

University of Lisbon

ISEG



CORPORATE FINANCE II

Problem Set for “Practice Lectures”

(Principles of Corporate Finance by Brealey, Myers and Allen, 11th Edition)

Licenciatura – Undergraduate Course

2nd Semester, 2016-2017

Introduction to corporation Finance and Financial Markets

- 1.6.** F&H Corp. continues to invest heavily in a declining industry. Here is an excerpt from a recent speech by F&H's CFO:

We at F&H have of course noted the complaints of a few spineless investors and uninformed security analysts about the slow growth of profits and dividends. Unlike those confirmed doubters, we have confidence in the long-run demand for mechanical encabulators, despite competing digital products. We are therefore determined to invest to maintain our share of the overall encabulator market. F&H has a rigorous CAPEX approval process, and we are confident of returns around 8% on investment. That's a far better return than F&H earns on its cash holdings.

The CFO went on to explain that F&H invested excess cash in short-term government securities, which are almost entirely risk-free but offered only a 4% rate of return.

- a) Is a forecasted 8% return in the encabulator business necessarily better than a 4% safe return on short-term government securities? Why or why not?
 - b) Is F&H's opportunity cost of capital 4%? How in principle should the CFO determine the cost of capital?
- 1.7.** We can imagine the financial manager doing several things on behalf of the firm's stockholders. For example, the manager might:
- a) Make shareholders as wealthy as possible by investing in real assets.
 - b) Modify the firm's investment plan to help shareholders achieve a particular time pattern of consumption.
 - c) Choose high- or low-risk assets to match shareholders' risk preferences.
 - d) Help balance shareholders' checkbooks.

But in well-functioning capital markets, shareholders will vote for only one of these goals. Which one? Why?

- 1.8.** Ms. Espinoza is retired and depends on her investments for her income. Mr. Liu is a young executive who wants to save for the future. Both are stockholders in Scaled Composites, LLC, which is building SpaceShipOne to take commercial passengers into space. This investment's payoff is many years away. Assume it has a positive NPV for Mr. Liu. Explain why this investment also makes sense for Ms. Espinoza.
- 1.9.** The box on page 11 describes the controversial involvement of Goldman Sachs in a mortgage-backed securities deal in 2006. When this involvement was revealed, the market value of Goldman Sachs' common stock fell overnight by \$10 billion. This was far more than any fine that might have been imposed. Explain.

Goldman Sachs Causes a Ruckus

► In 2006 a major hedge fund that was pessimistic about the outlook for house prices approached the investment bank Goldman Sachs. Goldman helped the fund to construct a complicated deal that would pay off if a \$2 billion package of low-grade residential mortgages declined in value. Goldman then approached some banks that it knew were optimistic about the prospect for house prices and that might, therefore, be prepared to take the other side of the bargain. In the event, house prices slumped, many of the owners defaulted on their mortgages, and the hedge fund made a profit of around \$1 billion. The banks on the other side of the transaction lost heavily.

Goldman's role in the transaction subsequently came under heavy criticism. One criticism centered on the fact that Goldman shared the hedge fund's concerns about the housing market and in 2007 had circulated internal warning memos to its traders. Some therefore questioned whether it was ethical for Goldman to take a pessimistic view on housing in its own trading positions and at the same time continue to sell what it regarded as overvalued securities to its customers. There were also questions about what Goldman was legally and ethically obliged to reveal. Although one of the banks was heavily involved in choosing the package of mortgages and rejected many of the suggested contents of the package, none of them was aware that the mortgages had originally been proposed by the hedge fund manager and therefore could be particularly toxic.

A senate subcommittee that investigated the deal lambasted Goldman for "unbridled greed" and suggested that the firm had operated with "less oversight than a pit boss in Las Vegas." When the SEC announced that it was charging Goldman with fraud and material omissions and misrepresentations, the market value of the bank's stock declined by about \$10 billion, far more than any penalty that Goldman might be expected to pay. Investors, it seemed, believed that the damage to Goldman's reputation was much more important than any fine. Three months later the bank admitted that the marketing material linked to the package of subprime mortgages was "incomplete" and agreed to pay a \$550 million fine.

The event raised several difficult questions of ethics. When an investment bank is employed to give advice on a new issue or a merger, it is essential that the client can trust the bank to give an honest and impartial view. But the situation becomes less clear-cut when the bank is acting as a middleman or trading securities. Much of the debate on the Goldman deal therefore centered on whether the bank was simply an intermediary between sophisticated traders or whether it had deeper responsibilities.*

*These issues are discussed in the context of the Goldman deal in S. M. Davidson, A. D. Morrison, and W. J. Wilhelm, Jr., "Computerization and the ABACUS: Reputation, Trust, and Fiduciary Responsibility in Investment Banking," January 2011, available at SSRN: <http://ssrn.com/abstract=1747647>. See also the presentation by Darrell Duffie at www.darrellduffie.com/creditrisk.cfm.

- 1.10. Why might one expect managers to act in shareholders' interests? Give some reasons.
- 1.11. Many firms have devised defenses that make it more difficult or costly for other firms to take them over. How might such defenses affect the firm's agency problems? Are managers of firms with formidable takeover defenses more or less likely to act in the shareholders' interests rather than their own? What would you expect to happen to the share price when management proposes to institute such defenses?
- 1.12. Most managers have no difficulty avoiding blatantly dishonest actions. But sometimes gray areas, where it is debatable whether an action is unethical and unacceptable, exist. Suggest an important ethical dilemma that companies may face. What principles should guide their decision?

Efficient Markets and Behavioral Finance

13.4. True or false?

- a) Financing decisions are less easily reversed than investment decisions.
- b) Tests have shown that there is almost perfect negative correlation between successive price changes.
- c) The semistrong form of the efficient-market hypothesis states that prices reflect all publicly available information.
- d) In efficient markets the expected return on each stock is the same.

13.6. True or false?

- a) Most managers tend to be overconfident.
- b) Psychologists have found that, once people have suffered a loss, they are more relaxed about the possibility of incurring further losses.
- c) Psychologists have observed that people tend to put too much weight on recent events when forecasting.
- d) Behavioral biases open up the opportunity for easy arbitrage profits.

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

13.8. Here again are the six lessons of market efficiency. For each lesson give an example showing the lesson's relevance to financial managers.

- a) Markets have no memory.
- b) Trust market prices.
- c) Read the entrails.
- d) There are no financial illusions.
- e) The do-it-yourself alternative.
- f) Seen one stock, seen them all.

