



# ECFS881

## Derivatives Valuation

AFC Term 4 City 2018

*Archive (Pre-2019) - Dept of Applied Finance and Actuarial Studies*

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#### **Disclaimer**

Macquarie University has taken all reasonable measures to ensure the information in this publication is accurate and up-to-date. However, the information may change or become out-dated as a result of change in University policies, procedures or rules. The University reserves the right to make changes to any information in this publication without notice. Users of this publication are advised to check the website version of this publication [or the relevant faculty or department] before acting on any information in this publication.

## General Information

|   |
|---|
| Unit convenor and teaching staff<br>Unit Convenor / Lecturer<br>Rob Trevor<br><a href="mailto:rob.trevor@mafc.mq.edu.au">rob.trevor@mafc.mq.edu.au</a><br>Contact via Email   |
| Credit points<br>2  |
| Prerequisites<br>(Admission to MAppFin or MAppFin(Adv) or GradDipAppFin or GradCertPost-MAppFin) and ECFS867  |
| Corequisites  |
| Co-badged status  |
| Unit description<br>This unit deals with important quantitative issues for derivatives market practitioners. The aim is to extend the student's understanding of derivatives valuation. This unit looks at key numerical techniques and applies them to value exotic, GARCH and interest rate options in cases where classical Black-Scholes assumptions are inappropriate. Teaching uses both lectures and hands-on sessions with computer software. |

## 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:

Understand how to appropriately adjust and apply discounted expected cash flow valuation to a derivative context.

Understand key analytical and numerical techniques for derivatives valuation including their appropriate applications and limitations.

Implement and apply appropriate techniques to value exotic, GARCH, bond and interest rate options in cases where classical Black-Scholes assumptions are inappropriate.

Critically evaluate the biases in Black-Scholes and know when its use is inappropriate.

Apply appropriate options and hedging valuation techniques to various situations.

Develop skills in communicating complex technical concepts.

## General Assessment Information

To pass this unit (requires a Mark of 50 or better) the student must pass the final examination.

## Assessment Tasks

| Name                                | Weighting | Hurdle | Due                |
|-------------------------------------|-----------|--------|--------------------|
| <a href="#">Pre-unit Assignment</a> | 10%       | No     | First Lecture      |
| <a href="#">Assignment</a>          | 35%       | No     | Refer to iLearn    |
| <a href="#">Final Exam</a>          | 55%       | Yes    | Refer to Timetable |

### Pre-unit Assignment

Due: **First Lecture**

Weighting: **10%**

#### Summary of Assessment Task

**Individual / Group:** Individual.

**Due Date:** First lecture.

**Grading Method:** Refer to 'Standards Required to Complete the Unit Satisfactorily' section.

**Submission Method:** In first lecture.

**Duration:** Maximum 12 standard pages.

#### Extension Requests:

- No extensions will be granted unless prior arrangements have been made with the lecturer. No submission will be accepted after solutions have been provided.
- In the absence of such arrangements, late submission will result in zero marks, unless an application for Special Consideration is made and approved. Refer to MAFC Program Rules at [www.mafc.mq.edu.au](http://www.mafc.mq.edu.au) for information on the University's Special Consideration Policy

**Other Information:** The assignment is distributed with the lecture notes.

On successful completion you will be able to:

- Understand how to appropriately adjust and apply discounted expected cash flow valuation to a derivative context.

## Assignment

Due: **Refer to iLearn**

Weighting: **35%**

### Summary of Assessment Task

**Individual / Group:** Individual.

**Due Date:** Refer to the unit's iLearn site.

**Grading Method:** Refer to 'Standards Required to Complete the Unit Satisfactorily' section.

**Submission Method:** Online via Turnitin on the unit's iLearn site.

**Duration:** Maximum 16 standard pages plus code.

### Extension Requests:

- No extensions will be granted unless an application for Special Consideration is made and approved. If you have extenuating circumstances that prevent you from submitting your assignment by the due date, you must apply for Special Consideration as soon as reasonably possible. Refer to MAFC Program Rules at [www.mafc.mq.edu.au](http://www.mafc.mq.edu.au) for information on the University's Special Consideration Policy.
- Unless such prior arrangements have been made, any late submission of assignments will automatically be penalised. 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).
- No submissions will be accepted after solutions have been posted.

