Engineering Tripos Part IIB, 4I1: Strategic Valuation, 2019-20

Module Leader

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Timing and Structure

Christmas vacation - dates below; Assessment: Coursework 100% ind project combining spreadsheet modelling, written analysis and a management-style report - details TBA. You may conduct some Excel modelling with fellow students. Michaelmas/Lent Term break.

Prerequisites

All participants are expected to be familiar with probability and statistics at the level of a final year high school or introductory undergraduate course. See the prerequisites document on the course website for details. Participants are also expected to be familiar with basic Excel spreadsheet modelling (see e.g. http://best-excel-tutorial.com/54-basics for a tutorial). The basic Excel functions and tasks that you must know how to use competently are: MAX, AVERAGE, COUNT, IF, SUMPRODUCT; mathematical formulas based on relative and absolute references; creating simple tables; plotting pie, bar, column and line charts.

Aims

The aims of the course are to:

- See below.

Objectives

As specific objectives, by the end of the course students should be able to:

- See below.

Content

- Module Time: 3 full days (9.00am – 5.00pm) on 9th, 11th, and 13th December 2019.
- Reserve 9th – 16th December 2019 for TPE25 only.
- Reserve 14th - 15th December 2019 for conducting part I of the course assessment.
- Reserve a compulsory Q&A session for the course assessment at 9am-11am on 16th December 2019.
- It is useful for you to have a Window-based laptop for Excel modelling. If you do not have a laptop, be prepared to stay in Cambridge for a few more days after 16th December 2019 so that you can conduct

Excel modelling in the CJBS Computer Lab.
- The level of mathematical theory may be below the expectation of some CUED students.

This module introduces students to two essential and complementary ways of dealing with future uncertainties. On one hand, we have diversification, the notion that you should "not put all your eggs in one basket", is both intuitive and ubiquitous in modern management. This exemplifies passive risk management. On the other, we have the real options paradigm. This emphasises that future value depends both on unfolding uncertainties, which you cannot control, and the flexibility of your future responses. By investing in research and development projects, for example, companies buy the option to launch a product, which they may or may not exercise, depending on the level of success of the R and D effort and on market conditions at the time of launch. However, flexibility also costs money: R and D expenditure, for example in the biotech industry, can be huge. So how much flexibility shall we build into the system? This is the realm of project design for active risk management. System designers and project managers need tools that help them decide if added flexibility is worth the money. This course provides the students with a mindset and a suite of tools to tackle such problems.

The emphasis is on management and design of technological projects. Examples and case studies will illustrate how theory can be adapted to actual conditions.

Please note that the number of places available to Part IIB Engineers is limited. A ballot will be held if the module looks likely to be oversubscribed. The ballot will take place on the first day of lectures, after which the Teaching Office will be in touch with any unsuccessful applicants to ask them to select another module.

Day 1: Foundations

- Course aims and objectives
- Review of traditional project valuation
- System value is a shape, not a number
- Monte Carlo Simulation
- (Valuing flexibility)

Preparatory reading:

- Savage (2003), Ch. 2: ‘The building blocks of uncertainty: random variables’, Ch. 3: ‘The buildings of uncertainty: functions of random variables’.
- If you have not seen Net Present Value (NPV) or Discounted Cash Flows before, read Brealey and Meyers, Ch. 2: ‘Present values’

Day 2: Portfolio Thinking

- Diversification
- Hedging
- Trading off risk against return

Preparatory reading:

- www.moneychimp.com/articles/risk/riskintro.htm [2], first five sections (short!) from ‘MPT Introduction’ to ‘Build a Portfolio’.
- Optionally, Brealey and Meyers, Ch. 9: ‘Risk’ [For 8th edition, use Ch. 8]

Day 3: Real Options Analysis

- Flexibility: Intuition behind real options
- Lattice valuations

Preparatory reading:

- Brealey and Meyers, Ch. 10: 'Project Analysis', Ch. 20: 'Understanding Options' [For the 9th edition, use Ch. 11, Ch. 21]
- de Neufville and Scholtes (2011), Ch. I: 'High Level Overview' (pp. 1-39)

Further notes

Required software

The basic modelling tool will be Microsoft Excel. Essential add-ins include Analysis ToolPak and Solver, both of which come with Excel but may require the Excel installation disks, and @Risk, which will be distributed to you.

