

MACQUARIE  
UNIVERSITY



FACULTY OF  
BUSINESS AND ECONOMICS

ACST 865

# Quantitative Methods in Financial Risk Management

Semester 2, 2010

*Department of Actuarial Studies*

**MACQUARIE UNIVERSITY  
FACULTY OF BUSINESS AND ECONOMICS  
UNIT OUTLINE**

**ACST 865 Quantitative Methods in Financial Risk Management**

**SECOND SEMESTER 2010**

**Unit convenor:** Nino Kordzakhia and Jiwook Jang

**Prerequisites:** ACST305/858(P) or ACST828(P) or STAT401/890(P) or Dean of Faculty Approval. Please consult the unit convenor if you do not meet any of the prerequisite requirements for the unit.

**Credit points:** 4

Students in this unit should read this unit outline carefully at the start of semester. It contains important information about the unit. If anything in it is unclear, please consult the unit convenor.

**ABOUT THIS UNIT**

This **4 credit point** unit encompasses theoretical and practical aspects of quantification of three main types of financial risk, namely, market, credit and operational risk. The numerical and statistical modelling techniques introduced in the unit represent the tools adopted by actuarial and banking business to comply with advanced regulatory requirements.

Topics covered include:

- Credit Risk – the risk of default of counterparty
  1. Modelling credit risk: one-factor model
    - Estimation of default probabilities and correlation
  2. Correlation and dependence: copulas
  3. Traditional approaches: default probabilities and transition matrices
  4. Modelling credit risk: the structural and reduced form models
  5. Credit Derivatives: CDS, CDO and default times for first to default swaps
  
- Operational Risk – the risk of losses resulting from failed internal or external processes
  1. The elementary approaches
  2. Regulatory capital for operational risk
  
- Market Risk – the risk of change in the value of position due to changes in underlying market variable
  1. Risk factors and loss distributions
  2. The VAR measure and other risk measures
  3. Copulas revisited: Dependence and Multivariate modelling

4. Market risk VaR: Linear Valuation
5. Market risk VaR: Historical simulation and Monte Carlo simulation
6. Back testing and Stress testing

#### TEACHING STAFF

The staff involved in the teaching of this unit are

Staff Member	Email	Telephone	Room
<b>Dr. Nino Kordzakhia</b> (Unit Convenor)	nino.kordzakhia@mq.edu.au	9850 8549	E4A 537
<b>Dr. Jiwook Jang</b> (Unit Convenor)	jiwook.jang@mq.edu.au	9850 8575	E4A 613
<b>Pan Jiang</b> (Unit Administrator)	jennypan408@gmail.com		

Nino Kordzakhia will be taking Week 1-7 lectures. Jiwook Jang will be taking Week 8-13 lectures.

Pan Jiang is a teaching administrator for this unit, who is responsible for all the administrative aspects of the unit. Administrative questions *that are not covered in this unit outline* should be directed to her on the Mail facility of the Blackboard.

All *academic* queries should be directed to the Unit Co-ordinators via the Macquarie University e-mail system.

#### CLASSES

The unit material is covered in the three hours that combines lectures and tutorials each week. Combined lectures and tutorials are held at the following times:

Day	Time	Location
<b>Thursday (Lecture)</b>	<b>9.00 am – 11:00 am</b>	<b>W6B 338</b>
<b>Thursday (Tutorial)</b>	<b>1.00 pm – 2:00 pm</b>	<b>W5C 311</b>

There is **no** tutorial held during Week 1 and 8.

Weekly lecture & tutorial materials will be available from the Blackboard. Solutions to the examples/exercises covered in lectures/tutorials will be available from the Blackboard after the lecture/tutorial.

Any alterations to the combined lecture or, tutorial times, locations or enrolments will be advised in lectures and/or on the Blackboard.

## CONSULTATION HOURS

There will be **no** official consultation hours. If face-to-face consultations for academic queries are required, students should contact to the staff member teaching the relevant part of the course via the Macquarie University e-mail system to make an appointment.