13.10. 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 the efficient-market theory is that it ignores investors' 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."

13.11. Respond to the following comments:

- a) "The random-walk theory, with its implication that investing in stocks is like playing roulette, is a powerful indictment of our capital markets."
- b) "If everyone believes you can make money by charting stock prices, then price changes won't be random."
- c) "The random-walk theory implies that events are random, but many events are not random. If it rains today, there's a fair bet that it will rain again tomorrow."

13.12. Which of the following observations appear to indicate market inefficiency? Explain whether the observation appears to contradict the weak, semistrong, or strong form of the efficient-market hypothesis.

- a) Tax-exempt municipal bonds offer lower pretax returns than taxable government bonds.
- b) Managers make superior returns on their purchases of their company's stock.
- c) There is a positive relationship between the return on the market in one quarter and the change in aggregate profits in the next quarter.
- d) There is disputed evidence that stocks that have appreciated unusually in the recent past continue to do so in the future.
- e) The stock of an acquired firm tends to appreciate in the period before the merger announcement.
- f) Stocks of companies with unexpectedly high earnings appear to offer high returns for several months after the earnings announcement.
- g) Very risky stocks on average give higher returns than safe stocks.

13.13. Here are alphas and betas for two Indian stocks for the 60 months ending November 2012. Alpha is expressed as a percent per month.

| | Alpha | Beta |
|---|-------|------|
| Housing Development Finance Corp (HDFC) | 1.5 | 1.00 |
| Tata Motors | 2.5 | 1.51 |

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

13.15. Two financial managers, Alpha and Beta, are contemplating a chart showing the actual performance of the Standard and Poor's Composite Index over a five-year period. Each manager's company needs to issue new shares of common stock sometime in the next year.

Alpha: My company's going to issue right away. The stock market cycle has obviously topped out, and the next move is almost surely down. Better to issue now and get a decent price for the shares.

Beta: You're too nervous; we're waiting. It's true that the market's been going nowhere for the past year or so, but the figure clearly shows a basic upward trend. The market's on the way up to a new plateau.

What would you say to Alpha and Beta?

- 13.16.** What does the 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 U.S. dollars.”

13.18. Column (A) in Table 13.1 below shows the monthly return on the British FTSE 100 index from May 2007 through February 2009. Columns (B) and (C) show returns on the stocks of two firms—Executive Cheese and Paddington Beer. Both firms announced their earnings in February 2009. Calculate the average abnormal return of the two stocks during the month of the earnings announcement.

TABLE 13.1
See Problem 18. Rates of return in percent per month.

| Month | (A) Market Return | (B) Executive Cheese Return | (C) Paddington Beer Return |
|--------|----------------------|-----------------------------------|----------------------------------|
| May 07 | 2.7 | -3 | 1.6 |
| Jun | -0.2 | 2.3 | -0.8 |
| Jul | -3.8 | -5.1 | 0.3 |
| Aug | -0.9 | -0.7 | -1.6 |
| Sep | 2.6 | 3.1 | 2.8 |
| Oct | 3.9 | 13 | 2.1 |
| Nov | -4.3 | -2.1 | -6 |
| Dec | 0.4 | 6.2 | -1.7 |
| Jan 08 | -8.9 | -4 | -5 |
| Feb | 0.1 | 0.4 | -0.4 |
| Mar | -3.1 | -2.1 | -2 |
| Apr | 6.8 | 4.6 | 3.2 |
| May | -0.6 | -0.3 | 0.4 |
| Jun | -7.1 | -12.7 | -7.3 |
| Jul | -3.8 | 1.1 | -4.1 |
| Aug | 4.2 | 7.2 | 2.3 |
| Sep | -13.0 | -18.1 | -8.7 |
| Oct | -10.7 | -6.2 | -12 |
| Nov | -2.0 | 0.5 | -4.2 |
| Dec | 3.4 | 4.7 | 2.7 |
| Jan 09 | -6.4 | -8.1 | -0.4 |
| Feb | -7.7 | -2.1 | -9.4 |

- 13.19.** On May 15, 1997, the government of Kuwait offered to sell 170 million BP shares, worth about \$2 billion. Goldman Sachs was contacted after the stock market closed in London and given one hour to decide whether to bid on the stock. They decided to offer 710.5 pence (\$11.59) per share, and Kuwait accepted. Then Goldman Sachs went looking for buyers. They lined up 500 institutional and individual investors worldwide, and resold all the shares at 716 pence (\$11.70). The resale was complete before the London Stock Exchange opened the next morning. Goldman Sachs made \$15 million overnight. What does this deal say about market efficiency? Discuss.
- 13.20.** Explain how incentive and agency problems can contribute to mispricing of securities or to bubbles. Give examples.

13.24. Here are alphas (in percent per month) and betas for two British stocks, based on monthly returns from March 2005 to February 2010:

| | Alpha | Beta |
|-----------------|--------|------|
| British Airways | + .07% | 1.38 |
| Vodafone | - .31% | .71 |

- How well did these two stocks perform in this period?
- Use the market model to calculate abnormal returns for March 2010, when the market returned 6.3%, British Airways 17.2% and Vodafone 6.2%.
- Suppose the CAPM holds exactly. Would you change your estimate of abnormal returns for March 2010? Would you need additional information? Explain.

Payout Policy

16.2. Here are several “facts” about typical corporate dividend policies. Which are true and which false?

- Companies decide each year’s dividend by looking at their capital expenditure requirements and then distributing whatever cash is left over.
- Managers and investors seem more concerned with dividend changes than with dividend levels.
- Managers often increase dividends temporarily when earnings are unexpectedly high for a year or two.
- Companies undertaking substantial share repurchases usually finance them with an offsetting reduction in cash dividends.

16.3. Seashore Salt Co. has surplus cash. Its CFO decides to pay back \$4 per share to investors by initiating a regular dividend of \$1 per quarter or \$4 per year. The stock price jumps to \$90 when the payout is announced.

- Why does the stock price increase?
- What happens to the stock price when the stock goes ex dividend?

16.4. Look again at Problem 3. Assume instead that the CFO announces a stock repurchase of \$4 per share instead of a cash dividend.

- What happens to the stock price when the repurchase is announced? Would you expect the price to increase to \$90? Explain briefly.
- Suppose the stock is repurchased immediately after the announcement. Would the repurchase result in an additional stock-price increase?

