



ACST 305 / 858

Quantitative Methods for Asset-
Liability Management

Semester 2, 2010

Department of Actuarial Studies

**MACQUARIE UNIVERSITY
FACULTY OF BUSINESS AND ECONOMICS
UNIT OUTLINE**

ACST 305 / 858 Quantitative Methods for Asset-Liability Management

SECOND SEMESTER 2010

Unit convenor: Jiwook Jang
Prerequisites: ACST201(P) or ACST202(P); STAT272(P). Please consult the Unit Convenor if you do not meet any of the prerequisite requirements for the unit.
Credit points: 4

Students in this unit should read this unit outline carefully at the start of semester. It contains important information about the unit. If anything in it is unclear, please consult the unit convenor.

ABOUT THIS UNIT

Tuesday lectures will cover utility theory and simple asset allocation, mean-variance portfolio theory, the Capital Asset Pricing Model (CAPM), single factor model, measures of investment risk and the efficient market hypothesis.

Thursday lectures will cover random walk, Brownian motions, martingale, stochastic calculus and Ito's lemma. These are essential to know to learn derivatives pricing starting week 5. With the introduction of the concept of forward, futures, swap and options in Week 1& 2 Tuesday lectures, the binomial lattice model is first used as a method of valuing the European option in discrete time steps, where arbitrage-free pricing framework is explained via replicating portfolio and risk-neutral probability measure. Next, we introduce the Black-Scholes option pricing model, which values the European option in continuous time. The Greeks are introduced and dynamic hedging techniques will also be shown. American and exotic option pricing are also covered in Week 8 lecture.

With the introduction of the relations among short rate, forward rate and default-free zero coupon bond price in Week 8 Tuesday lecture, we cover the term structure of interest rates and examine various models that are used in practice in this area. Considering the defaultability of the companies, we also study credit risk models based on firm-value and intensity-based approach respectively.

TEACHING STAFF

The staff involved in the teaching of this unit are

Staff Member	Email	Telephone	Room
--------------	-------	-----------	------

Dr Jiwook Jang (Unit Convenor)	jiwook.jang@mq.edu.au	9850 8575	E4A 613
Pan Jiang (Unit Administrator)	jennypan408@gmail.com		
Minh Phan (Tutor)	minh.phan@mq.edu.au		

Pan Jiang is a teaching administrator for this unit, who is responsible for all the administrative aspects of the unit. Administrative questions *that are not covered in this unit outline* should be directed to her on the Private Mail facility of the website. If the questions are of interest to everyone in the unit, the question and the reply will be posted to the Discussion Board, so you should specifically request if you want your message to remain private.

Questions about unit content should be sent to the Discussion Board of the website or raised during tutorials or lectures.

CLASSES

This unit will consist of 4 hours of lectures and 1 hour tutorial per week. Lectures are held at the following times:

Day	Time	Location
Tuesday	1.00 pm – 3:00 pm	W5A PRICE
Thursday	2:00 pm – 4:00 pm	C5C T1

One tutorial is held on every Thursday:

Day	Time	Location
Thursday	4.00 pm – 5:00 pm	C5C T1

The tutorial is an opportunity for you to attempt the section exercises given at the end of each section of work, and to discuss problems with the tutor.

There is **no** tutorial held during Week 1 and 2.

Any alterations to the class times or locations will be advised in lectures and via the website.

CONSULTATION HOURS

There will be no consultation hours as questions about unit content should be initially posted on the Discussion Board of the website.

If face-to-face consultations for academic queries are required, students should contact to the unit convenor via the Macquarie University e-mail system to make an appointment.

REQUIRED AND RECOMMENDED TEXTS AND/OR MATERIALS

The recommended textbooks for this course are:

Title	Author	Chapters
Options, Futures and Other Derivatives (7th edition)	John Hull	Chapters 1, 2, 4, 5, 7, 8, 9, 10, 11, 12, 13, 15, 16, 17, 19, 20, 22, 23, 24, 27, 30, 31
An Introduction to the Mathematics of Financial Derivatives (2nd edition)	Salih N. Neftci	Chapters 2, 4, 6, 7, 9, 10, 11, 13, 14, 15, 17, 18, 19, 20, 21, 22
Interest Rate Models: An Introduction	Andrew J. G. Cairns	Chapter 11
Investment Science	David G. Luenberger	Chapters 4, 6, 7, 8, 9, 10, 11, 12, 13
Modern Portfolio Theory and Investment Analysis	Edwin J. Elton, Martin J. Gruber, Stephen J. Brown and William N. Goetzmann	Chapter 4, 5, 6, 13, 16, 17, 21, 23, 24

The textbook by Hull includes many worked examples and exercises. You may wish to buy a copy of the Solutions Manual. Each copy of these books is available in the Reserve section of the Library.

