BUSINESS F770
Financial Economics and Quantitative Methods
Fall 2021 Course Outline

Finance and Business Economics
DeGroote School of Business
McMaster University

COURSE OBJECTIVE

This course explores the theoretical and conceptual foundations of finance. It seeks to explain the decisions taken by various participants of the financial markets, the pricing of financial instruments, and various observed market phenomena.

INSTRUCTOR AND CONTACT INFORMATION

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Class Time

Tuesdays, September 17 to December 10, 2021, 9:00 a.m. to 12:00 noon, via Zoom meetings.

Important Notice

For email communications with the instructor, please always use a McMaster University email account and "Business F770" for the subject heading.

COURSE DESCRIPTION

The major topics covered in this course are as follows: Consumption and investment decisions under certainty; utility theory; stochastic dominance; state preference theory; mean-variance portfolio theory; efficient set mathematics; market equilibrium; mean-variance spanning; alternative portfolio frameworks; option properties and option pricing models; the theory of capital structure; basic concepts of risk sharing; the principal-agent problem and incentive contracting. The statistical concepts involved are covered as well.

LEARNING OUTCOMES

This course formally covers various fundamental topics in finance. As most analytical results are derived, the approach will enable each student to understand more fully their implications and limitations and to relate them more properly to empirical evidence. Upon successful completion of the course, each student will have a good foundation in financial theory, which will allow various advanced topics in finance to be explored afterwards.

REQUIRED COURSE MATERIALS AND READINGS

The primary reading materials of this course are in the following courseware, supplementary courseware, and reference book:

Clarence C.Y. Kwan, *Business F770, Financial Economics and Quantitative Methods: Lecture Notes, Supplementary Materials, Illustrative Examples, and Exercises,* Fall 2021 (hereafter, *Lecture Notes*).

Clarence C.Y. Kwan, *Preparatory Mathematics and Selected Topics in Statistics for Students in Graduate Finance Programs*, Fall 2021 (hereafter, *Math/Stats Notes*).

T.E. Copeland, J.F. Weston, and K. Shastri, *Financial Theory and Corporate Policy*, *Fourth Edition*, (2005), Pearson Addison Wesley, Boston, MA; ISBN 0-321-12721-8 (hereafter, *CWS*).

Both the main courseware (*Lecture Notes*) and the supplementary courseware (*Math/Stats Notes*), which require password access, are distributed to registered students by the instructor via McMaster's Avenue-to-Learn site. Most of the materials in the supplementary courseware are intended for self-study to strengthen the analytical skills of students. However, some lectures are directly based on the materials there.

All journal articles listed in the course outline, as well as any additional journal articles assigned during the Term, can be accessed electronically (by registered students) from the library website.

EVALUATION

The following are the three components for evaluation:

A = the percentage marks of all assignments.
M = the percentage marks of the mid-term examination.
F = the percentage marks of the final (cumulative) examination.

The final grade is based on the highest among $(0.10\,A + 0.40\,M + 0.50\,F)$, $(0.15\,A + 0.40\,M + 0.45\,F)$, $(0.20\,A + 0.35\,M + 0.45\,F)$, and $(0.25\,A + 0.35\,M + 0.40\,F)$. The conversion of the final percentage grade to a letter grade will be in accordance with the following conversion scheme:

Grade	Points	Equivalent Percentages
A+	12	90 – 100
A	11	85 – 89
A-	10	80 – 84
B+	9	77 – 79
B	8	73 – 76
B-	7	70 – 72
F	0	69 and under

https://academiccalendars.romcmaster.ca/content.php?catoid=42&navoid=8734#2.6.1_Averaging_of_Letter_Grades

MORE DETAILED COURSE DESCRIPTION AND CORRESPONDING READING MATERIALS[1]

0. Preliminaries

Lecture Notes, Chapter 1.
Math/Stats Notes, Chapters 1, 2, 3, and 4.[2]

1. Consumption and investment decisions under certainty

In a world that is characterized as being without risk, an individual seeks to optimize his/her satisfaction from current and future consumptions. Any forgone current consumption will allow the individual to have a higher consumption in the future. We seek to understand how rational decisions are made under different characterizations of the economy.

Lecture Notes, Chapter 2.
Math/Stats Notes, Chapters 7 and 8.
CWS, Chapter 2.

2. Utility theory

We examine an individual's attitude towards risk. The concepts of risk aversion, risk premium, and certainty equivalent are considered. We also use some specific utility functions to illustrate these various concepts.

Lecture Notes, Chapter 3.

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[1] The additional reading materials are primarily original research articles on the corresponding topics. Each journal article indicated with an asterisk (*) is a pedagogic version. The number of listed articles depends on the intended depth of coverage of the topics involved.

[2] Chapter 12 of the *Math/Stats Notes*, which introduces the topic of difference equations, though not part of the required readings here, is valuable preparatory material for various graduate-level economics and finance courses.

