

12.7 Final Thoughts on Using the CAPM

- While the CAPM is not perfect, it is straightforward to use, relatively robust, hard to manipulate, and correctly emphasizes the importance of market risk. As a result, it is the most popular and best available method to use for capital budgeting.

Key Terms

alpha <i>p.</i> 410	market index <i>p.</i> 402
asset beta <i>p.</i> 418	market proxy <i>p.</i> 404
asset cost of capital <i>p.</i> 415	net debt <i>p.</i> 417
debt cost of capital <i>p.</i> 411	operating leverage <i>p.</i> 420
equal-ownership portfolio <i>p.</i> 402	passive portfolio <i>p.</i> 402
error (or residual) term <i>p.</i> 410	pretax WACC <i>p.</i> 422
exchange-traded fund (ETF) <i>p.</i> 404	price-weighted portfolio <i>p.</i> 404
execution risk <i>p.</i> 421	unlevered beta <i>p.</i> 416
free float <i>p.</i> 402	unlevered cost of capital <i>p.</i> 415
index funds <i>p.</i> 404	value-weighted portfolio <i>p.</i> 402
linear regression <i>p.</i> 410	weighted average cost of capital (WACC) <i>p.</i> 422

Further Reading

The following articles provide some additional insights on the CAPM: F. Black, “Beta and Return,” *Journal of Portfolio Management* 20 (Fall 1993): 8–18; and B. Rosenberg and J. Guy, “Beta and Investment Fundamentals,” *Financial Analysts Journal* (May–June 1976): 60–72.

Although not a focus of this chapter, there is an extensive body of literature on testing the CAPM. Besides the articles mentioned in the text, here are a few others that an interested reader might want to consult: W. Ferson and C. Harvey, “The Variation of Economic Risk Premiums,” *Journal of Political Economy* 99 (1991): 385–415; M. Gibbons, S. Ross, and J. Shanken, “A Test of the Efficiency of a Given Portfolio,” *Econometrica* 57 (1989): 1121–1152; S. Kothari, J. Shanken, and R. Sloan, “Another Look at the Cross-Section of Expected Stock Returns,” *Journal of Finance* 50 (March 1995): 185–224; and R. Levy, “On the Short-Term Stationarity of Beta Coefficients,” *Financial Analysts Journal* (November–December 1971): 55–62.

Problems

All problems are available in [MyFinanceLab](#). An asterisk (*) indicates problems with a higher level of difficulty.

The Equity Cost of Capital

1. Suppose PepsiCo’s stock has a beta of 0.57. If the risk-free rate is 3% and the expected return of the market portfolio is 8%, what is PepsiCo’s equity cost of capital?
2. Suppose the market portfolio has an expected return of 10% and a volatility of 20%, while Microsoft’s stock has a volatility of 30%.
 - a. Given its higher volatility, should we expect Microsoft to have an equity cost of capital that is higher than 10%?
 - b. What would have to be true for Microsoft’s equity cost of capital to be equal to 10%?
3. Aluminum maker Alcoa has a beta of about 2.0, whereas Hormel Foods has a beta of 0.45. If the expected excess return of the market portfolio is 5%, which of these firms has a higher equity cost of capital, and how much higher is it?

The Market Portfolio



4. Suppose all possible investment opportunities in the world are limited to the five stocks listed in the table below. What does the market portfolio consist of (what are the portfolio weights)?

Stock	Price/Share (\$)	Number of Shares Outstanding (millions)
A	10	10
B	20	12
C	8	3
D	50	1
E	45	20

5. Using the data in Problem 4, suppose you are holding a market portfolio, and have invested \$12,000 in Stock C.
- How much have you invested in Stock A?
 - How many shares of Stock B do you hold?
 - If the price of Stock C suddenly drops to \$4 per share, what trades would you need to make to maintain a market portfolio?
6. Suppose Best Buy stock is trading for \$20 per share for a total market cap of \$6 billion, and Walt Disney has 1.8 billion shares outstanding. If you hold the market portfolio, and as part of it hold 100 shares of Best Buy, how many shares of Walt Disney do you hold?
7. Standard and Poor's also publishes the S&P Equal Weight Index, which is an equally weighted version of the S&P 500.
- To maintain a portfolio that tracks this index, what trades would need to be made in response to daily price changes?
 - Is this index suitable as a market proxy?
8. Suppose that in place of the S&P 500, you wanted to use a broader market portfolio of all U.S. stocks and bonds as the market proxy. Could you use the same estimate for the market risk premium when applying the CAPM? If not, how would you estimate the correct risk premium to use?
9. From the start of 1999 to the start of 2009, the S&P 500 had a negative return. Does this mean the market risk premium we should have used in the CAPM was negative?

