May/June Examination Period 2023

ECN226 Capital Markets 1 *Duration: 2 hours*

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Answer ALL questions

Calculators are permitted in this examination. Please state on your answer book the name and type of machine used. Complete all rough workings in the answer book and cross through any work that is not to be assessed.

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Examiner: Manolis Noikokyris

Question 1

a) Explain how securitisation can affect the role of financial intermediaries in the economy.

[10 marks]

b) A company is expected to pay a dividend in year 1 of $1.50, a dividend in year 2 of $1.70, and a dividend in year 3 of $1.80. After year 3, dividends are expected to grow at the rate of 5% per year. An appropriate required rate of return for the stock of this company is 10%. How much is the stock worth today? Round your answer to two decimal points.

[10 marks]

Question 2

Analysts often use the historical returns of a security to estimate its expected rate of return and standard deviation. Explain how the length and the frequency of the past observations of securities' returns influence the accuracy of the estimates of expected rate of return and standard deviation.

[10 marks]

Question 3

a) Explain why a risk-averse investor will reject fair games and gambles, while she might accept a speculative position.

[10 marks]

b) Suppose that the borrowing rate that your client faces is 7%. Assume that the equity market index (denoted by M) has an expected return $[E(r_M)]$ of 11% and standard deviation (σ_M) of 21%, and that the risk-free rate (r_f) is 4%. If your client can form a portfolio using a risk-free asset and the market portfolio, what is the range of risk aversion for which a client will neither borrow nor lend, that is, for which y is equal to 1? y stands for the proportion of your investment budget which is to be allocated to the risky market portfolio. Round your answer to two decimal points.

[10 marks]

Question 4

a) Outline the separation principle of portfolio construction and explain why it is important for the mutual fund industry.

[10 marks]

b) Suppose you borrow at the risk-free rate an amount equal to your initial wealth and invest all the borrowed money and your initial wealth into a stock with an expected return of 10% and a standard deviation of 12%. The risk-free asset has an interest rate of 5%. Calculate the expected return and the standard deviation of the resulting portfolio. Round your answer to two decimal points.

[8 marks]

Question 5

a) Suppose that the index model for stocks A and B is estimated from excess returns (that is, stock returns in excess of the risk-free rate) with the following results:

$R_A = 3\% + 0.6R_M + e_A$

$R_B = 1\% + 0.9R_M + e_B$

Assume that the standard deviation of the market index returns (denoted by σ_M) is 35%. The adjusted R-square in the equation of security A is 0.22, while the adjusted R-square in the equation of security B is 0.15. Calculate the standard deviation of the returns of each stock. Round your answer to two decimal points.

[8 marks]

b) The expected return of equity A [denoted by $E(r_A)$] is 13%, its standard deviation (denoted by σ_A) is 38%, and its CAPM beta is 0.9. The market portfolio has an expected return of $E(r_M) = 15\%$ and the standard deviation of its returns is $\sigma_M = 20\%$. Calculate the coefficient of correlation between the expected returns of equity A and the market portfolio. Round your answer to two decimal points.

[10 marks]

Question 6

State the assumptions of the Capital Asset Pricing Model (CAPM). Explain the CAPM predictions about how to measure risk and the relation between expected return and risk.

[14 marks]

End of Paper - An appendix of 4 pages follows

APPENDIX

KEY FORMULAS AND EQUATIONS

- For a holding period of *H* years, the intrinsic value of an equity (denoted by V_0) can be given by the following relationship:

$$V_0 = \frac{D_1}{1+k} + \frac{D_2}{(1+k)^2} + \cdots + \frac{D_H + P_H}{(1+k)^H}$$

  where D_H is the dividend received at the end of year H, P_H is the expected sales price of the equity at the end of year H, and k is the market capitalisation rate (equity's required rate of return).

- The constant-growth version of the dividend discount model (DDM) asserts that if dividends are expected to grow at a constant rate g forever the intrinsic value of the stock is determined by the formula:

$$V_0 = \frac{D_1}{k-g}$$

  The dividend growth (g) is given by the following relationship: g = ROE $\times$ b. ROE stands for the return on equity (ROE) and b is the plowback ratio.

- The present value of growth opportunities ($PVGO$) is given by the following relationship:

$$PVGO = P_0 - \frac{E_1}{k}$$

  where E_1 stand for the earnings at the end of period 1, and P_0 is current stock price.

- The Price-Earnings ratio is:

$$\frac{P_0}{E_1} = \frac{1-b}{k - ROE \times b}$$

- The Free cash flow to the firm (FCFF) is given by the following formula:

$$FCFF = EBIT(1-t_c) + Depreciation - Capital\ Expenditures - Increases\ in\ NWC$$

  where EBIT stands for Earnings before Interest and Taxes, t_c is the corporate tax rate, and NWC is the net working capital.

  The Free cash flow to the equity (FCFE) is given by the following formula:

$$FCFE = FCFF - Interest\ Expense(1-t_c) + Increases\ in\ net\ bebt$$

- Calling $p(s)$ the probability of each scenario s and $r(s)$ the security's return in each scenario, where scenarios are indexed by s, we write the expected rate of return of a security [that is, $E(r)$] as follows:

$$E(r) = \sum_s p(s)r(s)$$

  The variance (σ^2) of this rate of return is given by:

$$\sigma^2 = \sum_s p(s)[r(s) - E(r)]^2$$

And its standard deviation σ is:

$$\sigma = \sqrt{Variance}$$

- The Reward-to-Volatility (Sharpe) ratio of a portfolio P is given by the following equation:

$$Sharpe\ ratio = \frac{Portfolio\ risk\ premium}{Standard\ deviation\ of\ excess\ return} = \frac{E(r_P) - r_f}{\sigma_P}$$

where $E(r_P)$ stands for the expected returns of portfolio P and σ_P for the standard deviation of portfolio P's excess returns, while r_f is the risk-free rate.