Lecture notes can also be found from the ActEd Study Materials (subject CT8). You can purchase these notes via ASSOC at a discounted price. Information about their availability and price will be confirmed on Blackboard and in the lectures.

The advanced textbooks for this course are:

Title	Author	Chapters
Risk-Neutral Valuation - Pricing and Hedging of Financial Derivatives (1 st Edition)	N. H. Bingham and R. Kiesel	Chapters 1, 4, 5, 6, 8
Quantitative Risk Management	Alexander J. McNeil, Rüdiger Frey and Paul Embrechts	Chapter 8
The Theory of Stochastic Processes	D. R. Cox and H. D. Miller	Chapters 2, 5
Introduction to Probability Models (8th edition)	Sheldon Ross	Chapter 6

UNIT WEB PAGE

To access the website, go to <http://learn.mq.edu.au> and login using your usual login and password. You will then have access to the websites for all the units in which you are enrolled. If you have any trouble logging in (e.g. you have forgotten your password), please contact the Student IT Helpdesk.

Before logging in, you should follow the link labelled "Technical Information" and read all the information there, including the Information Technology Security Policy and

Rules and the Information Technology Usage Rules. This technical information also mentions a number of “plugins” that may be required. Of those listed, in this unit you will only need Acrobat Reader.

The web site will be used as an integral part of this unit. The website for this unit contains:

- **Course content:**
 - **Unit outline.** A copy of this unit outline.
 - **Lecture notes and Reading lists.**
 - **Weekly exercises with solutions.**
 - **Tests and exams.** Past class tests and exams with solutions.
- **Discussions.** A Discussions board to discuss problems with your fellow students.
- **Mail.** To contact the teaching administrator and for the teaching administrator to contact you.

It is your responsibility to check the website regularly to make sure that you are up-to-date with announcements and with messages sent to your Mail address.

Remember to close your browser when you have finished using the site. If you don't, another person can use the still running browser to access the website with your account.

LEARNING OBJECTIVES AND OUTCOMES

This unit aims to introduce students to Brownian motions, stochastic calculus, derivatives pricing, interest rate models, credit risk models, financial market theory and portfolio management. The learning objectives of this unit are summarised at the beginning (or at the end) of each lecture. You should review lecture notes in advance of each lecture and after completing each section of work.

In addition to the discipline-based learning objectives, all academic programs at Macquarie seek to develop students' generic skills in a range of areas. One of the aims of this unit is that students develop their skills in the following: *Critical analysis skills; Problem-solving skills; Creative thinking skills.*

TEACHING AND LEARNING STRATEGY

The unit material is covered in the four hours of lectures each week. The tutorial is an opportunity for you to attempt questions for each section of work, or to ask questions. In addition to the tutorial, you should use the Discussion Board to ask questions or discuss concepts covered in the unit.