**Other Information:** The assignment is distributed during the weekend classes.

On successful completion you will be able to:

- Understand how to appropriately adjust and apply discounted expected cash flow valuation to a derivative context.
- Understand key analytical and numerical techniques for derivatives valuation including their appropriate applications and limitations.
- Implement and apply appropriate techniques to value exotic, GARCH, bond and interest rate options in cases where classical Black-Scholes assumptions are inappropriate.
- Apply appropriate options and hedging valuation techniques to various situations.
- Develop skills in communicating complex technical concepts.

## Final Exam

Due: **Refer to Timetable**

Weighting: **55%**

**This is a hurdle assessment task (see [assessment policy](#) for more information on hurdle assessment tasks)**

### **Summary of Assessment Task**

**Individual / Group:** Individual.

**Due Date:** Refer to Timetable.

**Grading Method:** Refer to 'Standards Required to Complete the Unit Satisfactorily' section.

**Submission Method:** As per MAFC Program Rules at [www.mafc.mq.edu.au](http://www.mafc.mq.edu.au)

**Duration:** 2 hours plus 10 minutes reading time.

### **Examination Conditions:**

- The exam will be a closed book exam. More details will be given in class.
- Exam times and locations are noted in the unit timetable at [www.mafc.mq.edu.au](http://www.mafc.mq.edu.au).
- Refer to MAFC Program Rules at [www.mafc.mq.edu.au](http://www.mafc.mq.edu.au).

### **Extension Requests:**

- You are expected to present yourself for examination at the time and place designated in the relevant MAFC Timetable at [www.mafc.mq.edu.au](http://www.mafc.mq.edu.au).
- Deferral of an examination is not permitted unless an application for Special Consideration is made and approved.
- Refer to MAFC Program Rules at [www.mafc.mq.edu.au](http://www.mafc.mq.edu.au) for information on the University's Special Consideration Policy or non-attendance at an examination.

On successful completion you will be able to:

- Understand how to appropriately adjust and apply discounted expected cash flow valuation to a derivative context.
- Understand key analytical and numerical techniques for derivatives valuation including their appropriate applications and limitations.
- Implement and apply appropriate techniques to value exotic, GARCH, bond and interest rate options in cases where classical Black-Scholes assumptions are inappropriate.
- Critically evaluate the biases in Black-Scholes and know when its use is inappropriate.
- Apply appropriate options and hedging valuation techniques to various situations.
- Develop skills in communicating complex technical concepts.

## Delivery and Resources

### CLASSES

**Face-to-Face Teaching:** Generally 20 hours.

**Timetable:** Detailed timetable for classes are on the Centre's website at [www.mafc.mq.edu.au](http://www.mafc.mq.edu.au)

#### **Consultation Times:**

Students who wish to contact any of the teaching staff may do so through:

- The unit's iLearn site, in relation to general queries (so that all students may benefit); or
- Individual consultation with the lecturer by email in the first instance, if necessary.

### REQUIRED AND RECOMMENDED TEXTS AND/OR MATERIALS

**Text:** Nil.

#### **Additional Readings:**

- Additional readings are included in the unit notes.
- **Students should assume these readings are examinable unless otherwise advised.**

**Lecture Notes:** Available in printed form and electronically via iLearn.

**Pre-unit Materials:** Information papers on statistics, regression, accounting and other material may be found at <http://mafstudents.mq.edu.au/new-to-mafc/pre-course-materials/>. Students should work through this material prior to commencing the degree. The material will remain a useful reference as students progress through the program.

#### **Useful Article References:**

- John C. Hull *Options, Futures, and Other Derivative Securities*, Prentice-Hall 10th Edition, 2018.
- Other books which may be of some value for parts of the unit include:
  - Robert Jarrow and Stuart Turnbull, *Derivatives Securities*, South-Western Publishing 2<sup>nd</sup> Edition, 2000. (This is now out of print.)
  - McDonald, Robert L. *Derivatives Markets (3rd edition)*. Pearson Education/Addison Wesley/Prentice Hall (they're all the same), Boston 2013.
  - Kerry Back, *A Course in Derivative Securities: Introduction to Theory and Computation*, Springer Finance, 2005. (Note: This is a bit more mathematical than Hull, but still accessible for some students and much more accessible than many such books.)

