FINM3007: Advanced Derivatives Pricing and Applications

This is an advanced course in derivatives pricing and hedging, and their applications. The aim is to cover topics such as: advanced features of the Black-Scholes model, including exotic options, derivatives dependent on the same Brownian motion; some bivariate/multivariate theory (normal distribution, Brownian motion in 2 dimensions), as needed for pricing options on correlated assets; Rubinstein's binomial pyramid for approximating a bivariate GBM; change of numeraire and equivalent martingale measures; optimal stopping theory as needed for American option pricing; hedging concepts in this context; alternatives to Black-Scholes models; local volatility models, jump diffusion and GARCH models. There will be an emphasis on early exercise options, and some time will be spent on the mathematical/stochastic foundations necessary for understanding these and other applications. Some Value-at-Risk concepts may be introduced, and applied to portfolios containing derivatives. Credit derivatives may also be discussed.

<table>
<thead>
<tr>
<th>Mode of Delivery</th>
<th>On campus</th>
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<tbody>
<tr>
<td>Prerequisites</td>
<td>Completion of FINM3003 or equivalent</td>
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<tr>
<td>Incompatible Courses</td>
<td>None</td>
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<tr>
<td>Co-taught Courses</td>
<td>None</td>
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<tr>
<td>Course Convener:</td>
<td><a href="mailto:Ross.Maller@anu.edu.au">Ross.Maller@anu.edu.au</a></td>
</tr>
<tr>
<td>Phone:</td>
<td>6125 3650</td>
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<tr>
<td>Email:</td>
<td><a href="mailto:Ross.Maller@anu.edu.au">Ross.Maller@anu.edu.au</a></td>
</tr>
<tr>
<td>Office hours for student consultation:</td>
<td>TBA</td>
</tr>
<tr>
<td>Research Interests</td>
<td>Probability, Stoch. Processes, Statistics, their applications in Finance, etc.</td>
</tr>
<tr>
<td>Relevant administrator</td>
<td>Adriana Longhitano</td>
</tr>
<tr>
<td>Phone:</td>
<td>Tel: 6125 6189</td>
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<td>Email:</td>
<td><a href="mailto:Adriana.Longhitano@anu.edu.au">Adriana.Longhitano@anu.edu.au</a></td>
</tr>
<tr>
<td>Tutor</td>
<td>Kevin Lu</td>
</tr>
</tbody>
</table>
COURSE OVERVIEW

SEMESTER 2

2018

Course Description

This is an advanced course in derivatives pricing and hedging, and their applications. It carries on from where Continuous Time Finance (FINM3003) left off. The aim is to cover much of the remaining material in Hull (2012), other than that mentioned in CTF, together with additional material. About half the course will be spent on advanced features of the Black-Scholes model, including derivatives dependent on the same Brownian motion, and some bivariate/multivariate theory (normal distribution, Brownian motion in 2 dimensions), needed for pricing options on correlated assets. Rubinstein’s binomial pyramid for approximating a bivariate GBM, change of numeraire and equivalent martingale measures are to be revised. The optimal stopping theory needed for an understanding of American option will also be addressed, along with a more intensive study of hedging concepts in this context. The remainder of the course will aim to examine alternatives to Black-Scholes models; possibilities include local volatility, jump diffusion and GARCH models. Some time will be spent on the mathematical/stochastic foundations necessary for understanding these and other applications. Some Value-at-Risk concepts may be introduced, and applied to portfolios containing derivatives. Credit derivatives may also be discussed.

Learning Outcomes

By the end of this course students are expected to have attained a sound working knowledge of the arbitrage-free approach to the pricing of options, including exotic options, the basic mathematical tools required, and the use of options in financial practice. A basic knowledge of Brownian motion, martingales and Itô’s formula should be acquired or reinforced. Options on correlated assets, including the mathematical/stochastic foundations necessary for understanding these, will be learned. An understanding of the theory and use of early exercise options, supplemented with the optimal stopping theory needed, should be gained. The use of alternatives to Black-Scholes models such as local volatility, jump diffusion and GARCH models, should be understood.

Tutorial Seminar Registration

Tutorial signup for this course will be done via the Wattle website. Detailed information about signup times will be provided on Wattle or during your first lecture. When tutorials are available for enrolment, follow these steps:

1. Log on to Wattle, and go to the course site
2. Click on the link “Tutorial enrolment”
3. On the right of the screen, click on the tab “Become Member of…..” for the tutorial class you wish to enter
4. Confirm your choice

If you need to change your enrolment, you will be able to do so by clicking on the tab “Leave group….” and then re-enrol in another group. You will not be able to enrol in groups that have reached their maximum number. Please note that enrolment in ISIS must be finalised for you to have access to Wattle.
Policies

ANU has educational policies, procedures and guidelines, which are designed to ensure that staff and students are aware of the University’s academic standards, and implement them. You can find the University’s education policies and an explanatory glossary at: http://policies.anu.edu.au/

Students are expected to have read the Academic Misconduct Rule before the commencement of their course.

Other key policies include:

- Student Assessment (Coursework)
- Student Surveys and Evaluations

Required Resources

None.

Field trips

None

Additional course costs

None

Examination material or equipment

None

Recommended Resources

Prescribed Text


Recommended Supplementary Reading

• Option Valuation, R. Gibson, McGraw-Hill, 1991

Journals to Consult:

• Risk
• Financial Analysts Journal
• Journal of Portfolio Management
• Journal of Derivatives
• Journal of Financial and Quantitative Analysis
• Derivatives Quarterly
• Review of Derivatives Research
• Derivatives Use, Trading and Regulation
• The Journal of Futures Markets

Research-Led Teaching: Teaching is informed by research.

