

FM 2555A

Solutions to Assignment No. 3

(Only for questions not assigned for submission)

Problem [2/242]

A company is 40% financed by risk-free debt. The interest rate is 10%, the expected market risk premium is 8%, and the beta of the company's common stock is 0.5. What is the company cost of capital? What is the after-tax WACC, assuming that the company pays tax at a 35% rate?

SOLUTION:

Company cost of capital = $.4(.10) + .6(.10 + .5 \times .08)$

Company cost of capital = .124, or 12.4%

After-tax WACC = $.4[.10 \times (1 - .35)] + .6(.10 + .5 \times .08)$

After-tax WACC = .110, or 11.0%.

Problem [3/242]

Refer to Chapter -9 slide presentation (slide #9-9). What proportion of Dow Chemical's returns was explained by market movements? What proportion of risk was diversifiable? How does the diversifiable risk show up in the plot? What is the range of possible errors in the estimated betas?

SOLUTION:

R-squared measures the proportion of the total variance in the stock's returns that can be explained by market movements. Dow's R^2 shows that .60, or 60 percent of variation was due to market movements; the remainder, $(1 - .60) = .40$, or 40 percent, of the variation was diversifiable. Diversifiable risk shows up in the scatter about the fitted line. The standard error of the estimated beta was .17. If you said that the true beta was $2 \times .17 = .34$ for either side of your estimate, you would have a 95 percent chance of being right. The beta shown in the graph is 1.65.

[Note: The last two statements are equivalent to statements in constructing a 95% confidence interval of an estimate, which is 1.96 plus/minus the standard error. 1.96 is approximated here as 2.0.]

Problem [4/242]

Define the following terms:

- a. Cost of debt
- b. Cost of equity

- c. After-tax WACC
- d. Equity beta
- e. Asset beta
- f. Pure-play comparable
- g. Certainty equivalent

SOLUTION:

- a. the expected return on debt; If the debt has very low default risk, this is close to its yield to maturity.
- b. the expected return on equity
- c. a weighted average of the cost of equity and the after-tax cost of debt, where the weights are the relative market values of the firm's debt and equity
- d. the change in the return of the stock for each additional one percent change in the market return
- e. the change in the return on a portfolio of all the firm's securities (debt and equity) for each additional one percent change in the market return
- f. a company specialising in one activity that is similar to that of a division of a more diversified company
- g. a certain cash flow occurring at Time t with the same present value as an uncertain cash flow at Time t

Problem [5/242]

EZCUBE Corp. is 50% financed with long-term bonds and 50% with common stock. The debt securities have a beta of 1.5. The company's equity beta is 1.25. What is EZCUBE's asset beta?

SOLUTION:

$$\text{Asset } \beta = .5 \times .15 + .5 \times 1.25$$

$$\text{Asset } \beta = .7$$

Problem [6/242]

Many investment projects are exposed to diversifiable risks. What does "diversifiable" mean in this context? How should diversifiable risks be accounted for in project valuation? Should they be ignored completely?

SOLUTION:

A diversifiable risk is unique to the project but has no effect on the risk of a well-diversified portfolio. If a risk is diversifiable it does not affect the cost of capital for the project. However, any possibility of bad outcomes should be reflected in the project cash flows.

Problem [8/243]

Which of these projects is likely to have the higher asset beta, other things equal? Why?

- The sales force for project A is paid a fixed annual salary. Project B's sales force is paid by commissions only.
- Project C is a first-class-only airline. Project D is a well-established line of breakfast cereals.

SOLUTION:

- Project A; a project with higher fixed costs generally has higher operating leverage, which leads to a higher beta
- Project C; airline revenue is more cyclical than cereal revenue

Problem [10/243]

A project has a forecasted cash flow of \$110 in year 1 and \$121 in year 2. The interest rate is 5%, the estimated risk premium on the market is 10%, and the project has a beta of 0.5. If you use a constant risk-adjusted discount rate, what is

- The PV of the project?
- The certainty-equivalent cash flow in year 1 and year 2?
- The ratio of the certainty-equivalent cash flows to the expected cash flows in years 1 and 2?