- The real rate of return (r^{real}) is:

$$\frac{1 + nominal\ return}{1 + Inflation\ rate} - 1$$

- The optimal allocation to risky portfolio, denoted by y^*, is proportional to the risk premium and inversely proportional to the variance and degree of risk aversion:

$$y^* = \frac{E(r_p) - r_f}{A\sigma_P^2}$$

where $E(r_P)$ stands for the expected returns of portfolio P and σ_P^2 for the variance of portfolio P's excess returns, while r_f is the risk-free rate. A is investor's coefficient of risk aversion.

- The utility score U of a portfolio with expected return $E(r)$ and variance of returns σ^2 is given by the following relationship:

$$U = E(r) - \frac{1}{2}A\sigma^2$$

A is investor's coefficient of risk aversion.

- Suppose that you are required to form a portfolio P containing a proportion (w_A) of security A, and a proportion (w_B) of security B. The expected return of that portfolio would be:

$$r_P = w_A r_A + w_B r_B$$

Where r_P, r_A , r_B are the expected returns of the portfolio P, security A, and security B respectively.

The standard deviation of the portfolio P would be:

$$\sigma_P = (w_A^2\sigma_A^2 + w_B^2\sigma_B^2 + 2w_A w_B \rho \sigma_A \sigma_B)^{1/2}$$

where σ_P, σ_A , σ_B are, respectively, the standard deviation of the expected returns of portfolio P, security A, and security B. $\rho_{A,B}$ is the coefficient of correlation between the expected returns of the two securities A and B. Also, the formula to calculate the covariance of returns on funds A and B is:

$$Cov(r_A, r_B) = \rho_{A,B} \times \sigma_A \times \sigma_B$$

and the formula for σ_P can be written as

$$\sigma_P = [\alpha_A^2\sigma_A^2 + \alpha_B^2\sigma_B^2 + 2\alpha_A\alpha_B Cov(r_A, r_B)]^{1/2}$$

- Asset allocation with two risky assets (say S and B).

The investment proportions (w_S and w_B) in the optimal risky portfolio, say P, of the two risky funds S and B are given by the following equation:

$$w_S = \frac{\left[E(r_S) - r_f\right]\sigma_B^2 - [E(r_B) - r_f] \times Cov(r_S, r_B)}{[E(r_S) - r_f]\sigma_B^2 + [E(r_B) - r_f]\sigma_S^2 - [E(r_S) - r_f + E(r_B) - r_f]Cov(r_S, r_B)}$$

and

$$w_B = 1 - w_S$$

where $E(r_s)$, $E(r_B)$, and r_f are the expected returns of assets S, B, and the risk-free one, respectively. σ_B^2 , σ_S^2 stand for the standard deviation of the returns of assets B and S respectively. $Cov(r_S, r_B)$ is the covariance of returns on funds S and B.

The investment proportions [$w_{Min}(S)$ and $w_{Min}(B)$] in the minimum variance portfolio are computed as follows:

$$w_{Min}(S) = \frac{\sigma_B^2 - Cov(r_s, r_B)}{\sigma_S^2 + \sigma_B^2 - 2Cov(r_s, r_B)}$$

and

$$w_{Min}(B) = 1 - w_{Min}(S)$$

- Single index model equations:

The excess returns of stock i over the risk-free rate r_f are given by: $R_i = r_i - r_f$. The excess returns on the market index (say M) are given by $R_M = r_M - r_f$. $R_i(t)$ and $R_M(t)$ stand for the excess returns of stock i and of the market index in month t. The index model can be written as the following regression equation:

$$R_i(t) = a_i + \beta_i R_M(t) + e_i(t)$$

Total risk of asset i (σ_i^2) = Systematic Risk ($\beta_i^2\sigma_M^2$) + Firm-specific risk [$\sigma^2(e_i)$]

The adjusted R-square from the single-index model regression (R_i^2) is the ratio of systematic variance to total variance:

$$R_i^2 = \frac{\beta_i^2\sigma_M^2}{\beta_i^2\sigma_M^2 + \sigma^2(e_i)}$$

When using the Index model, we can calculate the covariance of any pair of stocks (say i and j) using the following relationship:

$$Cov(r_i, r_j) = \beta_i\beta_j\sigma_M^2$$

When using the Index model, we can calculate the correlation of any pair of stocks (say i and j) using the following relationship:

$$Corr(r_i, r_j) = \frac{\beta_i\beta_j\sigma_M^2}{\sigma_i\sigma_j} = \frac{\beta_i\sigma_M^2}{\sigma_i\sigma_M} + \frac{\beta_j\sigma_M^2}{\sigma_j\sigma_M} = Corr(r_i, r_M) \times Corr(r_j, r_M)$$

- Capital Asset Pricing Model (CAPM)

The CAPM implies that the risk premium on any individual asset or portfolio, say i, is the product of the risk premium on the market portfolio $[E(r_M) - r_f]$ and the beta coefficient (the CAPM beta):

Turn over

$$E(r_i) - r_f = \beta_i[E(r_M) - r_f]$$

where the beta coefficient β_i is the covariance of the asset return with that of the market portfolio as a fraction of the variance of the return on the market portfolio:

$$\beta_i = \frac{Cov(r_i, r_M)}{\sigma_M^2}$$

End of Examination/ Manolis Noikokyris