- 16.7.** Mr. Milquetoast admires Warren Buffet and believes that Berkshire Hathaway is a good investment. He wants to invest \$100,000, but hesitates because Berkshire Hathaway has never paid a dividend. He needs to generate \$5,000 per year in cash for living expenses. What should Mr. Milquetoast do? (Note that Berkshire Hathaway's Class A shares have in recent years sold for more than \$100,000 but class B shares are available for substantially less.)
- 16.9.** Some types of investors prefer dividend-paying stocks because dividends provide a regular, convenient source of income. Does demand from these investors necessarily lift the prices of dividend-paying stocks relative to stocks of companies that pay no dividends but repurchase shares instead? Explain briefly.
- 16.13.** Investors and financial managers focus more on changes in cash dividends than on the level of cash dividends. Why?
- 16.14.** What is meant by "the information content of dividends"? Explain.
- 16.15** Does the good news conveyed by the announcement of a dividend increase mean that a firm can increase its stock price in the long run simply by paying cash dividends? Explain.
- 16.16.** MM insisted that payout policy should be analyzed holding debt and investment policy constant. Why? Explain.
- 16.17.** Little Oil has outstanding one million shares with a total market value of \$20 million. The firm is expected to pay \$1 million of dividends next year, and thereafter the amount paid out is expected to grow by 5% a year in perpetuity. Thus the expected dividend is \$1.05 million in year 2, \$1.105 million in year 3, and so on. However, the company has heard that the value of a share depends on the flow of dividends, and therefore it announces that next year's dividend will be increased to \$2 million and that the extra cash will be raised immediately by an issue of shares. After that, the total amount paid out each year will be as previously forecasted, that is, \$1.05 million in year 2 and increasing by 5% in each subsequent year.
- At what price will the new shares be issued in year 1?
 - How many shares will the firm need to issue?
 - What will be the expected dividend payments on these new shares, and what therefore will be paid out to the old shareholders after year 1?
 - Show that the present value of the cash flows to current shareholders remains \$20 million.
- 16.18.** We stated in Section 16-3 that MM's proof of dividend irrelevance assumes that new shares are sold at a fair price. Look back at Problem 17. Assume that new shares are issued in year 1 at \$10 a share. Show who gains and who loses. Is dividend policy still irrelevant? Why or why not?
- 16.23.** Fromagerie Hors d'Age has been paying a regular cash dividend of \$4 per share each year for over a decade. The company is paying out all its earnings as dividends and is not expected to grow. There are 100,000 shares outstanding selling for \$80 per share. The company has sufficient cash on hand to pay the next annual dividend.
- Suppose that Hors d'Age decides to cut its cash dividend to zero and announces that it will repurchase shares instead.

- What is the immediate stock price reaction? Ignore taxes, and assume that the repurchase program conveys no information about operating profitability or business risk.
- How many shares will Hors d'Age purchase?
- Project and compare future stock prices for the old and new policies. Do this for at least years 1, 2, and 3.

16.30. Suppose that there are just three types of investors with the following tax rates:

| | Individuals | Corporations | Institutions |
|---------------|-------------|--------------|--------------|
| Dividends | 50% | 5% | 0% |
| Capital gains | 15 | 35 | 0 |

Individuals invest a total of \$80 billion in stock and corporations invest \$10 billion. The remaining stock is held by the institutions. All three groups simply seek to maximize their after-tax income.

These investors can choose from three types of stock offering the following pretax payouts:

| | Low Payout | Medium Payout | High Payout |
|---------------|------------|---------------|-------------|
| Dividends | \$5 | \$5 | \$30 |
| Capital gains | 15 | 5 | 0 |

These payoffs are expected to persist in perpetuity. The low-payout stocks have a total market value of \$100 billion, the medium-payout stocks have a value of \$50 billion, and the high-payout stocks have a value of \$120 billion.

- Who are the marginal investors that determine the prices of the stocks?
- Suppose that this marginal group of investors requires a 12% after-tax return. What are the prices of the low-, medium-, and high-payout stocks?
- Calculate the after-tax returns of the three types of stock for each investor group.
- What are the dollar amounts of the three types of stock held by each investor group?

Does Debt Policy Matter?

17.1. Ms. Kraft owns 50,000 shares of the common stock of Copperhead Corporation with a market value of \$2 per share, or \$100,000 overall. The company is currently financed as follows:

| | Market Value |
|---------------------------------|--------------|
| Common stock (8 million shares) | \$16 million |
| Short-term loans | \$ 2 million |

Copperhead now announces that it is replacing \$1 million of short-term debt with an issue of common stock. What action can Ms. Kraft take to ensure that she is entitled to exactly the same proportion of profits as before?

17.2. Spam Corp. is financed entirely by common stock and has a beta of 1.0. The firm is expected to generate a level, perpetual stream of earnings and dividends. The stock has a price–earnings ratio of 8 and a cost of equity of 12.5%. The company’s stock is selling for \$50. Now the firm decides to repurchase half of its shares and substitute an equal value of debt. The debt is risk-free, with a 5% interest rate. The company is exempt from corporate income taxes. Assuming MM are correct, calculate the following items after the refinancing:

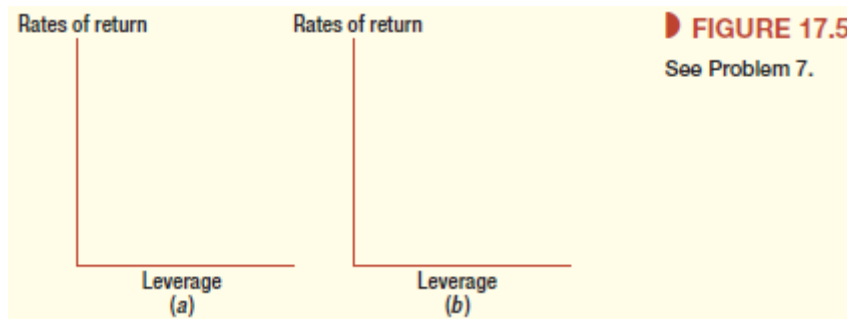
- The cost of equity.
- The overall cost of capital (WACC).
- The price–earnings ratio.
- The stock price.
- The stock’s beta.

17.3. The common stock and debt of Northern Sludge are valued at \$50 million and \$30 million, respectively. Investors currently require a 16% return on the common stock and an 8% return on the debt. If Northern Sludge issues an additional \$10 million of common stock and uses this money to retire debt, what happens to the expected return on the stock? Assume that the change in capital structure does not affect the risk of the debt and that there are no taxes.