SOLUTION:

- $$r_{\text{equity}} = r_f + \beta \times (r_m - r_f)$$

$$r_{\text{equity}} = .05 + .5 \times .10$$

$$r_{\text{equity}} = .10$$

$$\text{PV} = \$110 / (1 + .10) + \$121 / (1 + .10)^2$$

$$\text{PV} = \$200.00$$

- To solve for the certainty equivalent for the first year:

$$\text{CEQ}_1 / (1 + .05) = \$110 / (1 + .10)$$

$$\text{CEQ}_1 = \$105.00$$

For Year 2:

$$\text{CEQ}_2 / (1 + .05)^2 = \$121 / (1 + .10)^2$$

$$\text{CEQ}_2 = \$110.25$$

- $$\text{Ratio}_1 = \$105 / \$110$$

$$\text{Ratio}_1 = .95$$

$$\text{Ratio}_2 = \$110.25 / \$121$$

$$\text{Ratio}_2 = .91$$

Problem [11/243]

The total market value of the common stock of the Okefenokee Real Estate Company is \$6 million, and the total value of its debt is \$4 million. The treasurer estimates that the beta of the stock is currently 1.5 and the expected risk premium in the market is 6%. The Treasury bill rate is 4%. Assume for simplicity that Okefenokee debt is risk-free and the company does not pay tax.

- What is the required return on Okefenokee stock?
- Estimate the company cost of capital.
- What is the discount rate for an expansion of the company's present business?
- Suppose the company wants to diversify into the manufacture of rose-coloured spectacles. The beta of unlevered optical manufacturers is 1.2. Estimate the required return on Okefenokee's new venture.

SOLUTION:

$$\text{a. } r_{\text{equity}} = r_f + \beta(r_m - r_f)$$

$$r_{\text{equity}} = .04 + 1.5 \times .06$$

$$r_{\text{equity}} = .13, \text{ or } 13\%$$

$$\text{b. } r_{\text{assets}} = (D / V)r_{\text{debt}} + (E / V)r_{\text{equity}}$$

$$r_{\text{assets}} = \$4\text{m} / (\$4\text{m} + 6\text{m}) \times .04 + \$6\text{m} / (\$4\text{m} + 6\text{m}) \times [.04 + 1.5(.06)]$$

$$r_{\text{assets}} = .094, \text{ or } 9.40\%$$

- The cost of capital depends on the risk of the project being evaluated. If the risk of the project is similar to the risk of the other assets of the company, then the appropriate rate of return is the company cost of capital. Here, the appropriate discount rate is 9.4 percent.

$$\text{d. } r_{\text{assets}} = (D / V)r_{\text{debt}} + (E / V)r_{\text{equity}}$$

$$r_{\text{assets}} = \$4\text{m} / (\$4\text{m} + 6\text{m}) \times .04 + \$6\text{m} / (\$4\text{m} + 6\text{m}) \times [.04 + 1.2(.06)]$$

$$r_{\text{assets}} = .0832, \text{ or } 8.32\%$$

Problem [12/243]

Nero Violins has the following capital structure:

Security	Beta	Total Market Value (\$ millions)
Debt	0	\$100
2	0.20	40
3	1.20	299

- What is the firm's asset beta? (*Hint: What is the beta of a portfolio of all the firm's securities?*)
- Assume that the CAPM is correct. What discount rate should Nero set for investments that expand the scale of its operations without changing its asset beta? Assume a risk-free interest rate of 5% and a market risk premium of 6%.