Week	Week Beginning	Tuesday Lecture Topics	Thursday Lecture Topics	Tutorial	Lecturer
1	2 August	Spot, Options Swaps.	Futures, and stochastic processes	Introduction of	JJ
2	9 August	Spot, Options Swaps.	Futures, and stochastic processes	Introduction of	JJ
3	16 August	Binomial option pricing model via replicating portfolio.	Martingale, Introduction of stochastic calculus, Ito's lemma.	Tutorial	JJ
4	23 August	Binomial option pricing model via risk neutral probability distribution.	Binomial lattice model.	Tutorial	JJ
5	30 August	Introduction of Black-Scholes option pricing model.	Black-Scholes option pricing model via replication.	Tutorial	JJ
6	6 September	Relations among short rate, forward rate and default-free zero-coupon bond.	Black-Scholes option pricing model via risk neutral probability distribution	Tutorial	JJ
7	13 September	Test 1	Greeks and dynamic hedging.	Tutorial	JJ
STUDY BREAK	20 September 27 September				
8	5 October	Stochastic interest rate models.	American and exotic option pricing.	Tutorial	JJ
9	11 October	Utility Theory, Mean-Variance portfolio theory.	Interest rate models I (Short rate models).	Tutorial	JJ
10	18 October	The CAPM	Interest rate models II (Forward rate models).	Tutorial	JJ
11	25 October	Test 2	Interest rate models II (Forward rate models).	Tutorial	JJ
12	1 November	The CAPM, Single factor model, Measurements of Investment Risk.	Credit risk models I (Firm-value model).	Tutorial	JJ
13	8 November	Efficient Market Hypothesis.	Credit risk models II (Intensity-based model).	Tutorial	JJ

RELATIONSHIP BETWEEN ASSESSMENT AND LEARNING OUTCOMES

This unit is assessed using two class tests and a final examination. The following table gives an indication of the relative weighting of the assessment components:

Mid-Semester Test 1 (Cover topics up to Week 6)	15%
Mid-Semester Test 2 (Cover topics up to Week 10)	15%
Final Examination (Cover all topics)	70%

The assessment structure is suitable given the problem-solving and technical nature of the unit, and is also aimed at encouraging you to regularly review the material. An assessment schedule is given below and any changes to the assessment or assessment due dates will be advised in classes.

In addition to tasks that count for assessment, you will be provided with Lecture Examples and Tutorial Exercises to attempt before the tutorials. Lecture Examples and Tutorial Exercises solutions are available on the website after lectures/tutorials. Lecture Examples and Tutorial Exercises are aimed at helping you to understand the fundamental concepts before moving on to more difficult material. They are also aimed at developing your understanding of the unit material so that you are able to successfully complete the assessable tasks.

Past class tests and examinations with full solutions are available from the website, and give you a good source of practice questions that are of examination difficulty.

Mid-Semester Tests

There will be two class tests, each worth **15%** of the final assessment for the unit.

- Test 1 will be held Tuesday 14 September at 1 pm. It will cover topics up to Week 6.
- Test 2 will be held Tuesday 26 October at 1 pm. It will cover topics up to Week 10.

Please note that coverage may be subject to change and that any alterations will be advised in lectures/on Blackboard.

The format of the mid-semester test will be a written paper consisting of three (3) or four (4) questions. You will answer in the spaces provided on the test paper, although a writing booklet will be distributed to you for scribbling (which is NOT collected or marked). All answers must be written in black or blue pen or a pencil (do NOT use a red pen).

When the test is marked, you will be notified to collect them from **BESS** (E4B106). Class feedback and a marking guide will be provided on the website. It is hoped that marked papers will be returned within 12 working days of the class test date.

You should contact the unit convenor immediately (eg. prior to the test) if unexpected ill-health or other disruption affects your preparation for or performance in a class test. Applications for special consideration due to documented illness or unavoidable

disruption must then be made on the “Special Consideration” form, available at <http://www.registrar.mq.edu.au/Forms/APScons.pdf>, and submitted to the unit convenor.

Exam

The final examination (3 hours with 10 minutes reading time) is worth **70%** of the final assessment for the unit. The examination will cover the entire course. You will be allowed to take **one** A4 page into the exam (handwritten or typed and filled in on one or two sides).

The University Examination period in Second Half Year 2010 is from 17 November to 3 December.

You are expected to present yourself for examination at the time and place designated in the University Examination Timetable. The timetable will be available in Draft form approximately eight weeks before the commencement of the examinations and in Final form approximately four weeks before the commencement of the examinations. <http://www.timetables.mq.edu.au/exam>

The only exception to not sitting an examination at the designated time is because of documented illness or unavoidable disruption. In these circumstances you may wish to consider applying for Special Consideration. The University’s policy on special consideration process is available at http://www.mq.edu.au/policy/docs/special_consideration/policy.html

If a Supplementary Examination is granted as a result of the Special Consideration process the examination will be scheduled after the conclusion of the official examination period. (Individual Faculties may wish to signal when the Faculties’ Supplementary Exams are normally scheduled.)