17.5. True or false?

- MM’s propositions assume perfect financial markets, with no distorting taxes or other imperfections.
- MM’s proposition 1 says that corporate borrowing increases earnings per share but reduces the price–earnings ratio.
- MM’s proposition 2 says that the cost of equity increases with borrowing and that the increase is proportional to D/V , the ratio of debt to firm value.
- MM’s proposition 2 assumes that increased borrowing does not affect the interest rate on the firm’s debt.
- Borrowing does not increase financial risk and the cost of equity if there is no risk of bankruptcy.
- Borrowing increases firm value if there is a clientele of investors with a reason to prefer debt.

17.7. Note the two blank graphs in Figure 17.5, below. On graph (a), assume MM are right, and plot the relationship between financial leverage (debt–equityratio) and (i) the rates of return on debt and equity and (ii) the weighted-average cost of capital. Then fill in graph (b), assuming the traditionalists are right.



17.9. Companies A and B differ only in their capital structure. A is financed 30% debt and 70% equity; B is financed 10% debt and 90% equity. The debt of both companies is risk-free.

- Rosencrantz owns 1% of the common stock of A. What other investment package would produce identical cash flows for Rosencrantz?
- Guildenstern owns 2% of the common stock of B. What other investment package would produce identical cash flows for Guildenstern?
- Show that neither Rosencrantz nor Guildenstern would invest in the common stock of B if the total value of company A were less than that of B.

17.11. Executive Chalk is financed solely by common stock and has outstanding 25 million shares with a market price of \$10 a share. It now announces that it intends to issue \$160 million of debt and to use the proceeds to buy back common stock.

- How is the market price of the stock affected by the announcement?
- How many shares can the company buy back with the \$160 million of new debt that it issues?
- What is the market value of the firm (equity plus debt) after the change in capital structure?
- What is the debt ratio after the change in structure?
- Who (if anyone) gains or losses?

17.18. Imagine a firm that is expected to produce a level stream of operating profits. As leverage is increased, what happens to

- The ratio of the market value of the equity to income after interest?
- The ratio of the market value of the firm to income before interest if (i) MM are right and (ii) the traditionalists are right?

17.19. Archimedes Levers is financed by a mixture of debt and equity. You have the following information about its cost of capital:

| | | |
|----------------------------------|--------------------------------------|--------------------------------------|
| $r_E = \underline{\hspace{1cm}}$ | $r_D = 12\%$ | $r_A = \underline{\hspace{1cm}}$ |
| $\beta_E = 1.5$ | $\beta_D = \underline{\hspace{1cm}}$ | $\beta_A = \underline{\hspace{1cm}}$ |
| $r_f = 10\%$ | $r_m = 18\%$ | $D/V = .5$ |

Can you fill in the blanks?

- 17.20.** Look back to Problem 19. Suppose now that Archimedes repurchases debt and issues equity so that $D/V = 0.3$. The reduced borrowing causes r_D to fall to 11%. How do the other variables change?
- 17.22.** Gamma Airlines has an asset beta of 1.5. The risk-free interest rate is 6%, and the market risk premium is 8%. Assume the capital asset pricing model is correct. Gamma pays taxes at a marginal rate of 35%. Draw a graph plotting Gamma's cost of equity and after-tax WACC as a function of its debt-to-equity ratio D/E , from no debt to $D/E = 1.0$. Assume that Gamma's debt is risk-free up to $D/E = 0.25$. Then the interest rate increases to 6.5% at $D/E = 0.5$, 7% at $D/E = 0.8$, and 8% at $D/E = 1.0$. As in Problem 21, you can assume that the firm's overall beta $[\beta_A]$ is not affected by its capital structure or the taxes saved because debt interest is tax-deductible.

How Much Should a Corporation Borrow?

- 18.1.** The present value of interest tax shields is often written as $T_c D$, where D is the amount of debt and T_c is the marginal corporate tax rate. Under what assumptions is this present value correct?
- 18.2.** Here are book and market value balance sheets of the United Frypan Company (UF):

| Book | | | Market | | |
|---------------------|--------------|--------------|--------|---------------------|--------------|
| Net working capital | \$ 20 | \$ 40 | Debt | Net working capital | \$ 20 |
| Long-term assets | 80 | 60 | Equity | Long-term assets | 140 |
| | <u>\$100</u> | <u>\$100</u> | | | <u>\$160</u> |
| | | | | | <u>\$160</u> |

Assume that MM's theory holds with taxes. There is no growth, and the \$40 of debt is expected to be permanent. Assume a 40% corporate tax rate.

- a) How much of the firm's value is accounted for by the debt-generated tax shield?
- b) How much better off will UF's shareholders be if the firm borrows \$20 more and uses it to repurchase stock?
- 18.3.** What is the relative tax advantage of corporate debt if the corporate tax rate is $T_c = 0.35$, the personal tax rate is $T_p = 0.35$, but all equity income is received as capital gains and escapes tax entirely $T_{pE} = 0$? How does the relative tax advantage change if the company decides to pay out all equity income as cash dividends that are taxed at 15%?
- 18.4.** "The firm can't use interest tax shields unless it has (taxable) income to shield." What does this statement imply for debt policy? Explain briefly.
- 18.5.** This question tests your understanding of financial distress.
- a) What are the costs of going bankrupt? Define these costs carefully.
- b) "A company can incur costs of financial distress without ever going bankrupt." Explain how this can happen.

- c) Explain how conflicts of interest between bondholders and stockholders can lead to costs of financial distress.

18.12. Compute the present value of interest tax shields generated by these three debt issues. Consider corporate taxes only. The marginal tax rate is $T_c = 0.35$.

- a) A \$1,000, one-year loan at 8%.
- b) A five-year loan of \$1,000 at 8%. Assume no principal is repaid until maturity.
- c) A \$1,000 perpetuity at 7%.

18.13. Suppose that, in an effort to reduce the federal deficit, Congress increases the top personal tax rate on interest and dividends to 35% but retains a 15% tax rate on realized capital gains. The corporate tax rate stays at 35%. Compute the total corporate plus personal taxes paid on debt versus equity income if (a) all capital gains are realized immediately and (b) capital gains are deferred forever. Assume capital gains are half of equity income.

18.19. The Salad Oil Storage (SOS) Company has financed a large part of its facilities with long-term debt. There is a significant risk of default, but the company is not on the ropes yet. Explain:

- a) Why SOS stockholders could lose by investing in a positive-NPV project financed by an equity issue.
- b) Why SOS stockholders could gain by investing in a negative-NPV project financed by cash.
- c) Why SOS stockholders could gain from paying out a large cash dividend.