SOLUTION:

- Total market value = \$100m + 40m + 299m
Total market value = \$439m

$$\beta_{\text{Asset}} = \$100\text{m} / \$439\text{m} \times 0 + \$40\text{m} / \$439\text{m} \times .20 + \$299\text{m} / \$439\text{m} \times 1.20$$

$$\beta_{\text{Asset}} = .836$$

- $$r = r_f + \beta(r_m - r_f)$$

$$r = .05 + .836(.06)$$

$$r = .1001, \text{ or } 10.01\%$$

Problem [13/244]

The following table shows estimates of the risk of two well-known Canadian stocks:

	Standard Deviation (%)	R ²	Beta	Standard Error of Beta
TD Bank	13	0.49	0.83	0.11
Loblaw	21	0.01	0.21	0.25

- What proportion of each stock's risk was market risk, and what proportion was specific risk?
- What is the variance of TD? What is the specific variance?
- What is the confidence interval on Loblaw's beta?

- d. If the CAPM is correct, what is the expected return on TD? Assume a risk-free interest rate of 5% and an expected market return of 12%.
- e. Suppose the next year the market provides a zero return. Knowing this, what return would you expect from TD?

SOLUTION:

- a. The R^2 value for Toronto Dominion was .49, which means that 49 percent of total risk comes from movements in the market, i.e., market risk. Therefore, $(1 - .49) = .51$, or 51 percent of total risk is unique risk.

The R^2 value for Loblaw's was .01, which means that 1 percent of total risk comes from movements in the market and 99 percent is unique risk.

- b. The variance of Toronto Dominion is: $(13)^2 = 169$
 Variance due to the market = $.49 \times 169 = 82.81$
 Variance of diversifiable returns = $(1 - .49) \times 169 = 86.19$

- c. 95% confidence interval_{Loblaw's} = $\beta \pm 2(\text{Std error of } \beta)$
 95% confidence interval_{Loblaw's} = $.21 \pm 2(.25)$
 95% confidence interval_{Loblaw's} = $-.29$ to $.71$

- d. $r_{TD} = r_f + \beta_{TD} \times (r_m - r_f)$
 $r_{TD} = .05 + .83(.12 - .05)$
 $r_{TD} = .1081$, or 10.81%

- e. $r_{TD} = r_f + \beta_{TD} \times (r_m - r_f)$
 $r_{TD} = .05 + .83(0 - .05)$
 $r_{TD} = .0085$, or .85%

Problem [14/244]

You are given the following information for Golden Fleece Financial:

Long-term debt outstanding	\$300,000
Current yield to maturity (r_{debt})	8%
Number of shares of common stock	10,000
Price per share	\$50
Book value per share	\$25
Expected rate of return on stock (r_{equity})	15%

Calculate Golden Fleece's company cost of capital. Ignore taxes.

SOLUTION:

Market values:

$$\text{Debt} = \$300,000$$

$$\text{Equity} = 10,000 \times \$50 = \$500,000$$

$$\text{Total} = \$300,000 + 500,000 = \$800,000$$

$$r_{\text{assets}} = \$300,000 / \$800,000 \times .08 + \$500,000 / \$800,000 \times .15$$

$$r_{\text{assets}} = .1238, \text{ or } 12.38\%$$

Problem [17/244]

Binomial Tree Farm's financing includes \$5 million of bank loans. Its common equity is shown in Binomial's Annual Report at \$6.67 million. It has 500,000 shares of common stock outstanding, which trade on the Wichita Stock Exchange at \$18 per share. What debt ratio should Binomial use to calculate its WACC or asset beta? Explain.

SOLUTION:

Debt ratio = Market value of debt / Total market value of debt and equity

$$\text{Debt ratio} = \$5 \text{ million} / [\$5 \text{ million} + (500,000 \times \$18)]$$

$$\text{Debt ratio} = .3571, \text{ or } 35.71\%$$

Problem [18/244]

You run a perpetual encabulator machine, which generates revenues averaging \$20 million per year. Raw materials costs are 50% of revenues. These costs are variable – they are always proportional to revenues. There are no other operating costs. The cost of capital is 9%. Your firm's long-term borrowing rate is 6%.