#### **Calculators:**

- In examinations, any of the following calculators are permitted but not required:
  - Hewlett Packard hp17bII+
  - Hewlett Packard hp12c platinum or hp12c
  - Texas Instruments BAII PLUS (also the PROFESSIONAL version).
- No other calculators, mobile phones or computers are permitted in examinations.

### Assumed Knowledge:

- To complete the assignment, students will have to modify some Excel macros, written in Microsoft's VBA language.
- Students are not required to have VBA experience, but will need to be comfortable with learning how to modify the supplied macros. You will be shown how to do such modifications during the hands-on sessions.
- Support will also be provided via iLearn.

### Assumed Access:

- Access to a computer with word processing and MS Excel (with VBA) spreadsheet capability is assumed, as is general student computer literacy.
- Almost any version of MS Office (back to Office 95) on either Mac or Windows, will do. If you have a Mac, you will need Office 2004 or earlier, or Office 2011 (with Service Pack 1) or later. (**Office 2008 won't suffice since it doesn't have VBA.**)
- About one third of the class will need to bring a laptop computer to the weekend classes for the hands-on sessions. If you have one, or can arrange to borrow one from a friend or your employer for the weekend, please bring it provided it has an appropriate version of MS Excel installed.

## TECHNOLOGY USED AND REQUIRED

### Unit iLearn Site:

- Found by logging on to iLearn [ilearn.mq.edu.au](http://ilearn.mq.edu.au), then clicking on **ECFS881 Derivatives Valuation**.
- This is where you will find forums, downloadable resources and links to important pages.
- The forum allows you to communicate with other students and lecturer(s) and may provide supplementary material.
- You are requested to post your questions on the forums at least 24 hours prior to the assignment submission date or the examination date. Questions posted after that time may not be answered. **Please try to not leave your questions to the last few days.**

### Important Notice:

- It is important that you familiarise yourself with the unit's iLearn site.
- Students should check the unit's iLearn site regularly (minimum twice a week and prior to all lectures) and look for updates and distribution of materials (including case studies) related to the unit or assessments and, if relevant, participate in forum discussions.

## Unit Schedule

### NUMERICAL TECHNIQUES IN OPTION PRICING

#### Topics:

- the process behind the Black Scholes formula
- the Black-Scholes differential equation and the “risk-neutralised” process
- using simulation and binomial trees to approximate this process
- implementing Monte Carlo valuation with variance reduction
- Quasi–Monte Carlo
- more general trees and lattices, improving convergence
- finite difference schemes
- analytical approximations

### PRICING AND HEDGING EXOTIC OPTIONS

#### Topics:

- digital, gap, paylater, compound, chooser, exchange and rainbow options
- barriers, lookback and average (Asian) options
- special cases where pricing formula or approximations exist
- applying the numerical techniques

### GARCH OPTIONS—EXPLAINING THE BIASES IN BLACK SCHOLES

#### Topics:

- the GARCH model for spot prices
- pricing options under a GARCH process
- Monte Carlo approaches
- the Ritchken & Trevor lattice
- how well does it account for the strike price and maturity biases?

### INTEREST RATE OPTIONS

#### Topics:

- the Black model for bond and interest rate options



- caps, floors, collars, swaptions
- problems in using the Black model
- simple term structure models—Vasicek and single factor models
- Black-Derman–Toy, Hull and White and time varying parameter models
- the Heath, Jarrow, Morton paradigm, volatility structures and generalised Vasicek

## Learning and Teaching Activities

### Strategy

The Master of Applied Finance degree adopts a deep teaching and learning strategy, in which students acquire and retain knowledge and also are able to make sense of the issues and concepts and apply them in the “real world”. The degree relies heavily on student engagement and participation by: (a) Continuous learning throughout the term. This is encouraged through a combination of students undertaking prescribed reading throughout the units and/or completion of practice problems, case studies, assignments, class presentations etc and interaction via forums in the unit’s iLearn site; and (b) Assessments, which enable the student to demonstrate his/her understanding of the learning objectives achieved through the continuous learning.

