



# ACST887

## Quantitative Asset and Liability Modelling 1

S1 Day 2019

*Department of Actuarial Studies and Business Analytics*

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## General Information

Unit convenor and teaching staff

Unit Convenor

Colin Zhang

[colin.zhang@mq.edu.au](mailto:colin.zhang@mq.edu.au)

E4A 227

Refer to iLearn

Credit points

4

Prerequisites

(STAT810 or STAT806) and ACST881

Corequisites

Co-badged status

Unit description

This unit examines: rational expectations theory, rational choice theory, behavioural economics, properties of risk measures, risk and insurance companies, stochastic interest rate models, mean-variance portfolio theory, asset pricing models and single and multifactor returns models.

## 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 and understanding rational expectations theory, rational choice theory, behavioural economics

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

Being capable to measure investment risk and understanding how insurance companies help to reduce or remove risk as well as the policyholder behaviour.

Demonstrating ability to use a stochastic approach to the theory of rate of return - 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)

Learning how to use run-off triangles for liability valuation

## 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
<a href="#"><u>Class Test 1</u></a>	20%	No	Week 7
<a href="#"><u>Assignment</u></a>	20%	No	Wednesday 22 May 12:00noon
<a href="#"><u>Final Examination</u></a>	60%	No	Examination period

### Class Test 1

Due: **Week 7**

Weighting: **20%**

Class test 1 will be 90 minutes written papers with no reading time, held during the Lecture 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.

Formula sheet will be provided.

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 and understanding rational expectations theory,

rational choice theory, behavioural economics

- Asset pricing using Capital Asset Pricing Model (CAPM), single/multi index models and Arbitrage Pricing Theory (APT) Model
- Being capable to measure investment risk and understanding how insurance companies help to reduce or remove risk as well as the policyholder behaviour.
- Demonstrating ability to use a stochastic approach to the theory of rate of return - the mean and variance of the accumulation of a string of payments

## Assignment

Due: **Wednesday 22 May 12:00noon**

Weighting: **20%**

Assignment has to be submitted via the tool on the unit's iLearn web site.

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 and understanding rational expectations theory, rational choice theory, behavioural economics
- Asset pricing using Capital Asset Pricing Model (CAPM), single/multi index models and Arbitrage Pricing Theory (APT) Model
- Being capable to measure investment risk and understanding how insurance companies help to reduce or remove risk as well as the policyholder behaviour.
- Demonstrating ability to use a stochastic approach to the theory of rate of return - 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)

## 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.

No materials will be allowed to take into the exam. Non-programmable calculators with no text-

retrieval capacity are allowed. Dictionaries are not permitted.

Formula sheet will be provided.

On successful completion you will be able to:

- Decision making via utility functions and understanding rational expectations theory, rational choice theory, behavioural economics
- Asset pricing using Capital Asset Pricing Model (CAPM), single/multi index models and Arbitrage Pricing Theory (APT) Model
- Being capable to measure investment risk and understanding how insurance companies help to reduce or remove risk as well as the policyholder behaviour.
- Demonstrating ability to use a stochastic approach to the theory of rate of return - 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)
- Learning how to use run-off triangles for liability valuation

## Delivery and Resources

### Classes

The timetables for classes can be found on the University website at:

<https://timetables.mq.edu.au/2019/>.

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 iLearn website.

#### Recommended textbooks

- Adams, A., Bloomfield, D., Booth, P., & England, P. (1993). *Investment mathematics and statistics*. London: Graham & Tortman.
- Elton, E. J., Gruber, M. J., Brown, S. J., & Goetzmann, W. N. (2010). *Modern portfolio theory and investment analysis* (8th ed.). John Wiley and Sons.
- Hull, J. C. (2012). *Options, futures and other derivatives* (8th ed.). Pearson Education.

- Luenberger, D. G. (2014). *Investment science* (2nd ed.). New York: Oxford University Press.
- Wilkinson, N., & Klaes, M. (2014). *An introduction to behavioral economics* (2nd ed.). London: Macmillan education Palgrave.

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 CM2, 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.

## Unit Schedule

Week 1	Utility theory
Week 2	Stochastic dominance, Behavioural finance
Week 3	Measures of investment risk
Week 4	stochastic models of investment returns
Week 5	Portfolio theory
Week 6	Models of asset returns
Week 7	Mid-term class test/ Asset pricing models
Week 8	Asset pricing models

Week 9	Characteristics of derivative securities
Week 10	Characteristics of derivative securities
Week 11	Binomial model
Week 12	Runoff triangle
Week 13	Runoff triangle /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](https://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](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)

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 and understanding rational expectations theory, rational choice theory, behavioural economics
- Asset pricing using Capital Asset Pricing Model (CAPM), single/multi index models and Arbitrage Pricing Theory (APT) Model
- Being capable to measure investment risk and understanding how insurance companies help to reduce or remove risk as well as the policyholder behaviour.
- Demonstrating ability to use a stochastic approach to the theory of rate of return - 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)
- Learning how to use run-off triangles for liability valuation

## Assessment tasks

- Class Test 1
- Assignment
- 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 and understanding rational expectations theory, rational choice theory, behavioural economics
- Asset pricing using Capital Asset Pricing Model (CAPM), single/multi index models and Arbitrage Pricing Theory (APT) Model
- Being capable to measure investment risk and understanding how insurance companies help to reduce or remove risk as well as the policyholder behaviour.
- Demonstrating ability to use a stochastic approach to the theory of rate of return - the mean and variance of the accumulation of a string of payments
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- Learning how to use run-off triangles for liability valuation

## **Assessment tasks**

- Class Test 1
- Assignment
- 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 and understanding rational expectations theory, rational choice theory, behavioural economics
- Asset pricing using Capital Asset Pricing Model (CAPM), single/multi index models and Arbitrage Pricing Theory (APT) Model
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## **Assessment tasks**

- Class Test 1
- Assignment
- 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.