Coursework

Coursework	Format	Due date & marks
100% individual project combining spreadsheet modelling, written analysis and a management-style report. The coursework consists of two parts: Task I (65%-70%) and Task II (30%-35%). Task I contains a number of subtasks, in which students are asked to conduct intensive Excel modelling, to answer questions, to provide analysis, and to give intuitive business interpretations. Task II is a short presentation and is assessed by a set of criteria: intuition (business implication), prioritising information (structure), clarity and use of visual aids such as charts and graphs, and language.	Individually Assessed Answer Sheet, Presentation Document and Excel Files anonymously marked	The coursew out during Mi term break ar submitted rig beginning of January 201 Marks will be four weeks af submission d

Booklists

Please see the Booklist for Group I Courses [3] for references for this module.

Module Webpage

To be advised: https://www.vle.cam.ac.uk/course/view.php?id=83341 [4]

TPE6 Strategic Valuation

Reference Books

The following are available in multiple copies in the Judge Business School Information Centre:

de Neufville, R. and Scholtes, S. (2011)	*Flexibility in Engineering Design.* Cambridge, MA: MIT Press	**E-book via Dawsonera ('institutional login')** **Printed book at:** **TA174.D46 2011**

Brealey, R. A, Myers, S. C. and Allen, F. (2011) or Brealey, R. A, Myers, S. C. and Allen, F. (2008)	*Principles of Corporate Finance*. 10th ed. Boston, Mass.: Irwin McGraw Hill 9th ed. *N.B. For Brealey and Myers, any edition from 6th ed. onwards is fine.*	**Printed books at:** **HG4026.B73 P7 2011** **HG4026.B73 P7 2008**
Savage, S. L. (2003)	*Decision Making with Insight.* Belmont, CA: Brooks/Cole	**Printed book at:** **HF5548.4.S38 2003**
Luenberger, D. G. (1998)	*Investment Science.* Oxford: Oxford University Press	**Printed book at:** **HG4515.2.L83**

Examination Guidelines

Please refer to Form & conduct of the examinations [6].

UK-SPEC

This syllabus contributes to the following areas of the UK-SPEC [7] standard:

Toggle display of UK-SPEC areas.

GT1

Develop transferable skills that will be of value in a wide range of situations. These are exemplified by the Qualifications and Curriculum Authority Higher Level Key Skills and include problem solving, communication, and working with others, as well as the effective use of general IT facilities and information retrieval skills. They also include planning self-learning and improving performance, as the foundation for lifelong learning/CPD.

IA1

Apply appropriate quantitative science and engineering tools to the analysis of problems.

IA2

Demonstrate creative and innovative ability in the synthesis of solutions and in formulating designs.

KU1

Demonstrate knowledge and understanding of essential facts, concepts, theories and principles of their engineering discipline, and its underpinning science and mathematics.

KU2

Have an appreciation of the wider multidisciplinary engineering context and its underlying principles.

S1

The ability to make general evaluations of commercial risks through some understanding of the basis of such risks.

S2

Extensive knowledge and understanding of management and business practices, and their limitations, and how these may be applied appropriately to strategic and tactical issues.

E1

Ability to use fundamental knowledge to investigate new and emerging technologies.

E3

Ability to apply mathematical and computer based models for solving problems in engineering, and the ability to assess the limitations of particular cases.

P3

Understanding of contexts in which engineering knowledge can be applied (e.g. operations and management, technology, development, etc).

P8

Ability to apply engineering techniques taking account of a range of commercial and industrial constraints.

US1

A comprehensive understanding of the scientific principles of own specialisation and related disciplines.

US3

An understanding of concepts from a range of areas including some outside engineering, and the ability to apply them effectively in engineering projects.

Last modified: 05/06/2019 10:45

Links
[1] mailto:hj231@cam.ac.uk
[2] http://www.moneychimp.com/articles/risk/riskintro.htm
[3] https://www.vle.cam.ac.uk/mod/book/view.php?id=364101&chapterid=56121

[4] https://www.vle.cam.ac.uk/course/view.php?id=83341
[5] https://www.dawsonera.com/guard/protected/dawson.jsp?name=https://shib.raven.cam.ac.uk/shibboleth&dest=http://www.dawsonera.com/depp/reader/protected/external/AbstractView/S9780262303569
[6] https://teaching.eng.cam.ac.uk/content/form-conduct-examinations
[7] https://teaching.eng.cam.ac.uk/content/uk-spec