## REQUIRED AND RECOMMENDED TEXTS AND/OR MATERIALS

The recommended textbook is:

<b>Title</b>	<b>Author</b>
Risk Management and Financial Institutions, Prentice Hall, 2007.	John C. Hull

The textbook by Hull includes the worked examples and exercises. Two copies of this book will be placed in the Reserve Section of the Library.

Other recommended books for this course are:

- Hull, J. (2008, 7<sup>th</sup> Edition): Option, Futures and Other Derivatives
- Dowd, K. (2003): Measuring Market Risk.
- A. J. McNeil, R. Frey and P. Embrechts (2005): Quantitative Risk Management, Princeton University Press.
- Bluhm, C., L. Overbeck and C. Wagner (2002): An introduction to credit risk modelling, Chapman & Hall.
- Schonbucher, P. J. (2003): Credit Derivatives Pricing Models, Wiley.
- Jackel, P. (2002): Monte Carlo Methods in Finance, Wiley.
- Jackson, M., M. Staunton (2002): Advanced modelling in finance using Excel and VBA, Wiley.
- Glasserman, P. (2002): Monte Carlo Methods in Financial Engineering, Springer.
- Lando, D. (2004): Credit Risk Modeling: Theory and Applications. Princeton University Press.
- Crouhy, M., Galai D. and R. Mark (2001): Risk Management. McGraw-Hill.

## UNIT WEB PAGE

To access the website, go to <http://learn.mq.edu.au> and login using your usual login and password. You will then have access to the websites for all the units in which you are enrolled. If you have any trouble logging in (e.g. you have forgotten your password), please contact the Student IT Helpdesk.

Before logging in, you should follow the link labelled "Technical Information" and read all the information there, including the Information Technology Security Policy and Rules and the Information Technology Usage Rules. This technical information also

mentions a number of “plugins” that may be required. Of those listed, in this unit you will only need Acrobat Reader.

The web site will be used as an integral part of this unit. The website for this unit contains:

- **Course content:**
  - **Unit outline**
  - **Unit notes**
  - **Weekly exercises and their answers**
  - **Matlab codes**
  - **Assignments:** Assignment 1 and 2.
  
- **Mail.** To contact the teaching administrator and for the teaching administrator to contact you.

**It is your responsibility to check the website regularly to make sure that you are up-to-date with announcements and with messages sent to your Mail address.**

Remember to close your browser when you have finished using the site. If you don't, another person can use the still running browser to access the website with your account.

#### **LEARNING OBJECTIVES AND OUTCOMES**

The unit aims to cover the key properties of statistical models and measurement techniques specific to financial risk management with a focus on development of computational applications. Students will be exposed to simulation and financial data analysis at the level of development of their own computational routines for a model parameterization and evaluation of model specific risk measures.

In addition to the discipline-based learning objectives, all academic programs at Macquarie seek to develop students' generic skills in a range of areas. One of the aims of this unit is that students develop their skills in the following: *Critical analysis skills; Problem-solving skills; Creative thinking skills.*

#### **TEACHING AND LEARNING STRATEGY**

The unit material is covered in the three hours that combines lectures and tutorials each week. The tutorial is an opportunity for you to attempt questions for each section of work, or to ask questions. In addition to the tutorial, you can have face-to-face consultations for academic queries, for which students should contact to the staff member teaching that part of the course via the Macquarie University e-mail system to make an appointment.

Week	Week Beginning	Lecture Topics	Due Thu 9am	Tutorial	Lecturer
1	2 August	One-factor model. Estimation of default probabilities and correlations.			NK
2	9 August	Correlation and dependence: copulas		Tutorial	NK
3	16 August	Default probabilities and transition matrices		Tutorial	NK
4	23 August	The structural models		Tutorial	NK
5	30 August	The reduced form models		Tutorial	NK
6	6 September	Credit Derivatives	<b>Assign 1</b>	Tutorial	NK
7	13 September	Introduction to Operational Risk		Tutorial	NK
<b>STUDY BREAK</b>	20 September 27 September				
8	5 October	Risk factors, loss distributions and VaR			JJ
9	11 October	Expected shortfall and Coherent Risk Measures		Tutorial	JJ
10	18 October	Multivariate modelling and Copulas		Tutorial	JJ
11	25 October	Market risk VaR: Linear Valuation		Tutorial	JJ
12	1 November	Market risk VaR: Full Valuation 1. Historical Simulation method.		Tutorial	JJ
13	8 November	2. Monte Carlo Simulation method, Stress testing and Back testing	<b>Assign 2</b>	Tutorial	JJ