Now you are approached by Studebaker Capital Corp, which proposes a fixed-price contract to supply raw materials at \$10 million per year for 10 years.

- a. What happens to the operating leverage and business risk of the encabulator machine if you agree to this fixed-price contract?
- b. Calculate the present value of the encabulator machine with and without the fixed-price contract.

SOLUTION:

- a. If you agree to the fixed price contract, operating leverage will increase. Changes in revenue will result in greater than proportionate changes in profit. Business risk as measured by β_{assets} will also increase.

b. With the fixed price contract:

$$PV(\text{assets}) = PV(\text{revenue}) - PV(\text{fixed cost}) - PV(\text{variable cost})$$

$$PV(\text{assets}) = \$20 \text{ million} / .09 - \$10 \text{ million} \times ((1 / .06) - \{1 / [.06(1 + .06)^{10}]\}) - [(.50 \times \$20 \text{ million}) / .09] / (1 + .09)^{10}$$

$$PV(\text{assets}) = \$101,686,818$$

Without the fixed price contract:

$$PV(\text{assets}) = PV(\text{revenue}) - PV(\text{variable cost})$$

$$PV(\text{assets}) = \$20 \text{ million} / .09 - (.50 \times \$20,000,000) / .09$$

$$PV(\text{assets}) = \$111,111,111$$

Problem [21/245]

A project has the following forecasted cash flows:

Cash flows (\$ 000's)			
C_0	C_1	C_2	C_3
-100	+40	+60	+50

The estimated project beta is 1.5. The market return r_m is 16%, and the risk-free rate r_f is 7%.

- Estimate the opportunity cost of capital and the project's PV (using the same rate to discount each cash flow).
- What are the certainty-equivalent cash flows in each year?
- What is the ratio of the certainty-equivalent cash flow to the expected cash flow in each year?
- Explain why this ratio declines.

SOLUTION:

- Using the Security Market Line:

$$r = .07 + 1.5(.16 - .07)$$

$$r = .2050, \text{ or } 20.50\%$$

$$PV = -\$100 + \$40 / (1 + .205) + \$60 / (1 + .205)^2 + \$50 / (1 + .205)^3$$

$$PV = \$3.09$$

- b. $CEQ_1 = \$40 \times [(1 + .07) / (1 + .205)]^1 = \35.52
 $CEQ_2 = \$60 \times [(1 + .07) / (1 + .205)]^2 = \47.31
 $CEQ_3 = \$50 \times [(1 + .07) / (1 + .205)]^3 = \35.01
- c. $a_1 = \$35.52 / \$40 = .8880$
 $a_2 = \$47.31 / \$60 = .7885$
 $a_3 = \$35.01 / \$50 = .7001$
- d. Using a constant risk-adjusted discount rate is equivalent to assuming that a_t decreases at a constant compounded rate.

Problem [22/245]

The McGregor Whisky Company is proposing to market diet scotch. The product will first be test-marketed for two years in southern California at an initial cost of \$500,000. This test launch is not expected to produce any profits but should reveal consumer preferences. There is a 60% chance that demand will be satisfactory. In this case McGregor will spend \$5 million to launch the scotch nationwide and will receive an expected annual profit of \$700,000 in perpetuity. If demand is not satisfactory, diet scotch will be withdrawn.

Once consumer preferences are known, the product will be subject to an average degree of risk, and therefore, McGregor requires a return of 12% on its investment. However, the initial test-market phase is viewed as much riskier, and McGregor demands a return of 20% on this initial expenditure.

What is the NPV of the diet scotch project?

