6, 7	4
38	W	Introduction to options	[H] Ch. 9, 10, 11	5
	F	Option pricing - The binomial model	[H] Ch. 12	6
39	W	Wiener processes	[M] Ch. 3.0-3.9	7
	F	Wiener processes	[M] Ch. 3.0-3.9	8
40	W	Black-Scholes-Merton model	[H] Ch. 14, 16, 17	9
	F	Black-Scholes-Merton model	[H] Ch. 14, 16, 17	10
41	W	The Greeks	[H] Ch. 18	11
	F	Volatility smile	[H] Ch. 19	12
42	<b>No lectures</b>			
43	W	Numerical methods	[H] Ch. 20	13
	F	Value at Risk, volatility and correlations	[H] Ch. 21, 22	14
44	W	Credit risk, and credit derivatives	[H] Ch. 23	15
	F	Credit risk, and credit derivatives	[H] Ch. 24	16
45	W	Martingales and measures	[H] Ch. 27; [M] Ch. 3.10	17
	F	Bond options, caps, floors	[H] Ch. 28.1, 28.2	18
46	W	Extracting the yield curve	[M] Ch. 2	19
	F	Short rate models	[H] Ch. 30 + note	20
47	W	Short rate models	[H] Ch. 30 + note	21
	F	Short rate models	[H] Ch. 30 + note	22
48	<b>Recap for the exam</b>			

**Schedule for Assignments**

Assignment	Available from:	Deadline	Solution given
1	Week 36 (Thursday, 9:00)	19/09/2016, 14:00	Week 38 (Wednesday, 14:00 - 16:00)
2	Week 38 (Thursday, 9:00)	03/10/2016, 14:00	Week 40 (Wednesday, 14:00 - 16:00)
3	Week 40 (Thursday, 9:00)	17/10/2016, 14:00	Week 43 (Wednesday, 14:00 - 16:00)
4	Week 43 (Thursday, 9:00)	07/11/2016, 14:00	Week 45 (Wednesday, 14:00 - 16:00)
5	Week 46 (Thursday, 9:00)	28/11/2016, 14:00	Week 48 (Wednesday, 14:00 - 16:00)

Evaluation criteria used at the exam.

	Poor performance (grade -3)	Adequate performance (grade 02)	Excellent performance (grade 12)
<b>Factual knowledge about definitions, concepts and models of scientific relevance for the topic</b>	Important definitions and concepts of scientific relevance contain errors. The illustration and explanation of model assumptions and model elements of scientific relevance contain serious mistakes.	Important definitions and concepts of scientific relevance are reproduced without mistakes. Model assumptions and model elements of scientific relevance are correctly illustrated and explained. Answers to specific questions about definitions, concepts, content/structure of models are for the main part correct and can in broad terms be reproduced from the presentation in the curriculum.	Complete and satisfactory answer with respect to factual knowledge about concepts, definitions and models of scientific relevance for the topic.
<b>Application of the model for analysis of relevant questions within the topic and identification of critical model assumptions</b>	Is unable to reproduce examples of application of the model from the curriculum. Neither demonstration of an in-depth understanding of the model nor independent application of the model for analysis of relevant questions.	Demonstrates the ability to 'reproduce' examples of model applications from the curriculum, but lacks demonstration of an in-depth understanding of the model and distinctively independent application of the model for analysis of relevant questions.	Demonstration of original and certain scientific skills on the level of combination and analysis and demonstration of a deep understanding of the model assumptions.
<b>Overall impression of the answer</b>	Overall, the answer contains serious mistakes and misunderstandings, i.e. reveals neither knowledge nor skills for e.g. 'reproduction' of the core models and elements of analysis from the curriculum. The answer lacks any originality and is not adjusted to the given assignment – within the specific economic topic of interest. The answer contains no relevant scientific elements beyond 'common knowledge' etc.	The answer is broadly speaking without any serious mistakes and misunderstandings, i.e. reveals a certain knowledge and demonstrates certain skills such as the ability to 'reproduce' core models and elements of analysis from the curriculum, but without originality and not adjusted to the given assignment – within the specific economic topic of interest. The answer does not just reflect 'common knowledge' etc., but contains relevant scientific elements.	A fluent and complete answer with use of all relevant elements from the course. Besides demonstrating a satisfactory depth of understanding, the student shows independent thinking and insight by only including the necessary scientific elements etc. in the answer.