Introduction to Pricing Theory in Financial Markets

Economics Department
National Taiwan University
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Course Description:

This course provides an introduction to the theory of asset pricing in financial markets in one-period finite-state settings under uncertainty. The lectures will be built around concepts of *Arbitrage*, *Optimality*, and *Equlibrium*, i.e., the three basic constraints on asset prices: absence of arbitrage opportunites, economic agents' optimal consumption-investment decisions, and market equilibrium. Introduction to option pricing will be used as an application to the theory.

Prerequisites:

Microeconomics, investment or equivalents (Mean-variance analysis, portfolio theory, and CAPM), and basic knowledge of Calculus, Statistics, and Linear Algebra. Other necessary quantitative tools will be introduced in the course.

General Approach:

The course will be instructed by lectures. (Several lecture notes will be distibuted during the course.) The students are expected to prepare in advance, if requested, and to participate in class discussions.

Class Hours: Tuesday 1:20–3:10pm; Friday 10:20am–12:10pm.

Office Hours: Tuesday 3:10–5:00pm.

Grading:

Grades will primarily be based on the midterm and the final exams, with each counting for 40% of the course grade. Several problem sets will be assigned and count for 10% of the course grade, and the remaining 10% is for the class participation.

Tentative Course Outline

(Listed seminal work is for reference only, not required reading.)

- **Lecture 1:** Course Previews. Seminal work of no arbitrages:
  - Keynes, J. M. 1923. *A Tract on Monetary Reform*. London.
  - Modigliani, F., and M. H. Miller. 1958. The cost of capital, corportion finance, and the theory of Investment. *American Economic Review* 48: 261–297. (Modigliani, 1985 Nobel Laureate, and Miller, 1990.)
  - Black, F., and M. Scholes. 1973. The pricing of options and corporate liabilities. *Journal of Political Economy* 81: 637–659. (Scholes, 1997 Nobel Laureate.)
- **Lecture 2:** Reviews: Mean-variance Analysis, Efficient Frontier, and Capital Asset Pricing Model (**CAPM**). Seminal work:
  - Markowitz, H. 1952. Portfolio selection. *Journal of Finance* 7: 99–91. (1990 Nobel Laureate.)
  - Tobin, J. 1958. Liquidity preference as behavior towards risk. *Review of Economic Studies* 25: 65–86. (1981 Nobel Laureate.)
  - Sharpe, W. 1964. Capital asset prices: A theory of capital market equlibrium under condition of risk. *Journal of Finance* 19: 425–442. (1990 Nobel Laureate.)
- **Lecture 3–4:** Mean-variance Optimality and Equlibrium.
- **Lecture 5–6:** Expected Utility Hypothesis.
- **Lecture 7–10:** One-period Finite-state Model.
  - Arbitrages and state prices;
  - Arbitrages and optimality;
  - Arbitrages and equlibrium;
  - Pareto optimality, equlibrium, and representative agent.
- **Lecture 11:**: Midterm Exam.
- **Lecture 12:** Essentials of the Multi-period Finite-state Model.
- **Lecture 13-16:** Introduction to Options.
- **Lecture 17:** Practices of "Arbitrage" Trades. (If time permits.)
- **Lecture 18:** Final Exam.

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Review Questions

(Students, encouraged to work together, are to discuss the review questions in the first class.)

1. Mean-Variance Efficiency

Consider the expected returns and standard deviations of the following stocks:

	A	B	C	D	E	F	G	H
Expected Rerurn (%)	15.60	13.91	13.95	14.07	15.68	17.15	20.36	13.28
Standard deviation (%)	21.19	25.76	21.93	27.98	29.13	22.40	28.08	29.52

(a) Suppose that you must invest in **one and only one of these stocks**, i.e., you are not allowed to mix stocks. According to the mean-variance efficient criterion, which stocks will you **not** invest in?

(b) Suppose that you can borrow and lend at 4% riskless rate to invest in **one and only one stock**.

i. Which stock provides the best investment opportunity?

ii. Can you decide how to allocate your investment between the best stock and the riskless lending or borrowing? If not, what information do you need to make the decision?

iii. Suppose that you are to tolerate a standard deviation of 30%. What is the highest expected return you can achieve? How?

iv. Suppose that you would like to have an expected return of 15%. What is the minimum standard deviation you need to tolerate? How?

2. Efficient Frontier

You are considering investing in Stock A and B. Their expected returns and standard deviations are as follows:

Stock	Expected Return (%)	Standard Deviation (%)
A	10.19	14.75
B	16.19	21.03

The correlation between the two stocks is 0.43, and the minimum variance portfolio (**MVP**) weight for Stock A is 71.97%. Which of the following statements are correct?

(a) Stock A is in the efficient frontier.

(b) Stock B is in the efficient frontier.

(c) The efficient frontier for the two stocks is the part that the weight for Stock A is less than 71.97%.

(d) You would not include Stock A in your portfolio because of its lower expected return.

3. CAPM

Based on the following regressions results for five companies:

	A	B	C	D	E
Standard deviation (%)	25.79	24.52	26.29	26.91	19.41
Beta (β)	0.69	1.12	1.20	1.14	0.66
Alpha (α) (%)	0.56	0.68	0.80	0.23	1.27
R^2	0.24	0.71	0.70	0.61	0.44
Residual STD (%)	6.53	3.84	4.14	4.89	4.01

Please answer the folllowing questions:

(a) Which stock could be most accounted for by the market?

(b) Which stock has the highest market (or systematic) risk?

(c) Which stock has the highest unique (or idiosyncratice) risk?

(d) Which stock has the highest total risk?

(e) Which stock could outperform the market the most?

(f) Suppose that the riskless interest rate is 1% and the return on the market index is expected to be 10%. Advantage Fund has $500 million investment in the following portfolio:

	A	B	C	D	E	Borrowing
(in million)	-50	200	150	150	100	-50

What is the expected return of Advantage Fund?