Beta Estimation

10. You need to estimate the equity cost of capital for XYZ Corp. You have the following data available regarding past returns:

Year	Risk-free Return	Market Return	XYZ Return
2007	3%	6%	10%
2008	1%	-37%	-45%

- What was XYZ's average historical return?
- Compute the market's and XYZ's excess returns for each year. Estimate XYZ's beta.
- Estimate XYZ's historical alpha.
- Suppose the current risk-free rate is 3%, and you expect the market's return to be 8%. Use the CAPM to estimate an expected return for XYZ Corp.'s stock.
- Would you base your estimate of XYZ's equity cost of capital on your answer in part (a) or in part (d)? How does your answer to part (c) affect your estimate? Explain.



- *11. Go to Chapter Resources on MyFinanceLab and use the data in the spreadsheet provided to estimate the beta of Nike and Dell stock based on their monthly returns from 2007–2011. (Hint: You can use the slope() function in Excel.)



*12. Using the same data as in Problem 11, estimate the alpha of Nike and Dell stock, expressed as % per month. (*Hint:* You can use the `intercept()` function in Excel.)



*13. Using the same data as in Problem 11, estimate the 95% confidence interval for the alpha and beta of Nike and Dell stock using Excel's regression tool (from the data analysis menu) or the `linest()` function.

The Debt Cost of Capital

14. In mid-2012, Ralston Purina had AA-rated, 10-year bonds outstanding with a yield to maturity of 2.05%.
 - a. What is the highest expected return these bonds could have?
 - b. At the time, similar maturity Treasuries have a yield of 1.5%. Could these bonds actually have an expected return equal to your answer in part (a)?
 - c. If you believe Ralston Purina's bonds have 0.5% chance of default per year, and that expected loss rate in the event of default is 60%, what is your estimate of the expected return for these bonds?
15. In mid-2009, Rite Aid had CCC-rated, 6-year bonds outstanding with a yield to maturity of 17.3%. At the time, similar maturity Treasuries had a yield of 3%. Suppose the market risk premium is 5% and you believe Rite Aid's bonds have a beta of 0.31. The expected loss rate of these bonds in the event of default is 60%.
 - a. What annual probability of default would be consistent with the yield to maturity of these bonds in mid-2009?
 - b. In mid-2012, Rite-Aid's bonds had a yield of 8.3%, while similar maturity Treasuries had a yield of 1%. What probability of default would you estimate now?
16. During the recession in mid-2009, homebuilder KB Home had outstanding 6-year bonds with a yield to maturity of 8.5% and a BB rating. If corresponding risk-free rates were 3%, and the market risk premium was 5%, estimate the expected return of KB Home's debt using two different methods. How do your results compare?
17. The Dunley Corp. plans to issue 5-year bonds. It believes the bonds will have a BBB rating. Suppose AAA bonds with the same maturity have a 4% yield. Assume the market risk premium is 5% and use the data in Table 12.2 and Table 12.3.
 - a. Estimate the yield Dunley will have to pay, assuming an expected 60% loss rate in the event of default during average economic times. What spread over AAA bonds will it have to pay?
 - b. Estimate the yield Dunley would have to pay if it were a recession, assuming the expected loss rate is 80% at that time, but the beta of debt and market risk premium are the same as in average economic times. What is Dunley's spread over AAA now?
 - c. In fact, one might expect risk premia and betas to increase in recessions. Redo part (b) assuming that the market risk premium and the beta of debt both increase by 20%; that is, they equal 1.2 times their value in recessions.

