

BEAM039

**UNIVERSITY OF EXETER
BUSINESS SCHOOL**

MAY 2009

Module Convenor: Dr Grzegorz Trojanowski

PRINCIPLES OF FINANCE

DURATION: 75 MINUTES

- Solve any TWO out of FOUR problems.
- All problems carry an equal weight of 50 points. Figures in brackets refer to the maximum marks obtainable for each part of the questions.
- Please use one book for all the answers.
- Please fill in your data (candidate no., programme followed, etc.) and the numbers of the problems selected in the space provided on the cover of the exam paper.
- Approved, silent, non-programmable calculators are permitted.
- This is a closed note exam paper. During the exam students are not allowed to use any books, notes, handouts, etc. Only students who are able to produce a written permission from the School during the exam are allowed to use dictionaries in the exam hall.

Problem 1

A)

Consider a market with three stocks A, B, and C where $E(R_A) = 1.8\%$, $E(R_B) = 2.1\%$, and $E(R_C) = 2.5\%$. The variance-covariance matrix for stocks A, B, and C is given below:

$$\Omega = \begin{bmatrix} 0.003 & 0.002 & 0.003 \\ 0.002 & 0.006 & 0.003 \\ 0.003 & 0.003 & 0.009 \end{bmatrix}$$

Assume that investors can borrow and lend unlimited amounts at a risk-free rate of 1%. In Questions 1, 2 and 3 below, assume also that short sales are allowed.

1. Which portfolio of risky assets should be held by a mean-variance investor?
[14 points]
2. What is the expected return and standard deviation of return for this portfolio?
[5 points]
3. Describe and plot the efficient set in the analysed case.
[6 points]
4. Assume now that short sales are not allowed, while all the other assumptions (including unlimited lending and borrowing at risk-free rate) still hold. Answer Questions 1-3 above for this modified problem.
[10 points]

B)

An efficient portfolio P has an expected return of 20%. The riskless rate is 5%, the return on the market portfolio is 15%, and the standard deviation of the market portfolio is 20%.

1. What are the beta and standard deviation of returns of portfolio P? What is the correlation between returns on portfolio P and returns on the market portfolio?
[12 points]
2. Is it possible that a mean-variance investor finds it optimal to hold 100% of his or her wealth invested in portfolio P? Why (or why not)?
[3 points]

Problem 2

A)

Suppose the assumptions of the standard CAPM hold (in particular, unlimited risk-free lending and borrowing is possible). Consider the following three-stock economy:

	Stock A	Stock B	Stock C
Expected return	12%	6%	9%
Standard deviation of returns	27%	15%	21%
Share price	£6	£8	£5
Number of shares outstanding	150	75	60

The returns on stocks A, B and C are uncorrelated.

1. What are the expected return and the standard deviation of returns on the market portfolio?
[8 points]
2. Portfolio X is an equally weighted portfolio (i.e. $w_A = w_B = w_C = \frac{1}{3}$). Decompose the risk of portfolio X into systematic and idiosyncratic components.
[20 points]
3. Is portfolio X (defined in part (b) above) an efficient portfolio? Explain your answer.
[5 points]

B)

Assume that an investor's utility function is $U(W) = a + b \cdot e^{c \cdot W}$, where (i) a, b, c are constants, (ii) e is the base of the natural logarithm, and (iii) $W \geq 0$ is wealth.

1. Assuming that the investor prefers more to less and is risk-averse, what can be said about the sign of a, b , and c ?
[9 points]
2. What are the properties of this utility function in terms of absolute and relative risk aversion? What are their implications for the investor's decisions to invest in risky assets?
[8 points]

Turn over/...

Problem 3

A)

Discuss three different empirical approaches that can be followed in estimating and testing of the Arbitrage Pricing Theory. Illustrate your discussion with examples if you can.

[22 points]

B)

Assume that the yield curve is flat at 8% p.a. Zero-coupon bonds with maturities of 2, 3, and 5 years are available on the market. You have a short position in a 4-year coupon bond with a coupon rate of 8% and coupons paid annually and you want to immunise it using duration and convexity matching. How many bonds of each type have to be bought to immunise this short position. Each bond has the face value of £1,000.

Note: The following assumptions should be made when solving the problem:

- Fractional purchases are possible, i.e. you can, for instance, buy $\frac{1}{2}$ of a bond.
- The immunising portfolio can involve negative weights in some of the zero-coupon bonds, if necessary.

[28 points]

Problem 4

A)

The common stock of Quadrangle Co. is selling at \$135. A 26-week European call option written on Quadrangle's stock is selling for \$12. The call's exercise price is \$150. The risk-free interest rate is 10 percent per year.

1. Suppose that puts on Quadrangle's stock are not traded, but you want to hold one. Describe the strategy that would allow you to replicate the payoff of such a put option.

[10 points]

2. Suppose that puts are traded. What should a 26-week European put with an exercise price of \$150 sell for?

[6 points]

B)

The price of Alpine Corporation stock is \$200. During each of the next two 6-month periods the price may either rise by 25 percent or fall by 20 percent (equivalent to a standard deviation of 31.5 percent a year). In 6 months the company will pay a dividend of \$40. The interest rate is 10 percent per 6-month period.

1. What is the value of a 1-year American call option with an exercise price of \$160?

[20 points]

2. Now re-calculate the option value, assuming the dividend is equal to 20 percent of the with-dividend stock price.

[14 points]

END OF EXAM