18.23. The possible payoffs from Ms. Ketchup's projects (see Example 18.1, page 463) have not changed but there is now a 40% chance that Project 2 will pay off \$24 and a 60% chance that it will pay off \$0.

- a) Recalculate the expected payoffs to the bank and Ms. Ketchup if the bank lends the present value of \$10. Which project would Ms. Ketchup undertake?
- b) What is the maximum amount the bank could lend that would induce Ms. Ketchup to take Project 1?

EXAMPLE 18.1 • Ms. Ketchup Faces Credit Rationing

Consider the case of Henrietta Ketchup, a budding entrepreneur with two possible investment projects that offer the following payoffs:

| Now | Investment | Payoff | Probability of Payoff |
|-----------|------------|--------|-----------------------|
| Project 1 | - 12 | +15 | 1.0 |
| Project 2 | - 12 | +24 | .5 |
| | | 0 | .5 |

Project 1 is surefire and very profitable; project 2 is risky and a rotten project. Ms. Ketchup now approaches her bank and asks to borrow the present value of \$10 (she will find the remaining money out of her own purse). The bank calculates that the payoff will be split as follows:

| | Expected Payoff to Bank | Expected Payoff to Ms. Ketchup |
|-----------|---------------------------------------|--------------------------------|
| Project 1 | +10 | +5 |
| Project 2 | $(.5 \times 10) + (.5 \times 0) = +5$ | $.5 \times (24 - 10) = +7$ |

If Ms. Ketchup accepts project 1, the bank's debt is certain to be paid in full; if she accepts project 2, there is only a 50% chance of payment and the expected payoff to the bank is only \$5. Unfortunately, Ms. Ketchup will prefer to take project 2, for if things go well, she gets most of the profit, and if they go badly, the bank bears most of the loss. Unless Ms. Ketchup can convince the bank that she will not gamble with its money, the bank will limit the amount that it is prepared to lend.¹⁸

Financing and Valuation

19.1 Calculate the weighted-average cost of capital (WACC) for Federated Junkyards of America, using the following information:

- Debt: \$75,000,000 book value outstanding. The debt is trading at 90% of book value. The yield to maturity is 9%.
- Equity: 2,500,000 shares selling at \$42 per share. Assume the expected rate of return on Federated's stock is 18%.
- Taxes: Federated's marginal tax rate is $T_c = 0.35$.

19.2. Suppose Federated Junkyards decides to move to a more conservative debt policy. A year later its debt ratio is down to 15% ($D / V = .15$). The interest rate has dropped to 8.6%. Recalculate Federated's WACC under these new assumptions. The company's business risk, opportunity cost of capital, and tax rate have not changed. Use the three-step procedure explained in Section 19-3.

19.3. True or false? Use of the WACC formula assumes

- a) A project supports a fixed amount of debt over the project’s economic life.
- b) The ratio of the debt supported by a project to project value is constant over the project’s economic life.
- c) The firm rebalances debt each period, keeping the debt-to-value ratio constant.

19.6. A project costs \$1 million and has a base-case NPV of exactly zero (NPV = 0). What is the project’s APV in the following cases?

- a) If the firm invests, it has to raise \$500,000 by a stock issue. Issue costs are 15% of net proceeds.
- b) If the firm invests, its debt capacity increases by \$500,000. The present value of interest tax shields on this debt is \$76,000.

19.7. Whispering Pines, Inc., is all-equity-financed. The expected rate of return on the company’s shares is 12%.

- a) What is the opportunity cost of capital for an average-risk Whispering Pines investment?
- b) Suppose the company issues debt, repurchases shares, and moves to a 30% debt-to-value ratio ($D / V = .30$). What will the company’s weighted-average cost of capital be at the new capital structure? The borrowing rate is 7.5% and the tax rate is 35%.

19.11. Table 19.3 shows a book balance sheet for the Wishing Well Motel chain. The company’s long-term debt is secured by its real estate assets, but it also uses short-term bank loans as a permanent source of financing. It pays 10% interest on the bank debt and 9% interest on the secured debt. Wishing Well has 10 million shares of stock outstanding, trading at \$90 per share. The expected return on Wishing Well’s common stock is 18%.

Calculate Wishing Well’s WACC. Assume that the book and market values of Wishing Well’s debt are the same. The marginal tax rate is 35%.

TABLE 19.3
Book balance sheet
for Wishing Well, Inc.
(figures in \$ millions).

| | | | |
|--------------------------------|-------|---------------------|-------|
| Cash and marketable securities | 100 | Bank loan | 280 |
| Accounts receivable | 200 | Accounts payable | 120 |
| Inventory | 50 | Current liabilities | 400 |
| Current assets | 350 | | |
| Real estate | 2,100 | Long-term debt | 1,800 |
| Other assets | 150 | Equity | 400 |
| Total | 2,600 | Total | 2,600 |

19.12. Suppose Wishing Well is evaluating a new motel and resort on a romantic site in Madison County, Wisconsin. Explain how you would forecast the after-tax cash flows for this project. (Hints: How would you treat taxes? Interest expense? Changes in working capital?)

19.14. Table 19.4 shows a simplified balance sheet for Rensselaer Felt. Calculate this company's weighted-average cost of capital. The debt has just been refinanced at an interest rate of 6% (short term) and 8% (long term). The expected rate of return on the company's shares is 15%. There are 7.46 million shares outstanding, and the shares are trading at \$46. The tax rate is 35%.

TABLE 19.4
Simplified book balance sheet for Rensselaer Felt (figures in \$ thousands).

| | | | |
|--------------------------------|---------|----------------------|---------|
| Cash and marketable securities | 1,500 | Short-term debt | 75,600 |
| Accounts receivable | 120,000 | Accounts payable | 62,000 |
| Inventory | 125,000 | Current liabilities | 137,600 |
| Current assets | 246,500 | | |
| Property, plant, and equipment | 302,000 | Long-term debt | 208,600 |
| Other assets | 89,000 | Deferred taxes | 45,000 |
| Total | 637,500 | Shareholders' equity | 246,300 |
| | | Total | 637,500 |

19.19. Consider a project to produce solar water heaters. It requires a \$10 million investment and offers a level after-tax cash flow of \$1.75 million per year for 10 years. The opportunity cost of capital is 12%, which reflects the project's business risk.

