



# ACST816

## Quantitative Asset and Liability Modelling 1

S1 Day 2015

*Dept of Applied Finance and Actuarial Studies*

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## General Information

Unit convenor and teaching staff

Unit Convenor

Jiwook Jang

[jiwook.jang@mq.edu.au](mailto:jiwook.jang@mq.edu.au)

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E4A 613

Weekly Discussion Board

Credit points

4

Prerequisites

(ACST601 and ACST603 and ACST604) or (admission to MActPrac post 2014)

Corequisites

ACST851 and (STAT806 or STAT810)

Co-badged status

This unit is co-badged with ACST306.

Unit description

This unit examines: utility theory and simple asset allocation; mean-variance portfolio theory; the capital asset pricing model; measures of investment risk; single and multifactor models; arbitrage pricing theory; and the efficient market hypothesis. With the introduction of derivatives – forwards, futures and options – the single period binomial option pricing model (discrete time model) and the Black-Scholes option pricing model (continuous time model) are covered for European, American and exotic options. Stochastic interest rates and moments of the accumulation of annuities are also studied. Students gaining a grade of credit or higher in both ACST816 and ACST817 are eligible for exemption from subject CT8 of the professional exams of the Institute of Actuaries of Australia.

## Important Academic Dates

Information about important academic dates including deadlines for withdrawing from units are available at <https://www.mq.edu.au/study/calendar-of-dates>

## Learning Outcomes

On successful completion of this unit, you will be able to:

Decision making via utility functions

Asset pricing using Capital Asset Pricing Model (CAPM), single/multi index models and

Arbitrage Pricing Theory (APT) Model

Measuring investment risk using various risk measures

Detecting three forms of market efficiency

A stochastic approach to the theory of interest - the mean and variance of the accumulation of a string of payments

Understanding option and single to multi-period Binomial option pricing model (discrete time model), American and Exotic option pricing via Binomial model

## General Assessment Information

### GradeBook

Assignment and class test marks are available on GradeBook. It is the responsibility of students to view their marks for each within session assessment on iLearn within 20 working days of posting. If there are any discrepancies, students must contact the unit convenor immediately. Failure to do so will mean that queries received after the release of final results regarding assessment marks (not including the final exam mark) will not be addressed."

## Assessment Tasks

Name	Weighting	Due
<a href="#"><u>Class Test 1</u></a>	5%	Wednesday 25 March 1:00pm
<a href="#"><u>Assignment</u></a>	15%	Monday 20 April 2:00pm
<a href="#"><u>Class Test 2</u></a>	10%	Monday 18 May 9:00am
<a href="#"><u>Final Examination</u></a>	70%	Examination period

### Class Test 1

Due: **Wednesday 25 March 1:00pm**

Weighting: **5%**

No materials will be allowed to take into the class test 1. Non-programmable calculators with no text-retrieval capacity are allowed. Dictionaries are not permitted.

No extensions will be granted. Students who have not submitted the task prior to the deadline will be awarded mark of 0 for the task, except for cases in which an application for special consideration is made and approved.

On successful completion you will be able to:

- Decision making via utility functions

- Asset pricing using Capital Asset Pricing Model (CAPM), single/multi index models and Arbitrage Pricing Theory (APT) Model
- Measuring investment risk using various risk measures
- A stochastic approach to the theory of interest - the mean and variance of the accumulation of a string of payments

## Assignment

Due: **Monday 20 April 2:00pm**

Weighting: **15%**

Assignment has to be submitted to ACST307/817 Assignment Box in BESS (E4B 106).

No extensions will be granted. Late tasks will be accepted up to 72 hours after the submission deadline. There will be a deduction of 20% of the total available marks made from the total awarded mark for each 24 hour period or part thereof that the submission is late (for example, 25 hours late in submission – 40% penalty). This penalty does not apply for cases in which an application for special consideration is made and approved.

On successful completion you will be able to:

- Decision making via utility functions
- Asset pricing using Capital Asset Pricing Model (CAPM), single/multi index models and Arbitrage Pricing Theory (APT) Model

## Class Test 2

Due: **Monday 18 May 9:00am**

Weighting: **10%**

You are permitted ONE A4 page of paper containing reference material printed on both sides. The material may be handwritten or typed. The page will not be returned at the end of the class test 2. Nonprogrammable calculators with no text-retrieval capacity are allowed. Dictionaries are not permitted.

No extensions will be granted. Students who have not submitted the task prior to the deadline will be awarded mark of 0 for the task, except for cases in which an application for special consideration is made and approved.

On successful completion you will be able to:

- Measuring investment risk using various risk measures
- A stochastic approach to the theory of interest - the mean and variance of the accumulation of a string of payments
- Understanding option and single to multi-period Binomial option pricing model (discrete

time model), American and Exotic option pricing via Binomial model

## Final Examination

Due: **Examination period**

Weighting: **70%**

You are permitted ONE A4 page of paper containing reference material printed on both sides. The material may be handwritten or typed. The page will not be returned at the end of the final examination. Non-programmable calculators with no text-retrieval capacity are allowed. Dictionaries are not permitted.