### Student Participation

Students participate in this unit by: (a) Attending lectures and participating in class discussion; (b) Before each class, completing the recommended readings of notes and text, and working systematically through suggested problem sets; (c) Interacting on the unit’s iLearn site; and (d) Completing all assessment tasks and exams. On average, the unit will require students to complete, for every hour of class time, approximately 3 hours private study.

## 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](http://staff.mq.edu.au/work/strategy-planning-and-governance/university-policies-and-procedures/policy-central) (<http://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 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).

Students should also consult the MAFC Program Rules found at <http://www.mafc.mq.edu.au>

## 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 enquiry service (MAFC-specific)

For all student enquiries, please contact [studentsupport@mafc.mq.edu.au](mailto:studentsupport@mafc.mq.edu.au)

## 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.

## Learning Skills

Learning Skills ([http://www.students.mq.edu.au/support/learning\\_skills/](http://www.students.mq.edu.au/support/learning_skills/)) 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 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://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 - Capable of Professional and Personal Judgment and Initiative

Our postgraduates will demonstrate a high standard of discernment and common sense in their professional and personal judgment. They will have the ability to make informed choices and decisions that reflect both the nature of their professional work and their personal perspectives.

This graduate capability is supported by:

#### Learning outcomes

- Understand how to appropriately adjust and apply discounted expected cash flow valuation to a derivative context.
- Understand key analytical and numerical techniques for derivatives valuation including their appropriate applications and limitations.
- Implement and apply appropriate techniques to value exotic, GARCH, bond and interest rate options in cases where classical Black-Scholes assumptions are inappropriate.
- Critically evaluate the biases in Black-Scholes and know when its use is inappropriate.
- Apply appropriate options and hedging valuation techniques to various situations.
- Develop skills in communicating complex technical concepts.

#### Assessment tasks

- Pre-unit Assignment
- Assignment
- Final Exam

## 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

- Understand how to appropriately adjust and apply discounted expected cash flow valuation to a derivative context.
- Understand key analytical and numerical techniques for derivatives valuation including their appropriate applications and limitations.
- Implement and apply appropriate techniques to value exotic, GARCH, bond and interest rate options in cases where classical Black-Scholes assumptions are inappropriate.
- Critically evaluate the biases in Black-Scholes and know when its use is inappropriate.
- Apply appropriate options and hedging valuation techniques to various situations.
- Develop skills in communicating complex technical concepts.

### Assessment tasks

- Pre-unit Assignment
- Assignment
- Final Exam

## 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

- Understand how to appropriately adjust and apply discounted expected cash flow valuation to a derivative context.
- Understand key analytical and numerical techniques for derivatives valuation including their appropriate applications and limitations.
- Implement and apply appropriate techniques to value exotic, GARCH, bond and interest rate options in cases where classical Black-Scholes assumptions are inappropriate.

- Critically evaluate the biases in Black-Scholes and know when its use is inappropriate.
- Apply appropriate options and hedging valuation techniques to various situations.
- Develop skills in communicating complex technical concepts.

## **Assessment tasks**

- Pre-unit Assignment
- Assignment
- Final Exam

## **PG - Engaged and Responsible, Active and Ethical Citizens**

Our postgraduates will be ethically aware and capable of confident transformative action in relation to their professional responsibilities and the wider community. They will have a sense of connectedness with others and country and have a sense of mutual obligation. They will be able to appreciate the impact of their professional roles for social justice and inclusion related to national and global issues

This graduate capability is supported by:

## **Learning outcomes**

- Understand how to appropriately adjust and apply discounted expected cash flow valuation to a derivative context.
- Understand key analytical and numerical techniques for derivatives valuation including their appropriate applications and limitations.
- Implement and apply appropriate techniques to value exotic, GARCH, bond and interest rate options in cases where classical Black-Scholes assumptions are inappropriate.
- Critically evaluate the biases in Black-Scholes and know when its use is inappropriate.
- Apply appropriate options and hedging valuation techniques to various situations.
- Develop skills in communicating complex technical concepts.