Math/Stats Notes, Chapters 7, 8, 9, and 13.
CWS, Chapter 3.

J.W. Pratt, "Risk Aversion in the Small and in the Large," *Econometrica,* 32 (1-2), (1964), 122-136.

3. Stochastic dominance

For two competing investments with risky outcomes, we are interested in knowing whether one of them is always a better choice for a rational investor. We first consider a case where the investor's attitude towards risk does not matter. We then consider a different case where it does matter.

Lecture Notes, Chapter 4.
Math/Stats Notes, Chapters 9 and 13.
CWS, Chapter 3.

J. Hadar and W.R. Russell, "Rules for Ordering Uncertain Prospects," *American Economic Review,* 59 (1), (1969), 25-34.

4. State preference theory

In this theory, the future is characterized as some potential states of nature with corresponding probabilities of occurrence. With the payoffs from individual financial securities being state-dependent, we seek to determine security prices.

Lecture Notes, Chapter 5.
Math/Stats Notes, Chapters 5, 6, 7, and 8.
CWS, Chapter 4.

5. Introduction to mean-variance portfolio theory

This theory captures the risk of an investment with the variance of the probability distribution of the investment's random rates of returns. It provides guidance for allocating investment funds among the securities considered to achieve the best risk-return trade-off.

Lecture Notes, Chapters 6-7.
Math/Stats Notes, Chapters 5, 6, 8, 13, and 14.
CWS, Chapter 5.

6. Efficient set mathematics

In the study of efficient set mathematics, we explore analytical properties of minimum-variance portfolios. We provide a formal treatment of mean-variance portfolio analysis, based on a basic portfolio selection model. A crucial requirement for the covariance matrix of security returns is identified, and its implications are explored.

Lecture Notes, Chapter 8.
Math/Stats Notes, Chapters 5, 6, 7, 8, 9, 13, and 14.

R.C. Merton, "An Analytical Derivation of the Efficient Portfolio Frontier," *Journal of Financial and Quantitative Analysis,* 7 (4), (1972), 1851-1872.

R. Roll, "Critique of the Asset Pricing Theory's Tests," *Journal of Financial Economics*, 4 (2), (1977), 129-176. (Read only the Appendix, pp. 158-162.)

* C.C.Y. Kwan, "The Requirement of a Positive Definite Covariance Matrix of Security Returns for Mean-Variance Portfolio Analysis: A Pedagogic Illustration," *Spreadsheets in Education*, 4(1), (2010), Article 4.

7. *Markowitz portfolio selection models and some related topics*

The Markowitz critical line method for portfolio selection is presented in some detail. The idea of critical lines is explained. For analytical convenience, the constraints considered are first confined to full allocation of investment funds and disallowance of short sales. Portfolio selection with investment limits for individual securities is also considered. The requirement for the covariance matrix of security returns, as identified earlier, is examined further here. Efforts to improve input quality are discussed. Shrinkage estimation of the covariance matrix of returns is introduced.

Lecture Notes, Chapters 9-10.

* C.C.Y. Kwan, "A Simple Spreadsheet-Based Exposition of the Markowitz Critical Line Method for Portfolio Selection," *Spreadsheets in Education,* 2(3), (2007), Article 2.

C.C.Y. Kwan, "What Really Happens If the Positive Definiteness Requirement on the Covariance Matrix of Returns Is Relaxed in Efficient Portfolio Selection?" *Financial Markets and Portfolio Management*, 32(1), (2018), 77-110.

O. Ledoit and M. Wolf, "Honey, I Shrunk the Sample Covariance Matrix," *Journal of Portfolio Management*, (Summer 2004), 110-119.

* C.C.Y. Kwan, "An Introduction to Shrinkage Estimation of the Covariance Matrix: A Pedagogic Illustration," *Spreadsheets in Education,* 4(3), (2011), Article 6.

* C.C.Y. Kwan, "Shrinkage of the Sample Correlation Matrix of Returns Towards a Constant Correlation Target: A Pedagogic Illustration Based on Dow Jones Stock Returns," *Spreadsheets in Education,* 10(1), (2017), Article 3.

8. *Market equilibrium*

We consider the impact of the collective investment decisions by individual investors on security prices and expected returns. Some market-equilibrium models, including the Capital Asset Pricing

Model and its variants, as well as the Arbitrage Pricing Model, and the corresponding implications are considered.

Lecture Notes, Chapters 11-13.
Math/Stats Notes, Chapters 5, 6, 7, and 8.
CWS, Chapter 6.

W.F. Sharpe, "A Theory of Market Equilibrium under Conditions of Risk," *Journal of Finance,* 19 (3), (1964), 425-442.