- Suppose the project is financed with \$5 million of debt and \$5 million of equity. The interest rate is 8% and the marginal tax rate is 35%. The debt will be paid off in equal annual installments over the project's 10-year life. Calculate APV.
- How does APV change if the firm incurs issue costs of \$400,000 to raise the \$5 million of required equity?

19.23. Chiara Company's management has made the projections shown in Table 19.5. Use this table as a starting point to value the company as a whole. The WACC for Chiara is 12% and the long-run growth rate after year 5 is 4%. The company has \$5 million debt and 865,000 shares outstanding. What is the value per share?

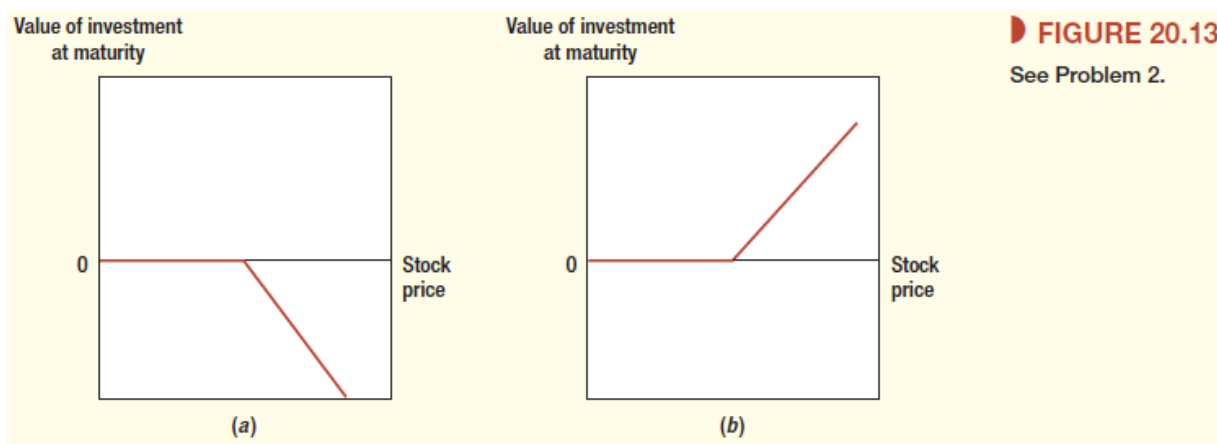
| | Historical | | | | Forecast | | | | |
|---|------------|--------|--------|--------|----------|--------|--------|--------|--|
| | Year: -2 | -1 | 0 | 1 | 2 | 3 | 4 | 5 | |
| 1. Sales | 35,348 | 39,357 | 40,123 | 36,351 | 30,155 | 28,345 | 29,982 | 30,450 | |
| 2. Cost of goods sold | 17,834 | 18,564 | 22,879 | 21,678 | 17,560 | 16,459 | 15,631 | 14,987 | |
| 3. Other costs | 6,968 | 7,645 | 8,025 | 6,797 | 5,078 | 4,678 | 4,987 | 5,134 | |
| 4. EBITDA (1 - 2 - 3) | 10,546 | 13,148 | 9,219 | 7,876 | 7,517 | 7,208 | 9,364 | 10,329 | |
| 5. Depreciation | 5,671 | 5,745 | 5,678 | 5,890 | 5,670 | 5,908 | 6,107 | 5,908 | |
| 6. EBIT (Pretax profit) (4 - 5) | 4,875 | 7,403 | 3,541 | 1,986 | 1,847 | 1,300 | 3,257 | 4,421 | |
| 7. Tax at 35% | 1,706 | 2,591 | 1,239 | 695 | 646 | 455 | 1,140 | 1,547 | |
| 8. Profit after tax (6 - 7) | 3,169 | 4,812 | 2,302 | 1,291 | 1,201 | 845 | 2,117 | 2,874 | |
| 9. Change in working capital | 325 | 566 | 784 | - 54 | - 342 | - 245 | 127 | 235 | |
| 10. Investment (change in gross fixed assets) | 5,235 | 6,467 | 6,547 | 7,345 | 5,398 | 5,470 | 6,420 | 6,598 | |

TABLE 19.5 Cash flow projections for Chiara Corp. (\$ thousands).

Understanding Options

20.2. Note Figure 20.13 below. Match each diagram, (a) and (b), with one of the following positions:

- Call buyer
- Call seller
- Put buyer
- Put seller



- 20.3.** Suppose that you hold a share of stock and a put option on that share. What is the payoff when the option expires if (a) the stock price is below the exercise price? (b) the stock price is above the exercise price?
- 20.4.** What is put–call parity and why does it hold? Could you apply the parity formula to a call and put with different exercise prices?
- 20.5.** There is another strategy involving calls and borrowing or lending that gives the same payoffs as the strategy described in Problem 3. What is the alternative strategy?
- 20.6.** Dr. Livingstone I. Presume holds £600,000 in East African gold stocks. Bullish as he is on gold mining, he requires absolute assurance that at least £500,000 will be available in six months to fund an expedition. Describe two ways for Dr. Presume to achieve this goal. There is an active market for puts and calls on East African gold stocks, and the rate of interest is 6% per year.
- 20.8.** Look again at Figure 20.13 . It appears that the investor in panel (b) can't lose and the investor in panel (a) can't win. Is that correct? Explain. (Hint: Draw a profit diagram for each panel.)
- 20.9.** What is a call option worth if (a) the stock price is zero? (b) the stock price is extremely high relative to the exercise price?

20.11. Respond to the following statements.

- a) "I'm a conservative investor. I'd much rather hold a call option on a safe stock like Exxon Mobil than a volatile stock like Apple."
- b) "I bought an American call option on Fava Farms stock, with an exercise price of \$45 per share and three more months to maturity. Fava Farms' stock has skyrocketed from \$35 to \$55 per share, but I'm afraid it will fall back below \$45. I'm going to lock in my gain and exercise my call right now."

20.14. Atacama Autos stock price is currently 200 pesos. A one-year American call option has an exercise price of 50 pesos and is priced at 75 pesos. How would you take advantage of this great opportunity? Now suppose the option is a European call. What would you do?

20.16. In October 2011, a 15-month call on the stock of Amazon.com, with an exercise price of \$230, sold for \$46.97. The stock price was \$230. The risk-free interest rate was 3%. How much would you be willing to pay for a put on Amazon stock with the same maturity and exercise price? Assume that the Amazon options are European options. (Note: Amazon does not pay a dividend.)

