

Engineering Tripos Part IIB, 4I1: Strategic Valuation, 2022-23

Module Leader

[Prof. H Jiang](#) [1]

Lecturer

[Prof. H Jiang](#) [1]

Lab Leader

[Prof. H Jiang](#) [1]

Timing and Structure

Christmas vacation - dates below; Assessment: Coursework 100% in 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; and 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 5th, 7th, and 9th December 2022.
- Reserve 5th – 12th December 2022 for TPE25 **ONLY**.
- Reserve 10th and 11th December 2022 for conducting part I of the course assessment.
- Reserve a compulsory Q&A session for the course assessment on 12th December 2022.
- There is a possibility that this course will be delivered online depending on when the Covid19 social distancing rules will be removed.

- It is necessary for you to have a Window-based laptop for Excel modelling although it is possible that a Mac-based laptop can be used for Excel modelling. If this course is delivered in classroom and Cambridge, then there is a possibility that students use computers in the computer lab. In the latter, if you do not have a laptop, be prepared to stay in Cambridge for a few more days after 12th December 2022 so that you can conduct Excel modelling in relation to your course assessment in the CJSB Computer Lab – subject to availability of the 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:

- de Neufville, R. and Scholtes, S. (2011), Ch 2: "Recognition of Uncertainty".
- 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 coursework is due out during Midterm break and must be submitted right at the beginning of January 2023. Marks will be available four weeks after submission date.

Booklists

Please refer to the Booklist for Part IIB Courses for references to this module, this can be found on the associated Moodle course.

Module Webpage

To be advised: <https://www.vle.cam.ac.uk> [3]

TPE25 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)	<i>Flexibility in Engineering Design</i> . Cambridge, MA: MIT Press	E-book: https://ebookcentral.proquest.com/detail.action?pq-orig
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		Printed book at: TA174.D46 2011
Brealey, R. A, Myers, S. C. and Allen, F. (2019)	<i>Principles of Corporate Finance</i> . 13 th ed. Boston, Mass.: Irwin McGraw Hill	Printed books at: HG4026.B73 P7 2011
or Brealey, R. A, Myers, S. C. and Allen, F. (2008)	9 th ed. <i>N.B. For Brealey and Myers, any edition from 6th ed. onwards is fine.</i>	E-book: https://www.vlebooks.com/uct/Index/1993343?page HG4026.B73 P7 2008
Savage, S. L. (2003)	<i>Decision Making with Insight</i> . Belmont, CA: Brooks/Cole	Printed book at: HF5548.4.S38 2003
Luenberger, D. G. (1998)	<i>Investment Science</i> . 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.

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Links

[1] <mailto:hj231@cam.ac.uk>

[2] <http://www.moneychimp.com/articles/risk/riskintro.htm>

[3] <https://www.vle.cam.ac.uk/course/view.php?id=83341>

[4] <https://ebookcentral.proquest.com/lib/CAM/detail.action?pq-origsite=primo&docID=3339361>

[5] <https://www.vlebooks.com/Vleweb/Product/Index/1993343?page=0>

[6] <https://teaching23-24.eng.cam.ac.uk/content/form-conduct-examinations>

[7] <https://teaching23-24.eng.cam.ac.uk/content/uk-spec>