The Macquarie university examination policy details the principles and conduct of examinations at the University. The policy is available at: <http://www.mq.edu.au/policy/docs/examination/policy.htm>

SPECIAL CONSIDERATION FOR EXAM

The University is committed to equity and fairness in all aspects of its learning and teaching. In stating this commitment, the University recognises that there may be circumstances where a student is prevented by unavoidable disruption from performing in accordance with their ability. A special consideration policy exists to support students who experience serious and unavoidable disruption such that they do not reach their usual demonstrated performance level. The policy and procedure are available at:

http://www.mq.edu.au/policy/docs/special_consideration/policy.html

http://www.mq.edu.au/policy/docs/special_consideration/procedure.html

RULES REGARDING TESTS AND EXAMINATIONS

Normal examination rules apply to the conduct of test and the final examination. These rules are set out under the heading "Conduct of Examinations" in the Student Information – Assessment section of the current Macquarie University Handbook of Undergraduate Studies. Students are responsible for familiarising themselves with these rules prior to the class test and the final examination.

You should ensure that your handwriting in the class test and in the final examination is legible. Sections of work that are not legible will not be marked.

Academic Senate has resolved that no mobile phones should be brought into examination rooms. Mobile phones must be switched off and sealed in closed bags during class tests.

Calculators will be allowed in the class test and the final examination but a clear indication of the steps involved in every calculation must be shown. Any machines that have a text-retrieval capacity, whether or not they have a full alphabet on the keyboard, are not allowed. Calculators may be checked at the commencement of class test and final exam, and the make/model may be recorded.

Dictionaries will not be permitted in the class test or the final examination.

PLAGIARISM

The University defines plagiarism in its rules: "Plagiarism involves using the work of another person and presenting it as one's own." Plagiarism is a serious breach of the University's rules and carries significant penalties. You must read the University's practices and procedures on plagiarism. These can be found in the *Handbook of Undergraduate Studies* or on the web at: <http://www.student.mq.edu.au/plagiarism>

The policies and procedures explain what plagiarism is, how to avoid it, the procedures that will be taken in cases of suspected plagiarism, and the penalties if you are found guilty. Penalties may include a deduction of marks, failure in the unit, and/or referral to the University Discipline Committee.

UNIVERSITY POLICY ON GRADING

Macquarie University uses the grades HD, D, Cr, P, PC and F for grading the achievements of students in units of study. The meaning of each symbol is explained in the Bachelor Degree Rules in the current Macquarie University Handbook of Undergraduate Studies. Your final result will include one of these grades plus a standardised numerical grade (SNG).

The numerical marks resulting from assessment of your work in this unit will be used as an initial indicator of the quality of your learning and understanding. The use of these numerical marks is, however, only a starting point in determining the appropriate grade. In particular, note that the SNG ranges mentioned in the Handbook of Undergraduate Studies are not the raw marks. To obtain a grade you must satisfy the qualitative definition of that grade. Once your grade has been determined, you are allocated an SNG indicating your approximate position amongst students assigned that grade.

GRADING APPEALS AND FINAL EXAMINATION SCRIPT VIEWING

If, at the conclusion of the unit, you have performed below expectations, and are considering lodging an appeal of grade and/or viewing your final exam script please refer to the following website which provides information about these processes and the cut off dates in the first instance. Please read the instructions provided concerning what constitutes a valid grounds for appeal before appealing your grade.

http://www.businessandeconomics.mq.edu.au/for/new_and_current_students/undergraduate/admin_central/grade_appeals

There will be a very limited time to make this request, and this must be done through the formal process rather than by a request to the unit convenor.

Please note that all marks will not be recorded on exam scripts in this unit. Instead, marks and marker notes / comments are recorded in detailed spreadsheets (which are not provided to individual students). **You will not, therefore, gain access to your raw marks by viewing your exam scripts.** The purpose of viewing your exam script is to compare your answers with the sample solutions for the purpose of identifying where you showed a lack of understanding.

STUDENT SUPPORT SERVICES

Macquarie University provides a range of Academic Student Support Services. Details of these services can accessed at <http://www.student.mq.edu.au>.