On successful completion you will be able to:

- Decision making via utility functions
- Asset pricing using Capital Asset Pricing Model (CAPM), single/multi index models and Arbitrage Pricing Theory (APT) Model
- Measuring investment risk using various risk measures
- Detecting three forms of market efficiency
- A stochastic approach to the theory of interest - the mean and variance of the accumulation of a string of payments
- Understanding option and single to multi-period Binomial option pricing model (discrete time model), American and Exotic option pricing via Binomial model

## Delivery and Resources

### Classes

This unit consist of 2 hours of lectures and 2 hours tutorial per week, Lectures are held at the following times: Monday 9:00-11:00noon E7B T3.

ACST816 Tutorials are held at the following times, commencing in Week 2:

Wednesday 12:00-2:00pm E4B 314 (Jiwook Jang (Week 2-13) and Jiaqin Wei (Week 9-12))

You must attend the tutorial class. 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.

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

### Required and Recommended Texts and/or Materials Prescribed

Required texts

Lecture materials are available for downloading from ACST306/816 teaching website.

Recommended textbooks

Lecture materials are available for downloading from ACST306/816 teaching website.

- Investment Science; David Luenberger
- Modern Portfolio Theory and Investment Analysis; Edwin J. Elton, Martin J. Gruber, Stephen J. Brown and William N. Goetzmann
- Investment Mathematics and Statistics; Andrew Adams, Della Bloomfield, Philip Booth and Peter England
- Options, Futures and Other Derivatives (8th Edition); John Hull

Each copy of these books is available in the Reserve section of the Library and can be purchased from the Macquarie University Co-op bookshops

Optional ActEd material

- The ActEd CT8, that can be purchased directly from ActEd.

### **Technology Used and Required**

Students need to be able to use a computer to analyse financial problems. You should be able to use a word processing package (such as WORD), a spreadsheet (such as EXCEL), a statistical package (such as MINITAB) and a programming language (such as Visual Basics or Matlab). Although the unit does not aim to teach students how to use computers, as this is covered in prerequisite units, you are encouraged to make use of spreadsheets and other software packages for the assignment.

Unit Web Page

To access the website, go to <http://ilearn.mq.edu.au> and login using your usual login and password.

### **Changes since the last offering**

Nil.

## **Unit Schedule**

Week Lecture Topics

1. Utility Theory
2. Decision making via utility functions
3. Mean-Variance portfolio theory
4. The CAPM
5. Single/Multi index models and Arbitrage pricing theory (APT) (Class Test 1 - Wednesday 25 March 1:00pm)
6. Measurements of investment risk (Assignment due - Monday 20th April at 2pm)

Semester Break

7. Stochastic interest rate models
8. Options, Single period Binomial option pricing model
9. Multi period Binomial option pricing model
10. American and Exotic option pricing via Binomial model
11. Class Test 2 (Monday 18 May 9:00-11:00noon)
12. Efficient market hypothesis
13. Revision

## Policies and Procedures

Macquarie University policies and procedures are accessible from [Policy Central](#). Students should be aware of the following policies in particular with regard to Learning and Teaching:

Academic Honesty Policy [http://mq.edu.au/policy/docs/academic\\_honesty/policy.html](http://mq.edu.au/policy/docs/academic_honesty/policy.html)

Assessment Policy <http://mq.edu.au/policy/docs/assessment/policy.html>

Grading Policy <http://mq.edu.au/policy/docs/grading/policy.html>

Grade Appeal Policy <http://mq.edu.au/policy/docs/gradeappeal/policy.html>

Grievance Management Policy [http://mq.edu.au/policy/docs/grievance\\_management/policy.html](http://mq.edu.au/policy/docs/grievance_management/policy.html)

Disruption to Studies Policy [http://www.mq.edu.au/policy/docs/disruption\\_studies/policy.html](http://www.mq.edu.au/policy/docs/disruption_studies/policy.html) *The Disruption to Studies Policy is effective from March 3 2014 and replaces the Special Consideration Policy.*

In addition, a number of other policies can be found in the [Learning and Teaching Category](#) of Policy Central.

## Student Code of Conduct

Macquarie University students have a responsibility to be familiar with the Student Code of Conduct: [https://students.mq.edu.au/support/student\\_conduct/](https://students.mq.edu.au/support/student_conduct/)

## Results

Results shown in *iLearn*, or released directly by your Unit Convenor, are not confirmed as they are subject to final approval by the University. Once approved, final results will be sent to your student email address and will be made available in [eStudent](#). For more information visit [ask.mq.edu.au](http://ask.mq.edu.au).