J. Lintner, "The Valuation of Risk Assets and the Selection of Risky Investments in Stock Portfolios and Capital Budgets," *Review of Economics and Statistics,* 47 (1), (1965), 13-17.

J. Mossin, "Equilibrium in a Capital Market," *Econometrica,* 34 (4), (1966), 768-783.

R. Roll, "Critique of the Asset Pricing Theory's Tests," *Journal of Financial Economics*, 4 (2), (1977), 129-176.

S.A. Ross, "The Arbitrage Theory of Capital Asset Pricing," *Journal of Economic Theory,* 13 (3), (1976), 341-360.

* C.C.Y. Kwan, "The Arbitrage Pricing Model: A Pedagogic Derivation and a Spreadsheet-Based Illustration," *Spreadsheets in Education,* 9(1), (2016), Article 4.

9. *Mean-variance spanning*

Under the mean-variance framework, we examine the spanning conditions; that is, the conditions under which the addition of a set of extra assets does not improve the portfolio performance in terms of risk-return trade-off. We also explore some practical implications of spanning.

Lecture Notes, Chapter 14.
Math/Stats Notes, Chapters 5, 6, 7, and 8.

G. Huberman and S. Kandel, "Mean-Variance Spanning," *Journal of Finance*, 42(4), (1987), 873-888.

J.D. Jobson and B. Korkie, "A Performance Interpretation of Multivariate Tests of Asset Set Intersection, Spanning, and Mean Variance Efficiency," *Journal of Financial and Quantitative Analysis*, 24, (1989), 185-204.

M. Raab and R. Schwager, "Spanning with Short-Selling Restrictions," *Journal of Finance*, 48(2), (1993), 791-793.

G.V.G. Stevens, "On the Inverse of the Covariance Matrix in Portfolio Analysis," *Journal of Finance*, 53(5), (1998), 1821-1827.

C.S. Cheung, C.C.Y. Kwan, and D.C. Mountain, "On the Nature of Mean-Variance Spanning," *Finance Research Letters*, 6, (2009), 106-113.

* C.C.Y. Kwan, "A Regression-Based Interpretation of the Inverse of the Sample Covariance Matrix," *Spreadsheets in Education*, 7(1), (2014), Article 3.

10. *Stochastic dominance, mean-Gini, and asset pricing*

We consider an alternative analytical framework, where risk of an asset is measured by its Gini coefficient. Various analytical issues pertaining to stochastic dominance and asset pricing are examined here.

Lecture Notes, Chapter 15.
Math/Stats Notes, Chapters 7, 8, and 9.

R. Dorfman, "A Formula for the Gini Coefficient," *Review of Economics and Statistics*, 61, (1979), 146-149.

S. Yitzhaki, "Stochastic Dominance, Mean Variance, and Gini's Mean Difference," *American Economic Review*, 72(1), (1982) 178-185.

H. Shalit and S. Yitzhaki, "Mean-Gini, Portfolio Theory, and the Pricing of Risky Assets," *Journal of Finance*, 39(5), (1984), 1449-1468.

R.I. Lerman and S. Yitzhaki, "A Note on the Calculation and Interpretation of the Gini Index," *Economics Letters*, 15, (1984), 363-368.

* C.S. Cheung, C.C.Y. Kwan, and P.C. Miu, "Mean-Gini Portfolio Analysis: A Pedagogic Illustration," *Spreadsheets in Education*, 2(2), (2007), Article 3.

11. *Options properties and option pricing models*

Various basic option properties are considered. Also considered is the connection between binomial and Black-Scholes option pricing models.

Lecture Notes, Chapter 16.
Math/Stats Notes, Chapters 7, 8, 9, 10, 11, 13, 14, and 15 (with special attention to Chapters 11, 13, and 15).
CWS, Chapter 7.

F. Black and M. Scholes, "The Pricing of Options and Corporate Liabilities," *Journal of Political Economy*, 81(3), (1973), 637-654.

J.C. Cox, S.A. Ross, and M. Rubinstein, "Option Pricing: A Simplified Approach," *Journal of Financial Economics*, 7, (1979), 229-263.

* Y. Feng and C.C.Y. Kwan, "Connecting Binomial and Black-Scholes Option Pricing Models: A Spreadsheet-Based Illustration," *Spreadsheets in Education,* 5(3), (2012), Article 2.

* K.D. Brewer, Y. Feng, and C.C.Y. Kwan, "Geometric Brownian Motion, Option Pricing, and Simulation: Some Spreadsheet-Based Exercises in Financial Modeling," *Spreadsheets in Education,* 5(3), (2012), Article 4.

* C.C.Y. Kwan, "Solving the Black-Scholes Partial Differential Equation via the Solution Method for a One-Dimensional Heat Equation: A Pedagogic Approach with a Spreadsheet-Based Illustration," *Spreadsheets in Education*, <u>12</u>, Issue 1, (September 2019).