#### RELATIONSHIP BETWEEN ASSESSMENT AND LEARNING OUTCOMES

This unit is assessed using two assignments and a final examination. The following table gives an indication of the relative weighting of the assessment components:

<b>Assignment 1</b>	<b>15%</b>
<b>Assignment 2</b>	<b>15%</b>
<b>Final Examination</b>	<b>70%</b>

The assessment structure is suitable given the problem-solving and technical nature of the unit, and is also aimed at encouraging you to regularly review the material. An assessment schedule is given below and any changes to the assessment or assessment due dates will be advised in classes/on website.

In addition to tasks that count for assessment, you will be provided with Lecture Examples and Tutorial Exercises to attempt before the tutorials. Lecture Examples

and Tutorial Exercises solutions are available on the website after lectures/tutorials. Lecture Examples and Tutorial Exercises are aimed at helping you to understand the fundamental concepts before moving on to more difficult material. They are also aimed at developing your understanding of the unit material so that you are able to successfully complete the assessable tasks.

Past examination paper will be made available from the website to give you a good source of practice questions that are of examination difficulty.

## **Assignment**

There will be two assignments, each worth **15%** of the final assessment for the unit.

- Assignment 1 due: **Thursday 9 September 2010, 9:00 am**
- Assignment 2 due : **Thursday 11 November 2010, 9:00 am**

Assignments should be handed to the Unit Convenor at the commencement of the lecture in the week the assignment is due. **Late assignments will not be marked.**

Although you may discuss general aspects of the assignments with other students, you will be required to certify that the assignments are all your **own** work, and to provide your detailed working immediately on request if required. Further details of the assignments will be provided in class.

When the assignment is marked, you will be notified to collect them from **BESS** (E4B106). It is hoped that marked papers will be returned within 12 working days of the class test date.

You should contact the corresponding unit convenor immediately (eg. prior to the assignment due date) if unexpected ill-health or other disruption affects your preparation for or performance in an assignment. Applications for special consideration due to documented illness or unavoidable disruption must then be made on the "Special Consideration" form, available at <http://www.registrar.mq.edu.au/Forms/APScons.pdf>, and submitted to the unit convenor.

## **Exam**

The final examination (3 hours with 10 minutes reading time) is worth **70%** of the final assessment for the unit. The examination will cover the entire course. There will be a mix of calculation questions and short answer questions that require you to demonstrate a deeper understanding of the material. You will be allowed to take **one** A4 page into the exam (handwritten or typed and filled in on one or two sides).

The University Examination period in Second Half Year 2010 is from 17 November to 3 December.

You are expected to present yourself for examination at the time and place designated in the University Examination Timetable. The timetable will be available in the Draft form approximately eight weeks before the commencement of the

examinations and in the Final form approximately four weeks before the commencement of the examinations: <http://www.timetables.mq.edu.au/exam>

The only exception to not sitting an examination at the designated time is because of documented illness or unavoidable disruption. In these circumstances you may wish to consider applying for Special Consideration. The University's policy on special consideration process is available at [http://www.mq.edu.au/policy/docs/special\\_consideration/policy.html](http://www.mq.edu.au/policy/docs/special_consideration/policy.html)

If a Supplementary Examination is granted as a result of the Special Consideration process the examination will be scheduled after the conclusion of the official examination period. The Faculty usually will announce when the Supplementary Exams are scheduled within the Faculty.