SOLUTION:

At $t = 2$, there are two possible values for the project's NPV:

$$NPV_{2 \text{ launch}} = -\$5,000,000 + \$700,000 / .12 = \$833,333$$

$$NPV_{2 \text{ withdraw}} = \$0$$

Therefore, at $t = 0$:

$$NPV_0 = -\$500,000 + \{(.60 \times \$833,333) + [(1 - .60) \times \$0]\} / (1 + .20)^2$$

$$NPV_0 = -\$152,778$$

Problem [7/352]

Geothermal Corporation has just received good news: Its earnings increased by 20% from last year's value. Most investors are anticipating an increase of 25%. Will Geothermal's stock price increase or decrease when the announcement is made?

SOLUTION:

Decrease. The stock price already reflects an expected 25% increase. The 20% increase conveys bad news relative to expectations.

Problem [10/352]

How would you respond to the following comments?

- a. "Efficient market, my eye! I know lots of investors who do crazy things."
- b. "Efficient market? Balderdash! I know at least a dozen people who have made a bundle in the stock market."
- c. "The trouble with efficient-market theory is that it ignores investor's psychology."
- d. "Despite all the limitations, the best guide to a company's value is its written-down book value. It is much more stable than market value, which depends on temporary fashions."

SOLUTION:

- a. An individual *can* do crazy things, but still not affect the efficiency of markets. The price of the asset in an efficient market is a consensus price as well as a marginal price. A nutty person can give assets away for free or offer to pay twice the market value. However, when the person's supply of assets or money runs out, the price will adjust back to its prior level (assuming there is no new, relevant information released by his action). If you are lucky enough to know such a person, you *will* receive a positive gain at the nutty investor's expense. You had better not count on this happening very often, though. Fortunately, an efficient market protects crazy investors in cases less extreme than the above. Even if they trade in the market in an "irrational" manner, they can be assured of getting a fair price since the price reflects all information.
- b. Yes, and how many people have dropped a bundle? Or, more to the point, how many people have made a bundle only to lose it later? People can be lucky and some people can be very lucky; efficient markets do not preclude this possibility.
- c. Investor psychology is a slippery concept, more often than not used to explain price movements that the individual invoking it cannot personally explain. Even if it exists, is there any way to make money from it? If investor psychology drives up the price one day, will it do so the next day also? Or will the price drop to a "true" level? Almost no one can tell you beforehand what "investor psychology" will do. Theories based on it have no content.

- d. What good is a stable value when you can't buy or sell at that value because new conditions or information have developed which make the stable price obsolete? It is the market price, the price at which you can buy or sell today, which determines value.

Problem [13/353]

Here are alphas and betas for Intel and ConAgra for the 60 months ending February 2012. Alpha is expressed as a percent per month.

	Alpha	Beta
Intel	0.97	1.08
ConAgra	0.51	0.67

Explain how these estimates would be used to calculate an abnormal return.

SOLUTION:

The estimates are first substituted in the market model. Then the result from this expected return equation is subtracted from the actual return for the month to obtain the abnormal return.

$$\text{Abnormal return (Intel)} = \text{actual return} - [(.97) + (1.08 \times \text{market return})]$$

$$\text{Abnormal return (ConAgra)} = \text{actual return} - [(.51) + (.67 \times \text{market return})]$$

Problem [16/353]

What does efficient-market hypothesis have to say about these two statements?

- “I notice that short-term interest rates are about 1% below long-term rates. We should borrow short-term.”
- I notice that interest rates in Japan are lower than rates in the United States. We would do better to borrow Japanese yen rather than US dollars.

SOLUTION:

The efficient-market hypothesis says that there is no easy way to make money. Thus, when such an opportunity seems to present itself, we should be very skeptical. For example:

- In the case of short- versus long-term rates, and borrowing short term versus long term, there are different risks involved. For example, suppose that we need the money long term but we borrow short term. When the short-term note is due, we must somehow refinance. However; this may not be possible or may be possible only at a very high interest rate.
- In the case of Japanese versus United States interest rates, there is the risk that the Japanese yen–U.S. dollar exchange rate will change during the period of time for which we have borrowed.