12. *The theory of capital structure*[3]

Capital structure pertains to the corporate decision on how much debt and equity to have proportionally. The theory is considered with and without tax effects. Also considered is the effect of risky debt on capital structure, as well as risk sharing between debt and equity holders.

Lecture Notes, Chapter 17.
Math/Stats Notes, Chapter 3, 7, and 8.
CWS, Chapter 15.

F. Modigliani and M.H. Miller, "The Cost of Capital, Corporation Finance and the Theory of Investment," *American Economic Review,* 48 (3), (1958), 261-297.

F. Modigliani and M.H. Miller, "Corporate Income Taxes and the Cost of Capital: A Correction," *American Economic Review,* 53 (3), (1963), 433-443.

13. *Basic concepts of risk sharing*

The coverage includes two-party and multi-party cases. Efficiency conditions for uncorrelated and correlated random outcomes are considered. Examples in the context of corporate merger are provided.

Lecture Notes, Chapter 18.
Math/Stats Notes, Chapter 13.

14. *The principal-agent problem and incentive contracting*

Incentive contracting for situations where the agent's effort is observable and unobservable is considered. For the latter situation, also considered is the informativeness of indirect measures of the agent's effort. The intensity of incentives (in incentive contracting) is examined.

Lecture Notes, Chapter 19.
Math/Stats Notes, Chapter 13.
CWS, Chapter 12.

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[3] If time permits, the topic of dividend policy is also covered. The primary reading material is *CWS*, Chapter 16.

M.C. Jensen and W.H. Meckling, "Theory of the Firm, Managerial Behavior, Agency Costs and Ownership Structure," *Journal of Financial Economics,* 3 (4), (1976), 305-360.

15. Concluding remarks

Lecture Notes, Chapter 20.

The materials below are duplicated verbatim from the 2021 PhD Course Outline Template.

Please review the Graduate Examinations Policy (if applicable):

http://www.mcmaster.ca/policy/Students-AcademicStudies/GradExamsPolicy.pdf

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ACADEMIC INTEGRITY

You are expected to exhibit honesty and use ethical behaviour in all aspects of the learning process. Academic credentials you earn are rooted in principles of honesty and academic integrity.

Academic dishonesty is to knowingly act or fail to act in a way that results or could result in unearned academic credit or advantage. This behaviour can result in serious consequences, e.g. the grade of zero on an assignment, loss of credit with a notation on the transcript (notation reads: "Grade of F assigned for academic dishonesty"), and/or suspension or expulsion from the university.

It is your responsibility to understand what constitutes academic dishonesty. For information on the various types of academic dishonesty please refer to the Academic Integrity Policy, located at:

www.mcmaster.ca/academicintegrity

The following illustrates only three forms of academic dishonesty:

1. Plagiarism, e.g. the submission of work that is not one's own or for which other credit has been obtained.
2. Improper collaboration in group work.
3. Copying or using unauthorized aids in tests and examinations

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MISSED ACADEMIC WORK

Late assignments will not be accepted. No extensions are available except under extraordinary circumstances. Please discuss any extenuating situation with your instructor at the earliest possible

opportunity.

STUDENT ACCESSIBILITY SERVICES

Students who require academic accommodation must contact Student Accessibility Services (SAS) to make arrangements with a Program Coordinator. Academic accommodations must be arranged for each term of study. Student Accessibility Services can be contacted by phone 905-525-9140 ext. 28652 or e-mail sas@mcmaster.ca.

For further information, consult McMaster University's Policy for Academic Accommodation of Students with Disabilities:

http://www.mcmaster.ca/policy/Students-AcademicStudies/AcademicAccommodation-StudentsWithDisabilities.pdf

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ACADEMIC ACCOMMODATION FOR RELIGIOUS, INDIGENOUS OR SPIRITUAL OBSERVANCES (RISO)

Students requiring academic accommodation based on religious, indigenous or spiritual observances should follow the procedures set out in the RISO policy. Students requiring a RISO accommodation should submit their request, including the dates/times needing to be accommodated and the courses which will be impacted, to their Program Office normally within 10 days of the beginning of term. Students should also contact their instructors as soon as possible to make alternative arrangements for classes, assignments, and tests.

POTENTIAL MODIFICATION TO THE COURSE

The instructor reserves the right to modify elements of the course during the term. There may be changes to the dates and deadlines for any or all courses in extreme circumstances. If either type of modification becomes necessary, reasonable notice and communication with the students will be given with explanation and the opportunity to comment on changes. It is the responsibility of the student to check their McMaster email and course websites weekly during the term and to note any changes.

The University reserves the right to change the dates and deadlines for any or all courses in extreme circumstances (e.g., severe weather, labour disruptions, etc.). Changes will be communicated through regular McMaster communication channels, such as McMaster Daily News, A2L and/or McMaster email.