Feedback: Staff Feedback Written comments, verbal comments.
<table>
<thead>
<tr>
<th>Week/Beginning</th>
<th>Summary of Activities</th>
<th>Assignment</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 23/7/2018</td>
<td>Review of the Continuous Time Market Model; Dividends &amp; American Options: Critical Price, etc.</td>
<td>1 (out)</td>
</tr>
<tr>
<td>2 30/7/2018</td>
<td>Hull's approximation for dividends. Snell Envelope and Optimal Stopping.</td>
<td></td>
</tr>
<tr>
<td>3 6/8/2018</td>
<td>Martingales &amp;etc. review. American Options and Optimal Stopping.</td>
<td>1 (due) 2 (out)</td>
</tr>
<tr>
<td>4 13/8/2018</td>
<td>Change of Numeraire, Derivatives Dependent on the same BM, Option to Exchange Assets.</td>
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<tr>
<td>6 27/8/2018</td>
<td>Binomial Pyramid; Compound Options. Quantos, Siegel's paradox.</td>
<td>2 (due) 3 (out)</td>
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<tr>
<td></td>
<td>2 Week Mid-Semester Teaching Break</td>
<td></td>
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<tr>
<td>7 17/9/2018</td>
<td>Alternatives to BS: Local Volatility, Dupire's Formula, Jump Diffusion, etc.</td>
<td>3 (due) 4 (out)</td>
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<tr>
<td>8 24/9/2018</td>
<td>GARCH, CEV, Heston Models, etc.</td>
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<tr>
<td>9 1/10/2018</td>
<td>Credit Risk and Credit Derivatives.</td>
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<tr>
<td>10 8/10/2018</td>
<td>Value at Risk using EVT and POT methods</td>
<td>4 (due) 5 (out)</td>
</tr>
<tr>
<td>11 15/10/2018</td>
<td>Risk of Portfolio of Derivatives.</td>
<td></td>
</tr>
<tr>
<td>12 22/10/2018</td>
<td>Revision and/or catch-up</td>
<td>5 (due)</td>
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</tbody>
</table>
ASSESSMENT REQUIREMENTS

The ANU is using Turnitin to enhance student citation and referencing techniques, and to assess assignment submissions as a component of the University’s approach to managing Academic Integrity. For additional information regarding Turnitin please visit the ANU Online website.

Students may choose not to submit assessment items through Turnitin. In this instance you will be required to submit, alongside the assessment item itself, copies of all references included in the assessment item.

Assessment Tasks

Assessment Task 1: Assignments

Details of task: 5 assignments to be completed and handed in through the semester. Each one of these is worth 6% of the final mark. Assignments not handed in on time receive a mark of zero. No “redemption” of assignments.

Assessment Task 2: Final Examination

Details of task: Final Examination is compulsory. It is worth 70% of the final mark. No written material or formula sheets may be taken into the final exam.

Examination(s)

Final Examination: Final Examination is compulsory.

No written material or formula sheets may be taken into the final exam

Assignment submission

Online Submission: Unless an exemption has been approved by the Associate Dean (Education) a submission must be through Turnitin. Assignments are submitted using Turnitin in the course Wattle site. You will be required to electronically sign a declaration as part of the submission of your assignment. Please keep a copy of the assignment for your records.

Hard Copy Submission: In exceptional circumstances and with permission students may submit assignments via the physical assignment box. Assignments must include cover sheet. Please keep a copy of tasks completed for your records.

Extensions and penalties

Extensions and late submission of assessment pieces are covered by the Student Assessment (Coursework) Policy and Procedure. The Course Convener may grant extensions for assessment pieces that are not examinations or take-home examinations. If you need an extension, you must request it in writing on or before the due date. If you have documented and appropriate medical evidence that demonstrates you were not able to request an extension on or before the due date, you may be able to request it after the due date.

Returning assignments

Student work is to be returned via Turnitin
**Resubmission of assignments**
Is not permitted.

**Referencing requirements**
None

**Scaling**
Your final mark for the course will be based on the raw marks allocated for each of your assessment items. However, your final mark may not be the same number as produced by that formula, as marks may be scaled. Any scaling applied will preserve the rank order of raw marks (i.e. if your raw mark exceeds that of another student, then your scaled mark will exceed the scaled mark of that student), and may be either up or down.

**Privacy Notice**
The ANU has made a number of third party, online, databases available for students to use. Use of each online database is conditional on student end users first agreeing to the database licensor's terms of service and/or privacy policy. Students should read these carefully.

In some cases student end users will be required to register an account with the database licensor and submit personal information, including their: first name; last name; ANU email address; and other information.

In cases where student end users are asked to submit ‘content’ to a database, such as an assignment or short answers, the database licensor may only use the student’s ‘content’ in accordance with the terms of service – including any (copyright) licence the student grants to the database licensor.

Any personal information or content a student submits may be stored by the licensor, potentially offshore, and will be used to process the database service in accordance with the licensors terms of service and/or privacy policy.

If any student chooses not to agree to the database licensor’s terms of service or privacy policy, the student will not be able to access and use the database. In these circumstances students should contact their lecturer to enquire about alternative arrangements that are available.

**Student Feedback**
ANU is committed to the demonstration of educational excellence and regularly seeks feedback from students. One of the key formal ways students have to provide feedback is through Student Experience of Learning Support (SELS) surveys. The feedback given in these surveys is anonymous and provides the Colleges, University Education Committee and Academic Board with opportunities to recognise excellent teaching, and opportunities for improvement.

For more information on student surveys at ANU and reports on the feedback provided on ANU courses, go to

http://unistats.anu.edu.au/surveys/selt/students/ and
http://unistats.anu.edu.au/surveys/selt/results/learning/

**SUPPORT FOR STUDENTS**
The University offers a number of support services for students. Information on these is available online from http://students.anu.edu.au/studentlife/