Supplementary Exams

Further information regarding supplementary exams, including dates, is available here [http://www.businessandconomics.mq.edu.au/current\\_students/undergraduate/how\\_do\\_i/special\\_consideration](http://www.businessandconomics.mq.edu.au/current_students/undergraduate/how_do_i/special_consideration)

## Student Support

Macquarie University provides a range of support services for students. For details, visit <http://students.mq.edu.au/support/>

### Learning Skills

Learning Skills ([mq.edu.au/learningskills](http://mq.edu.au/learningskills)) provides academic writing resources and study strategies to improve your marks and take control of your study.

- [Workshops](#)
- [StudyWise](#)
- [Academic Integrity Module for Students](#)
- [Ask a Learning Adviser](#)

## Student Services and Support

Students with a disability are encouraged to contact the [Disability Service](#) who can provide appropriate help with any issues that arise during their studies.

## Student Enquiries

For all student enquiries, visit Student Connect at [ask.mq.edu.au](http://ask.mq.edu.au)

## IT Help

For help with University computer systems and technology, visit <http://informatics.mq.edu.au/help/>.

When using the University's IT, you must adhere to the [Acceptable Use Policy](#). The policy applies to all who connect to the MQ network including students.

## Graduate Capabilities

### PG - Discipline Knowledge and Skills

Our postgraduates will be able to demonstrate a significantly enhanced depth and breadth of knowledge, scholarly understanding, and specific subject content knowledge in their chosen fields.

This graduate capability is supported by:

#### Learning outcomes

- Decision making via utility functions
- Asset pricing using Capital Asset Pricing Model (CAPM), single/multi index models and Arbitrage Pricing Theory (APT) Model
- Measuring investment risk using various risk measures
- Detecting three forms of market efficiency



- A stochastic approach to the theory of interest - the mean and variance of the accumulation of a string of payments
- Understanding option and single to multi-period Binomial option pricing model (discrete time model), American and Exotic option pricing via Binomial model

## **Assessment tasks**

- Class Test 1
- Assignment
- Class Test 2
- Final Examination

## **PG - Critical, Analytical and Integrative Thinking**

Our postgraduates will be capable of utilising and reflecting on prior knowledge and experience, of applying higher level critical thinking skills, and of integrating and synthesising learning and knowledge from a range of sources and environments. A characteristic of this form of thinking is the generation of new, professionally oriented knowledge through personal or group-based critique of practice and theory.

This graduate capability is supported by:

## **Learning outcomes**

- Decision making via utility functions
- Asset pricing using Capital Asset Pricing Model (CAPM), single/multi index models and Arbitrage Pricing Theory (APT) Model
- Measuring investment risk using various risk measures
- Detecting three forms of market efficiency
- A stochastic approach to the theory of interest - the mean and variance of the accumulation of a string of payments
- Understanding option and single to multi-period Binomial option pricing model (discrete time model), American and Exotic option pricing via Binomial model

## **Assessment tasks**

- Class Test 1
- Assignment
- Class Test 2
- Final Examination

## **PG - Research and Problem Solving Capability**

Our postgraduates will be capable of systematic enquiry; able to use research skills to create new knowledge that can be applied to real world issues, or contribute to a field of study or

practice to enhance society. They will be capable of creative questioning, problem finding and problem solving.

This graduate capability is supported by:

## Learning outcomes

- Decision making via utility functions
- Asset pricing using Capital Asset Pricing Model (CAPM), single/multi index models and Arbitrage Pricing Theory (APT) Model
- Measuring investment risk using various risk measures
- Detecting three forms of market efficiency
- A stochastic approach to the theory of interest - the mean and variance of the accumulation of a string of payments
- Understanding option and single to multi-period Binomial option pricing model (discrete time model), American and Exotic option pricing via Binomial model

## Assessment tasks

- Class Test 1
- Assignment
- Class Test 2
- Final Examination

## Research and Practice

- This unit uses research from external sources:

Edwin J. Elton and Martin J. Gruber: "Modern portfolio theory, 1950 to date",  
Journal of Banking & Finance, 21 (1997) 1743-1759.

Markowitz, H.M. (March 1952): "Portfolio Selection", Journal of Finance, 7 (1): 77–91.

Ross, Stephen (1976): "The arbitrage theory of capital asset pricing", Journal of Economic Theory 13 (3): 341–360.

Neumann, John von & Morgenstern, Oskar (1944): Theory of Games and Economic Behavior, Princeton, NJ: Princeton University Press.

[John C. Cox](#), [Stephen A. Ross](#), and [Mark Rubinstein](#) (1979): "Option Pricing: A Simplified Approach", Journal of Financial Economics 7: 229-263.

- This unit gives you opportunities to conduct your own research.

## Changes since First Published

Date	Description
09/02/2015	The due date for assignment submission in the unit schedule has been updated.