The Macquarie university examination policy details the principles and conduct of examinations at the University. The policy is available at: <http://www.mq.edu.au/policy/docs/examination/policy.htm>

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#### **SPECIAL CONSIDERATION FOR EXAM**

The University is committed to equity and fairness in all aspects of its learning and teaching. In stating this commitment, the University recognises that there may be circumstances where a student is prevented by unavoidable disruption from performing in accordance with their ability. A special consideration policy exists to support students who experience serious and unavoidable disruption such that they do not reach their usual demonstrated performance level. The policy and procedure are available at:

[http://www.mq.edu.au/policy/docs/special\\_consideration/policy.html](http://www.mq.edu.au/policy/docs/special_consideration/policy.html)

[http://www.mq.edu.au/policy/docs/special\\_consideration/procedure.html](http://www.mq.edu.au/policy/docs/special_consideration/procedure.html)

#### **RULES REGARDING TESTS AND EXAMINATIONS**

Normal examination rules apply to the final examination. These rules are set out under the heading "Conduct of Examinations" in the Student Information – Assessment section of the current Macquarie University Handbook of Undergraduate Studies. Students are responsible for familiarising themselves with these rules prior to the final examination.

You should ensure that your handwriting in the final examination is legible. Sections of work that are not legible will not be marked.

Academic Senate has resolved that no mobile phones should be brought into examination rooms. Mobile phones must be switched off and sealed in closed bags during examination.



Calculators will be allowed in the final examination but a clear indication of the steps involved in every calculation must be shown. Any machines that have a text-retrieval capacity, whether or not they have a full alphabet on the keyboard, are not allowed. Calculators are subject to inspection by the exam invigilators.

Dictionaries will not be permitted in the final examination.

## **PLAGIARISM**

The University defines plagiarism in its rules: "Plagiarism involves using the work of another person and presenting it as one's own." Plagiarism is a serious breach of the University's rules and carries significant penalties. You must read the University's practices and procedures on plagiarism. These can be found in the *Handbook of Undergraduate Studies* or on the web at: <http://www.student.mq.edu.au/plagiarism>

The policies and procedures explain what plagiarism is, how to avoid it, the procedures that will be taken in cases of suspected plagiarism, and the penalties if you are found guilty. Penalties may include a deduction of marks, failure in the unit, and/or referral to the University Discipline Committee.

## **UNIVERSITY POLICY ON GRADING**

Macquarie University uses the grades HD, D, Cr, P, PC and F for grading the achievements of students in units of study. The meaning of each symbol is explained in the Bachelor Degree Rules in the current Macquarie University Handbook of Undergraduate Studies. Your final result will include one of these grades plus a standardised numerical grade (SNG).

The numerical marks resulting from assessment of your work in this unit will be used as an initial indicator of the quality of your learning and understanding. The use of these numerical marks is, however, only a starting point in determining the appropriate grade. In particular, note that the SNG ranges mentioned in the Handbook of Undergraduate Studies are not the raw marks. To obtain a grade you must satisfy the qualitative definition of that grade. Once your grade has been determined, you are allocated an SNG indicating your approximate position amongst students assigned that grade.

## **GRADING APPEALS AND FINAL EXAMINATION SCRIPT VIEWING**

If, at the conclusion of the unit, you have performed below expectations, and are considering lodging an appeal of grade and/or viewing your final exam script please refer to the following website which provides information about these processes and the cut off dates in the first instance. Please read the instructions provided concerning what constitutes a valid grounds for appeal before appealing your grade [http://www.businessandconomics.mq.edu.au/for/new\\_and\\_current\\_students/undergraduate/admin\\_central/grade\\_appeals](http://www.businessandconomics.mq.edu.au/for/new_and_current_students/undergraduate/admin_central/grade_appeals)

There will be a very limited time to make this request, and this must be done through the formal process rather than by a request to the unit convenor.

Please note, that

**“The purpose of a Grade Review application is to resolve any clerical error in your final grade”.**

Usually all marks are not recorded on exam scripts in this unit. Instead, marks and marker notes/comments are recorded in detailed spreadsheets which are not provided to individual students.