20.24. Option traders often refer to "straddles" and "butterflies." Here is an example of each:

- Straddle: Buy one call with exercise price of \$100 and simultaneously buy one put with exercise price of \$100.
- Butterfly: Simultaneously buy one call with exercise price of \$100, sell two calls with exercise price of \$110, and buy one call with exercise price of \$120.

Draw position diagrams for the straddle and butterfly, showing the payoffs from the investor's net position. Each strategy is a bet on variability. Explain briefly the nature of each bet.

Valuing Options

21.1. The stock price of Heavy Metal (HM) changes only once a month: either it goes up by 20% or it falls by 16.7%. Its price now is \$40. The interest rate is 12.7% per year, or about 1% per month.

- a) What is the value of a one-month call option with an exercise price of \$40?
- b) What is the option delta?
- c) Show how the payoffs of this call option can be replicated by buying HM's stock and borrowing.
- d) What is the value of a two-month call option with an exercise price of \$40?
- e) What is the option delta of the two-month call over the first one-month period?

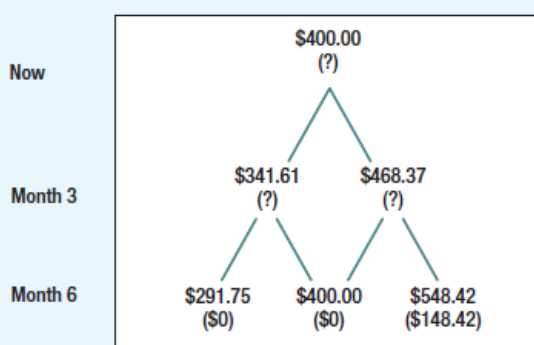
21.2. Option delta

- a) Can the delta of a call option be greater than 1.0? Explain.
- b) Can it be less than zero?
- c) How does the delta of a call change if the stock price rises?
- d) How does it change if the risk of the stock increases?

- 21.3.** Take another look at our two-step binomial trees for Apple, for example, in Figure 21.2. Use the replicating-portfolio or risk-neutral method to value six-month call and put options with an exercise price of \$370. Assume the Apple stock price is \$400.
- 21.4.** Imagine that Apple's stock price will either rise by 33.3% or fall by 25% over the next six months (see Section 21-1). Recalculate the value of the call option (exercise price 5 \$400) using (a) the replicating portfolio method and (b) the risk- neutral method. Explain intuitively why the option value rises from the value computed in Section 21-1.

FIGURE 21.2

Present and possible future prices of Apple stock assuming that in each three-month period the price will either rise by 17.09% or fall by 14.60%. Figures in parentheses show the corresponding values of a six-month call option with an exercise price of \$400. The interest rate is .86% a quarter.



- 21.5.** Over the coming year Ragwort's stock price will halve to \$50 from its current level of \$100 or it will rise to \$200. The one-year interest rate is 10%.
- What is the delta of a one-year call option on Ragwort stock with an exercise price of \$100?
 - Use the replicating-portfolio method to value this call.
 - In a risk-neutral world what is the probability that Ragwort stock will rise in price?
 - Use the risk-neutral method to check your valuation of the Ragwort option.
 - If someone told you that in reality there is a 60% chance that Ragwort's stock price will rise to \$200, would you change your view about the value of the option? Explain.
- 21.6.** Use the Black–Scholes formula to value the following options:
- A call option written on a stock selling for \$60 per share with a \$60 exercise price. The stock's standard deviation is 6% per month. The option matures in three months. The risk-free interest rate is 1% per month.
 - A put option written on the same stock at the same time, with the same exercise price and expiration date. Now for each of these options find the combination of stock and risk-free asset that would replicate the option.
- 21.8.** For which of the following options might it be rational to exercise before maturity? Explain briefly why or why not.
- American put on a non-dividend-paying stock.
 - American call—the dividend payment is \$5 per annum, the exercise price is \$100, and the interest rate is 10%.
 - American call—the interest rate is 10%, and the dividend payment is 5% of future stock price. (Hint: The dividend depends on the stock price, which could either rise or fall.)

- 21.9.** Johnny Jones's high school derivatives homework asks for a binomial valuation of a 12-month call option on the common stock of the Overland Railroad. The stock is now selling for \$45 per share and has an annual standard deviation of 24%. Johnny first constructs a binomial tree like Figure 21.2, in which stock price moves up or down every six months. Then he constructs a more realistic tree, assuming that the stock price moves up or down once every three months, or four times per year.
- Construct these two binomial trees.
 - How would these trees change if Overland's standard deviation were 30%? (Hint: Make sure to specify the right up and down percentage changes.)
- 21.10.** Suppose a stock price can go up by 15% or down by 13% over the next year. You own a one-year put on the stock. The interest rate is 10%, and the current stock price is \$60.
- What exercise price leaves you indifferent between holding the put or exercising it now?
 - How does this break-even exercise price change if the interest rate is increased?
- 21.11.** The price of Moria Mining stock is \$100. During each of the next two six-month periods the price may either rise by 25% or fall by 20% (equivalent to a standard deviation of 31.5% a year). At month 6 the company will pay a dividend of \$20. The interest rate is 10% per six-month period. What is the value of a one-year American call option with an exercise price of \$80? Now recalculate the option value, assuming that the dividend is equal to 20% of the with-dividend stock price.
- 21.12.** Buffelhead's stock price is \$220 and could halve or double in each sixmonth period (equivalent to a standard deviation of 98%). A one-year call option on Buffelhead has an exercise price of \$165. The interest rate is 21% a year.
- What is the value of the Buffelhead call?
 - Now calculate the option delta for the second six months if (i) the stock price rises to \$440 and (ii) the stock price falls to \$110.
 - How does the call option delta vary with the level of the stock price? Explain intuitively why.
 - Suppose that in month 6 the Buffelhead stock price is \$110. How at that point could you replicate an investment in the stock by a combination of call options and risk-free lending? Show that your strategy does indeed produce the same returns as those from an investment in the stock.
- 21.13.** Suppose that you own an American put option on Buffelhead stock (see Problem 12) with an exercise price of \$220.
- Would you ever want to exercise the put early?
 - Calculate the value of the put.
 - Now compare the value with that of an equivalent European put option.
- 21.15.** Suppose that you have an option that allows you to sell Buffelhead stock (see Problem 12) in month 6 for \$165 or to buy it in month 12 for \$165. What is the value of this unusual option?

Real Options

22.1. Look again at the valuation in Table 22.2 of the option to invest in the Mark II project. Consider a change in each of the following inputs. Would the change increase or decrease the value of the expansion option?

