



# ACST816

## Quantitative Asset and Liability Modelling 1

S1 Day 2019

*Department of Actuarial Studies and Business Analytics*

### Contents

<u>General Information</u>	2
<u>Learning Outcomes</u>	2
<u>General Assessment Information</u>	3
<u>Assessment Tasks</u>	3
<u>Delivery and Resources</u>	5
<u>Unit Schedule</u>	6
<u>Policies and Procedures</u>	7
<u>Graduate Capabilities</u>	9
<u>Research and Practice</u>	10

#### **Disclaimer**

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## General Information

Unit convenor and teaching staff

Unit Convenor

Jiwook Jang

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E4A 613

Weekly Discussion Board

Credit points

4

Prerequisites

ACST603 or (admission to MActPrac post 2014)

Corequisites

ACST851 and (STAT806 or STAT810)

Co-badged status

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 and 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

### Assessment Criteria

Assessment criteria for all assessment tasks will be provided on the unit iLearn site

### 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.

### Feedback Prior to the Census Date

Self-assessment exercise question(s) will be released in Week 3 for feedback prior to the census date. Its answer will be also provided before the census date in Week 4.

## Assessment Tasks

Name	Weighting	Hurdle	Due
<u>Class Test 1</u>	5%	No	Monday 25 March 11:00am
<u>Assignment</u>	15%	No	Thursday 11 April 12:00noon
<u>Class Test 2</u>	20%	No	Thursday 23 May 12:00noon
<u>Final Examination</u>	60%	No	Examination period

### Class Test 1

Due: **Monday 25 March 11:00am**

Weighting: **5%**

Class test 1 will be 45 minutes written papers with no reading time, held during the tutorial time.

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.

Students who do not sit the test will be awarded a mark of 0, 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

## Assignment

Due: **Thursday 11 April 12:00noon**

Weighting: **15%**

Assignment has to be submitted via both on **iLearn** and ACST306/816 **Assignment Box** in BESS.

No extensions will be granted. There will be a deduction of 10% 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 – 20% penalty). This penalty does not apply for cases in which an application for special consideration is made and approved. No submission will be accepted after solutions have been posted.

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: **Thursday 23 May 12:00noon**

Weighting: **20%**

Class test 2 will be 95 minutes written papers with no reading time, held during the lecture time.

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 be returned to the students at the end of the class test 2. Nonprogrammable calculators with no text-retrieval capacity are allowed. Dictionaries are not permitted.

Students who do not sit the test will be awarded a mark of 0, 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 and 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

## Final Examination

Due: **Examination period**

Weighting: **60%**

The final examination will be a three-hour written paper with ten minutes reading time, held during the University Examination period.

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 be returned to the students 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 and 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: Thursday 12:00-2:00pm, 14SCO T2.

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

Monday 10:00-12:00noon, 8SCO 179.

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; 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**

None.

## **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

(Class Test 1 - Monday 25 March 11:00am)

6. Arbitrage pricing theory (APT)

7. Measurements of investment risk

(Assignment due - Thursday 11 April 12:00noon)

Semester Break

8. Options

9. Single/Multi period Binomial option pricing model

10. American and Exotic option pricing via Binomial model

11. Class Test 2 (Thursday 23 May 12:00-2:00pm)

12. Stochastic interest rate models / Efficient market hypothesis

13. Revision

## Policies and Procedures

Macquarie University policies and procedures are accessible from [Policy Central](https://staff.mq.edu.au/work/strategy-planning-and-governance/university-policies-and-procedures/policy-central) (<https://staff.mq.edu.au/work/strategy-planning-and-governance/university-policies-and-procedures/policy-central>). Students should be aware of the following policies in particular with regard to Learning and Teaching:

- [Academic Appeals Policy](#)
- [Academic Integrity Policy](#)
- [Academic Progression Policy](#)
- [Assessment Policy](#)
- [Fitness to Practice Procedure](#)
- [Grade Appeal Policy](#)
- [Complaint Management Procedure for Students and Members of the Public](#)
- [Special Consideration Policy](#) (**Note:** *The Special Consideration Policy is effective from 4 December 2017 and replaces the Disruption to Studies Policy.*)

Undergraduate students seeking more policy resources can visit the [Student Policy Gateway](https://students.mq.edu.au/support/study/student-policy-gateway) (<https://students.mq.edu.au/support/study/student-policy-gateway>). It is your one-stop-shop for the key policies you need to know about throughout your undergraduate student journey.

If you would like to see all the policies relevant to Learning and Teaching visit [Policy Central](https://staff.mq.edu.au/work/strategy-planning-and-governance/university-policies-and-procedures/policy-central) (<https://staff.mq.edu.au/work/strategy-planning-and-governance/university-policies-and-procedures/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/study/getting-started/student-conduct>

## Results

Results published on platform other than [eStudent](#), (eg. iLearn, Coursera etc.) 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> or if you are a Global MBA student contact [globalmba.support@mq.edu.au](mailto:globalmba.support@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>) 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>

If you are a Global MBA student contact [globalmba.support@mq.edu.au](mailto:globalmba.support@mq.edu.au)

## IT Help

For help with University computer systems and technology, visit [http://www.mq.edu.au/about\\_us/offices\\_and\\_units/information\\_technology/help/](http://www.mq.edu.au/about_us/offices_and_units/information_technology/help/).

When using the University's IT, you must adhere to the [Acceptable Use of IT Resources 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 and 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 and 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 and 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.