The unit convenors will make sure that there are no errors made in the spreadsheet prior the requested viewing of exam script takes place.

**You will not, therefore, gain access to your raw marks by viewing your exam scripts.**

### STUDENT SUPPORT SERVICES

Macquarie University provides a range of Academic Student Support Services. Details of these services can accessed at: <http://www.student.mq.edu.au>

**BESS.** The Business and Economics Student Centre (BESS) is located in room E4B106 and offers photocopying facilities, reading areas and reference material. Class tests will be returned to BESS. Information about facilities and services is at: [http://businessandeconomics.mq.edu.au/for/new\\_and\\_current\\_students/undergraduate/bess](http://businessandeconomics.mq.edu.au/for/new_and_current_students/undergraduate/bess)

**ACSTINFO.** This ACSTINFO site is used to distribute information to all students majoring in actuarial studies. The information supplied may include administrative information and job advertisements. You will retain access to this site during the vacation following the end of this semester. It is to your advantage to ensure you read information on this web site regularly. You should not assume that information posted there will also be repeated in lectures. To access the site, login at: <http://learn.mq.edu.au/> and the site should appear among your list of units. When you first login, please read the section labelled “How to use this site”. This contains useful information which will help you determine when there is a new information on the site which you should read.

### IT CONDITIONS OF USE

Access to all student computing facilities within the Faculty of Business and Economics is restricted to authorised coursework for approved units. Student ID cards must be displayed in the locations provided at all times.

Students are expected to act responsibly when utilising University IT facilities. The following regulations apply to the use of computing facilities and online services:

- Accessing inappropriate web sites or downloading inappropriate material is not permitted. Material that is not related to coursework for approved unit is deemed inappropriate.
- Downloading copyright material without permission from the copyright owner is illegal, and strictly prohibited. Students detected undertaking such activities will face disciplinary action, which may result in criminal proceedings.

Non-compliance with these conditions may result in disciplinary action without further notice.

Students must use their Macquarie University email addresses to communicate with staff as it is University policy that the University issued email account is used for official University communication.

### **CLASS ETIQUETTE**

Mobile phones should be switched off during all lectures and tutorials. If there is an important reason for you to keep your phone on you should request to be allowed to do so before the start of the class.

Lectures commence at 5 minutes past the hour and you are expected to be punctual. You are expected to keep talking to a minimum so as not to disrupt your fellow students (and the lecturer!).

### **ELECTRONIC COMMUNICATION AND YOUR STUDENT FILE**

Every business keeps a record of its correspondence with its customers. The University is no exception and it maintains a file for every student. Staff are required to ensure that copies of all correspondence with you are added to your file. Historically, "correspondence" meant letters, but nowadays it also includes electronic communication such as email. Staff have some discretion here and might not file copies of trivial emails, but it is difficult to define precise boundaries here, so it is safer to assume that any email you send to a staff member will be added to your file.

Some people regard email as more ephemeral than a letter and thus tend to take less care with issues such as clarity of expression, grammar and spelling. Before sending an email to a staff member, a good question to ask yourself is: "If a member of staff is reviewing my student file prior to writing a reference for me, and they see a copy of this email, would that staff member gain a favourable impression of my level of communication skills?"

In this context, email includes communications you send to staff with the mail tool in the unit's web site. It does not normally include postings you make to the discussion area. However, in those very rare cases where a student makes an inappropriate posting to the discussion area, a copy of the posting would be added to that student's file.

### **FEEDBACK**

We would welcome your feedback on any aspect of the unit.

If you see that something could be improved, let us know your ideas and if we agree that your ideas are good we will make changes. You can give us feedback in lectures or by posting to the website (anonymously if need be).

We hope not to see any feedback in the end-of-semester unit evaluations that we haven't heard about already and therefore had the opportunity to respond to. Please get involved in making this unit as useful and rewarding as possible.

Nino Kordzakhia and Jiwook Jang  
26 July 2010