BESS. The Business and Economics Student Centre (BESS) is located in room E4B106 and offers photocopying facilities, reading areas and reference material. Class tests will be returned to BESS. Information about facilities and services is at http://businessandeconomics.mq.edu.au/for/new_and_current_students/undergraduate/bess.

ACSTINFO. This ACSTINFO site is used to distribute information to all students majoring in actuarial studies. The information supplied may include administrative information and job advertisements. You will retain access to this site during the vacation following the end of this semester. It is to your advantage to ensure you read information on this web site regularly. You should not assume that information posted there will also be repeated in lectures. To access the site, login at: <http://learn.mq.edu.au/> and the site should appear among your list of units. When you first login, please read the section labelled "How to use this site." This contains useful information which will help you determine when there is new information on the site which you should read.

IT CONDITIONS OF USE

Access to all student computing facilities within the Faculty of Business and Economics is restricted to authorised coursework for approved units. Student ID cards must be displayed in the locations provided at all times.

Students are expected to act responsibly when utilising University IT facilities. The following regulations apply to the use of computing facilities and online services:

- Accessing inappropriate web sites or downloading inappropriate material is not permitted. Material that is not related to coursework for approved unit is deemed inappropriate.
- Downloading copyright material without permission from the copyright owner is illegal, and strictly prohibited. Students detected undertaking such activities will face disciplinary action, which may result in criminal proceedings.

Non-compliance with these conditions may result in disciplinary action without further notice.

Students must use their Macquarie University email addresses to communicate with staff as it is University policy that the University issued email account is used for official University communication.

EXEMPTIONS

The unit ACST 305/858 corresponds to the professional subject CT8. **You require a Credit grade or higher to receive the exemption.**

INSTITUTE OF ACTUARIES OF AUSTRALIA

The Institute of Actuaries of Australia (IAAust) has recently launched a new free offer for students to become IAAust University Subscribers. Full time undergraduates studying at an Institute accredited university who are members of a university student actuarial society are eligible. To sign up, go to

<http://www.actuaries.asn.au/Membership/MembershipoftheInstitute/Subscriber.aspx>.

The University Subscriber offer is not a membership of the IAAust but a subscription to receive information on career opportunities, invitations to selected IAAust events and online publications. You might also consider joining the IAAust – there are advantages in doing so while a full-time student. For membership information, go to

<http://www.actuaries.asn.au/Membership/MembershipoftheInstitute.aspx>

CLASS ETIQUETTE

Mobile phones should be switched off during all lectures and tutorials. If there is an important reason for you to keep your phone on you should request to be allowed to do so before the start of the class.

Lectures commence at 5 minutes past the hour and you are expected to be punctual. You are expected to keep talking to a minimum so as not to disrupt your fellow students (and the lecturer!).

ELECTRONIC COMMUNICATION AND YOUR STUDENT FILE

Every business keeps a record of its correspondence with its customers. The University is no exception and it maintains a file for every student. Staff are required to ensure that copies of all correspondence with you are added to your file. Historically, “correspondence” meant letters, but nowadays it also includes electronic communication such as email. Staff have some discretion here and might not file copies of trivial emails, but it is difficult to define precise boundaries here, so it is safer to assume that any email you send to a staff member will be added to your file.

Some people regard email as more ephemeral than a letter and thus tend to take less care with issues such as clarity of expression, grammar and spelling. Before sending an email to a staff member, a good question to ask yourself is: “If a member of staff is reviewing my student file prior to writing a reference for me, and they see a copy of this email, would that staff member gain a favourable impression of my level of communication skills?”

In this context, email includes communications you send to staff with the mail tool in the unit's web site. It does not normally include postings you make to the discussion area. However, in those very rare cases where a student makes an inappropriate posting to the discussion area, a copy of the posting would be added to that student's file.

FEEDBACK

I would welcome your feedback on any aspect of the unit.

If you see that something could be improved, let me know your ideas and if I agree that your ideas are good I will make changes. You can give me feedback in lectures or by posting to the website (anonymously if need be).

I hope not to see any feedback in the end-of-semester unit evaluations that I haven't heard about already and therefore had the opportunity to respond to. Please get involved in making this unit as useful and rewarding as possible.

Jiwook Jang
26 July 2010