

## Corporate Finance, Module 7: "Risk and return" (Chapter 8)

### Practice Problems

(The attached PDF file has better formatting.)

#### Exercise 7.1: CAPM

If the risk-free interest rate is 5%, the market risk premium is 8.4%, and the expected return on a stock is 18%, what is the stock's CAPM beta?

Solution 7.1:  $18\% = 5\% + \beta \times 8.4\% \Rightarrow \beta = 13\% / 8.4\% = 1.548$

*Question:* Can you classify the types of CAPM beta problems covered on the final exam?

*Answer:* We classify all the problem types; some of them are covered in later modules.

(1) The CAPM equation has three variables: the expected return of the security, the risk-free rate, and the market risk premium. Given two of these variables, solve for the third.

(2) By definition, the overall market has a beta of one. Instead of giving the market risk premium, the exam problem may give the overall market return, which is the market risk premium plus the risk-free rate.

(3) The exam problem may give the expected returns and two stocks (or two portfolios) and ask you to derive the risk-free rate and the market risk premium. Alternatively, the exam problem may give the expected returns and beta on two stocks; for a third stock, it may give just the beta and ask you to derive the expected return.

(4) The CAPM beta equals  $\text{covar}(r_s, r_m) / \text{var}(r_m)$ ; this is the beta coefficient of a linear regression of the security's return on the market return. The exam problem may give the covariance and the variance, and ask you to derive the beta.

- $\text{covar}(r_s, r_m)$  = covariance of the security's return with the market return
- $\text{var}(r_m)$  = variance of market return

(5) The covariance is the correlation times the standard deviations of the two random variables. Instead of giving the covariance and the variance, the exam problem may give the correlation and the standard deviations.

(6) The beta of a portfolio is a *value weighted* average of the betas of the pieces. This follows directly from the definition of the beta.

(7) The problem types above are the easy CAPM problems. The capital structure modules deal with the betas of assets, equity, and debt. (Not all financial analysts think of capital structure in this fashion, and we explain in later modules what Brealey and Myers mean.) The assets equal the equity plus the debt, so the beta of the assets is a value weighted average of the betas of the equity and the debt. By value, Brealey and Myers mean market value, not book equity.

(8) Taxes are the crux of corporate finance, and we should conceive of all CAPM relations on an after-tax basis. But taxes are amazingly difficult to model, since every taxpayer may have a different tax rate, and the tax rates by taxpayer differ by the type of security. Some authors give up and ignore taxes; this gives incorrect solutions to many finance problems. Brealey and Myers make some simplifying assumptions about taxes and show the results. For this course, we make some further simplifications, such as no personal income taxes.

### Exercise 7.2: CAPM

We have the following information for a stock:

- Beta 1.2
- Market rate of return 10%
- Risk-free rate of return 2%

What is the expected return for this stock according to the CAPM?

Solution 7.2:  $2\% + 1.2 \times (10\% - 2\%) = 11.60\%$

### Question 7.3: Portfolio Selection

Which of the following are true regarding portfolio selection?

- A. In an efficient portfolio, the relation between a stock's expected return and its marginal contribution to the portfolio risk is linear.
- B. The marginal contribution of a stock to the risk of the market portfolio is measured by its standard deviation.
- C. If the beta is 2, the expected return is twice the expected market return.
- D. If the beta is zero, the expected return is the market return.
- E. None of A, B, C, or D is true.

Answer 7.3: A

Statement A: The marginal contribution to the portfolio risk is the stock's beta. Statement A says that the expected return =  $A + B \times \beta$ : A is the risk-free interest rate and the B is the market risk premium.

Statement B should say "the marginal contribution of a stock to the risk of the market portfolio is measured by its *beta*." The standard deviation includes diversifiable risk, which does not contribute to the risk of the portfolio.

Statement C should say: "If the beta is 2, the excess return on the security is twice the market risk premium."

Statement D should say: "if the beta is zero, the expected return is the risk-free rate."

#### Exercise 7.4: Net Present Value

An project with a beta of 1.0 has a required investment of \$100,000 at inception and cash flows of \$42,000, \$55,000, and \$77,000 at the end of years 1, 2, and 3. The risk-free rate is 5% and the market risk premium is 9%.

- A. What is the project's capitalization rate?
- B. What is the project's net present value?

Solution 7.4:

*Part A:* The capitalization rate is  $5\% + 1.0 \times 9\% = 14\%$ .

*Part B:* The net present value is

$$-\$100,000 + \$42,000 / 1.14 + \$55,000 / 1.14^2 + \$77,000 / 1.14^3 = \$31,135.63$$

For the IRR, we solve a quadratic equation:

$$-\$100,000 + \$42,000 / (1+x) + \$55,000 / (1+x)^2 + \$77,000 / (1+x)^3 = \$0.00$$