A Project's Cost of Capital

18. Your firm is planning to invest in an automated packaging plant. Harburtin Industries is an all-equity firm that specializes in this business. Suppose Harburtin's equity beta is 0.85, the risk-free rate is 4%, and the market risk premium is 5%. If your firm's project is all equity financed, estimate its cost of capital.
19. Consider the setting of Problem 18. You decided to look for other comparables to reduce estimation error in your cost of capital estimate. You find a second firm, Thurbinar Design, which is also engaged in a similar line of business. Thurbinar has a stock price of \$20 per share, with 15 million shares outstanding. It also has \$100 million in outstanding debt, with a yield on the debt of 4.5%. Thurbinar's equity beta is 1.00.
 - a. Assume Thurbinar's debt has a beta of zero. Estimate Thurbinar's unlevered beta. Use the unlevered beta and the CAPM to estimate Thurbinar's unlevered cost of capital.

- b. Estimate Thurbinar's equity cost of capital using the CAPM. Then assume its debt cost of capital equals its yield, and using these results, estimate Thurbinar's unlevered cost of capital.
 - c. Explain the difference between your estimates in part (a) and part (b).
 - d. You decide to average your results in part (a) and part (b), and then average this result with your estimate from Problem 17. What is your estimate for the cost of capital of your firm's project?
- 20.** IDX Tech is looking to expand its investment in advanced security systems. The project will be financed with equity. You are trying to assess the value of the investment, and must estimate its cost of capital. You find the following data for a publicly traded firm in the same line of business:

Debt Outstanding (book value, AA-rated)	\$400 million
Number of shares of common stock	80 million
Stock price per share	\$15.00
Book value of equity per share	\$6.00
Beta of equity	1.20

What is your estimate of the project's beta? What assumptions do you need to make?

- 21.** In mid-2012, Cisco Systems had a market capitalization of \$101 billion. It had A-rated debt of \$16 billion as well as cash and short-term investments of \$48 billion, and its estimated equity beta at the time was 1.23.
- a. What is Cisco's enterprise value?
 - b. Assuming Cisco's debt has a beta of zero, estimate the beta of Cisco's underlying business enterprise.
- 22.** Consider the following airline industry data from mid-2009:

Company Name	Market Capitalization (\$mm)	Total Enterprise Value (\$mm)	Equity Beta	Debt Ratings
Delta Air Lines (DAL)	4,938.5	17,026.5	2.04	BB
Southwest Airlines (LUV)	4,896.8	6,372.8	0.966	A/BBB
JetBlue Airways (JBLU)	1,245.5	3,833.5	1.91	B/CCC
Continental Airlines (CAL)	1,124.0	4,414.0	1.99	B

- a. Use the estimates in Table 12.3 to estimate the debt beta for each firm (use an average if multiple ratings are listed).
- b. Estimate the asset beta for each firm.
- c. What is the average asset beta for the industry, based on these firms?

Project Risk Characteristics and Financing

- 23.** Weston Enterprises is an all-equity firm with two divisions. The soft drink division has an asset beta of 0.60, expects to generate free cash flow of \$50 million this year, and anticipates a 3% perpetual growth rate. The industrial chemicals division has an asset beta of 1.20, expects to generate free cash flow of \$70 million this year, and anticipates a 2% perpetual growth rate. Suppose the risk-free rate is 4% and the market risk premium is 5%.
- a. Estimate the value of each division.
 - b. Estimate Weston's current equity beta and cost of capital. Is this cost of capital useful for valuing Weston's projects? How is Weston's equity beta likely to change over time?

- *24.** Harrison Holdings, Inc. (HHI) is publicly traded, with a current share price of \$32 per share. HHI has 20 million shares outstanding, as well as \$64 million in debt. The founder of HHI, Harry Harrison, made his fortune in the fast food business. He sold off part of his fast food empire, and purchased a professional hockey team. HHI's only assets are the hockey team, together with 50% of the outstanding shares of Harry's Hotdogs restaurant chain. Harry's Hotdogs (HDG) has a market capitalization of \$850 million, and an enterprise value of \$1.05 billion. After a little research, you find that the average asset beta of other fast food restaurant chains is 0.75. You also find that the debt of HHI and HDG is highly rated, and so you decide to estimate the beta of both firms' debt as zero. Finally, you do a regression analysis on HHI's historical stock returns in comparison to the S&P 500, and estimate an equity beta of 1.33. Given this information, estimate the beta of HHI's investment in the hockey team.
- 25.** Your company operates a steel plant. On average, revenues from the plant are \$30 million per year. All of the plant's costs are variable costs and are consistently 80% of revenues, including energy costs associated with powering the plant, which represent one quarter of the plant's costs, or an average of \$6 million per year. Suppose the plant has an asset beta of 1.25, the risk-free rate is 4%, and the market risk premium is 5%. The tax rate is 40%, and there are no other costs.
- Estimate the value of the plant today assuming no growth.
 - Suppose you enter a long-term contract which will supply all of the plant's energy needs for a fixed cost of \$3 million per year (before tax). What is the value of the plant if you take this contract?
 - How would taking the contract in (b) change the plant's cost of capital? Explain.
- 26.** Unida Systems has 40 million shares outstanding trading for \$10 per share. In addition, Unida has \$100 million in outstanding debt. Suppose Unida's equity cost of capital is 15%, its debt cost of capital is 8%, and the corporate tax rate is 40%.
- What is Unida's unlevered cost of capital?
 - What is Unida's after-tax debt cost of capital?
 - What is Unida's weighted average cost of capital?
- 27.** You would like to estimate the weighted average cost of capital for a new airline business. Based on its industry asset beta, you have already estimated an unlevered cost of capital for the firm of 9%. However, the new business will be 25% debt financed, and you anticipate its debt cost of capital will be 6%. If its corporate tax rate is 40%, what is your estimate of its WACC?