## **Assessment tasks**

- Pre-unit Assignment
- Assignment
- Final Exam

## **Important Notice**

This Unit Guide may be subject to change. The latest version is on the Centre's website at [www.mafc.mq.edu.au](http://www.mafc.mq.edu.au).

Students should read the Unit Guide carefully at the start of term. It contains important information about the unit. If anything is unclear, please consult one of the unit lecturers.

## Standards Required to Complete the Unit Satisfactorily

### University Policy on Grading:

- Macquarie University’s Academic Senate has established a Grading Policy available at <http://www.mq.edu.au/policy/docs/grading/policy.html>. Your final result will include:
  - A grade ranging from Fail Hurdle to High Distinction; and
  - A numerical Mark which is a summation of the individual assessment components, providing the examination component is passed.
- It is important to note:
  - The Policy does not require that a minimum or maximum number of students are to be failed in any unit;
  - Grades will not be allocated to fit a predetermined distribution; and
  - Grades for all individual assessment items will be released to students, but Marks may not be necessarily be released.

### Specific Unit Grading:

- To pass this unit (i.e. requires a Mark of 50 or better) the student must pass the final examination.
  - Students who have attained a total raw mark of 50% or greater in a unit, but have failed the unit’s exam requirement and who have demonstrated “sufficient effort” in the exam, will be granted a single opportunity to sit a Supplementary Exam which will be graded on a pass/fail basis. The unit mark and grade for students who pass this examination will be those corresponding to the original total raw mark of all their assessment tasks, including the original exam. That is, the Supplementary Hurdle Exam only determines the meeting of the hurdle requirement. Students who have attained a raw mark of 50% or greater in a unit, yet failed all attempts at the requirement, will be awarded an Fail Hurdle grade with a final Mark of 49.
- All final Marks and Grades in the Applied Finance Centre are determined by a grading committee and are not the sole responsibility of the unit convenor.

| Grade            | Expectation   |
|------------------|---|
| High Distinction | Provides consistent evidence of deep and critical understanding in relation to the learning outcomes. There is substantial originality and insight in identifying, generating and communicating competing arguments, perspectives or problem solving approaches; critical evaluation of problems, their solutions and their implications; creativity in application as appropriate to the discipline. |

| Grade       | Expectation  |
|-------------|--|
| Distinction | Provides evidence of integration and evaluation of critical ideas, principles and theories, distinctive insight and ability in applying relevant skills and concepts in relation to learning outcomes. There is demonstration of frequent originality in defining and analysing issues or problems and providing solutions; and the use of means of communication appropriate to the discipline and the audience.  |
| Credit      | Provides evidence of learning that goes beyond replication of content knowledge or skills relevant to the learning outcomes. There is demonstration of substantial understanding of fundamental concepts in the field of study and the ability to apply these concepts in a variety of contexts; convincing argumentation with appropriate coherent justification; communication of ideas fluently and clearly in terms of the conventions of the discipline.    |
| Pass        | Provides sufficient evidence of the achievement of learning outcomes. There is demonstration of understanding and application of fundamental concepts of the field of study; routine argumentation with acceptable justification; communication of information and ideas adequately in terms of the conventions of the discipline. The learning attainment is considered satisfactory or adequate or competent or capable in relation to the specified outcomes. |
| Fail        | Does not provide evidence of attainment of learning outcomes. There is missing or partial or superficial or faulty understanding and application of the fundamental concepts in the field of study; missing, undeveloped, inappropriate or confusing argumentation; incomplete, confusing or lacking communication of ideas in ways that give little attention to the conventions of the discipline.   |
| Fail Hurdle | Student has obtained a raw mark over 50, yet failed all available attempts of at least one hurdle assessment.  |

**Review of Grade and final examination Script viewing:**

- A student who has been awarded a final grade for a unit and who does not believe it is an accurate reflection of their performance, and has grounds for such a claim and can demonstrate those grounds, may apply to have their grade reviewed.
- For information on requesting a review of grade and/or viewing your final exam script, please refer to the University’s Grade Appeal Policy at <http://www.mq.edu.au/policy/docs/gradeappeal/policy.html> and MAFC Program Rules at <http://www.mafc.mq.edu.au>.