Data Case

You work in Walt Disney Company's corporate finance and treasury department and have just been assigned to the team estimating Disney's WACC. You must estimate this WACC in preparation for a team meeting later today. You quickly realize that the information you need is readily available online.

- Go to <http://finance.yahoo.com>. Under the "Investing Tab" and then "Market Overview," you will find the yield to maturity for ten-year Treasury bonds listed as "10 Yr Bond(%)." Collect this number as your risk-free rate.
- In the box next to the "Get Quotes" button, type Walt Disney's ticker symbol (DIS) and press enter. Once you see the basic information for Disney, find and click "Key Statistics" on the left side of the screen. From the key statistics, collect Disney's market capitalization (its market value of equity), enterprise value (market-value equity + net debt), cash, and beta.
- To get Disney's cost of debt and the market value of its long-term debt, you will need the price and yield to maturity on the firm's existing long-term bonds. Go to <http://cxa.marketwatch.com/finra/BondCenter/Default.aspx>. Under "Quick Bond Search," click "Corporate" and type Disney's ticker symbol. A list of Disney's outstanding bond issues will appear. Assume that

Disney's policy is to use the expected return on noncallable ten-year obligations as its cost of debt. Find the noncallable bond issue that is at least 10 years from maturity. (*Hint:* You will see a column titled "Callable"; make sure the issue you choose has "No" in this column. Bonds may appear on multiple pages.) Find the credit rating and yield to maturity for your chosen bond issue (it is in the column titled "Yield"). Hold the mouse over the table of Disney's bonds and right-click. Select "Export to Microsoft Excel." (Note that this option is available in IE, but may not be in other browsers.) An Excel spreadsheet with all of the data in the table will appear.

4. You now have the price for each bond issue, but you need to know the size of the issue. Returning to the Web page, click "Walt Disney Company" in the first row. This brings up a Web page with all of the information about the bond issue. Scroll down until you find "Amount Outstanding" on the right side. Noting that this amount is quoted in thousands of dollars (e.g., \$60,000 means \$60 million = \$60,000,000), record the issue amount in the appropriate row of your spreadsheet. Repeat this step for all of the bond issues.
5. The price for each bond issue in your spreadsheet is reported as a percentage of the bond's par value. For example, 104.50 means that the bond issue is trading at 104.5% of its par value. You can calculate the market value of each bond issue by multiplying the amount outstanding by $(\text{Price} \div 100)$. Do so for each issue and then calculate the total of all the bond issues. This is the market value of Disney's debt.
6. Compute the weights for Disney's equity and debt based on the market value of equity and Disney's market value of debt, computed in Step 5.
7. Calculate Disney's cost of equity capital using the CAPM, the risk-free rate you collected in Step 1, and a market risk premium of 5%.
8. Assuming that Disney has a tax rate of 35%, calculate its after-tax debt cost of capital.
9. Calculate Disney's WACC.
10. Calculate Disney's net debt by subtracting its cash (collected in Step 2) from its debt. Recalculate the weights for the WACC using the market value of equity, net debt, and enterprise value. Recalculate Disney's WACC using the weights based on the net debt. How much does it change?
11. How confident are you of your estimate? Which implicit assumptions did you make during your data collection efforts?