- Increased uncertainty (higher standard deviation).
- More optimistic forecast (higher expected value) of the Mark II in 1985.
- Increase in the required investment in 1985.

| Assumptions |
|---|
| <ol style="list-style-type: none"> The decision to invest in the Mark II must be made after three years, in 1985. The Mark II investment is double the scale of the Mark I (note the expected rapid growth of the industry). Investment required is \$900 million (the exercise price), which is taken as fixed. Forecasted cash inflows of the Mark II are also double those of the Mark I, with present value of \$807 million in 1985 and $807/(1.2)^3 = \\$467$ million in 1982. The future value of the Mark II cash flows is highly uncertain. This value evolves as a stock price does with a standard deviation of 35% per year. (Many high-technology stocks have standard deviations higher than 35%.) The annual interest rate is 10%. |
| Interpretation |
| The opportunity to invest in the Mark II is a three-year call option on an asset worth \$467 million with a \$900 million exercise price. |
| Valuation |
| $PV(\text{exercise price}) = \frac{900}{(1.1)^3} = 676$ $\text{Call value} = [N(d_1) \times P] - [N(d_2) \times PV(EX)]$ $d_1 = \frac{\log[P/PV(EX)]/\sigma\sqrt{t} + \sigma\sqrt{t}/2}{\sigma\sqrt{t}}$ $= \frac{\log[.691]/.606 + .606/2}{.606} = -.3072$ $d_2 = d_1 - \sigma\sqrt{t} = -.3072 - .606 = -.9134$ $N(d_1) = .3793, N(d_2) = .1805$ $\text{Call value} = [.3793 \times 467] - [.1805 \times 676] = \55.1 million |

TABLE 22.2
Valuing the option to invest in the Mark II microcomputer.

22.2. A start-up company is moving into its first offices and needs desks, chairs, filing cabinets, and other furniture. It can buy the furniture for \$25,000 or rent it for \$1,500 per month. The founders are of course confident in their new venture, but nevertheless they rent. Why? What's the option?

22.4. You own a parcel of vacant land. You can develop it now, or wait.

- What is the advantage of waiting?
- Why might you decide to develop the property immediately?

22.5. Gas turbines are among the least efficient ways to produce electricity, much less thermally efficient than coal or nuclear plants. Why do gas-turbine generating stations exist? What's the option?

22.6. Why is quantitative valuation of real options often difficult in practice? List the reasons briefly.

22.7. True or false?

- a) Real-options analysis sometimes tells firms to make negative-NPV investments to secure future growth opportunities.
- b) Using the Black–Scholes formula to value options to invest is dangerous when the investment project would generate significant immediate cash flows.
- c) Binomial trees can be used to evaluate options to acquire or abandon an asset. It's OK to use risk-neutral probabilities in the trees even when the asset beta is 1.0 or higher.
- d) It's OK to use the Black–Scholes formula or binomial trees to value real options, even though the options are not traded.
- e) A real-options valuation will sometimes reveal that it's better to invest in a single large plant than a series of smaller plants.

22.9. Describe each of the following situations in the language of options:

- a) Drilling rights to undeveloped heavy crude oil in Northern Alberta. Development and production of the oil is a negative-NPV endeavor. (Assume a break-even oil price is C\$90 per barrel, versus a spot price of C\$80.) However, the decision to develop can be put off for up to five years. Development costs are expected to increase by 5% per year.
- b) A restaurant is producing net cash flows, after all out-of-pocket expenses, of \$700,000 per year. There is no upward or downward trend in the cash flows, but they fluctuate as a random walk, with an annual standard deviation of 15%. The real estate occupied by the restaurant is owned, not leased, and could be sold for \$5 million. Ignore taxes.
- c) A variation on part (b): Assume the restaurant faces known fixed costs of \$300,000 per year, incurred as long as the restaurant is operating. Thus, Net cash flow = revenue less variable costs – fixed costs = \$700,000 – 1,000,000 – 300,000. The annual standard deviation of the forecast error of revenue less variable costs is 10.5%. The interest rate is 10%. Ignore taxes.
- d) A paper mill can be shut down in periods of low demand and restarted if demand improves sufficiently. The costs of closing and reopening the mill are fixed.
- e) A real estate developer uses a parcel of urban land as a parking lot, although construction of either a hotel or an apartment building on the land would be a positive-NPV investment.
- f) Air France negotiates a purchase option for 10 Boeing 787s. Air France must confirm the order by 2014. Otherwise Boeing will be free to sell the aircraft to other airlines.

22.10. Look again at Table 22.2. How does the value in 1982 of the option to invest in the Mark II change if

- a) The investment required for the Mark II is \$800 million (vs. \$900 million)?
- b) The present value of the Mark II in 1982 is \$500 million (vs. \$467 million)?
- c) The standard deviation of the Mark II's present value is only 20% (vs. 35%)?

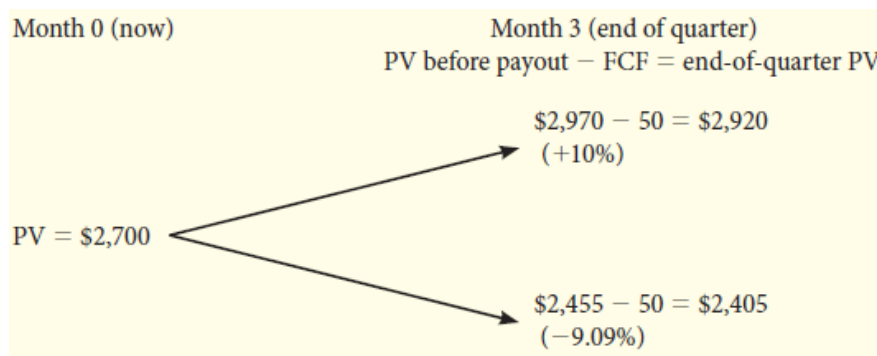
22.11. You own a one-year call option to buy one acre of Los Angeles real estate. The exercise price is \$2 million, and the current, appraised market value of the land is \$1.7 million. The land is currently used as a parking lot, generating just enough money to cover real estate taxes. The annual standard deviation is 15% and the interest rate 12%. How much is your call worth? Use

the Black–Scholes formula. You may find it helpful to go to the spreadsheet for Chapter 21, which calculates Black–Scholes values (visit this book’s website, www.mhhe.com/bma).

22.12. A variation on Problem 11: Suppose the land is occupied by a warehouse generating rents of \$150,000 after real estate taxes and all other out-of-pocket costs. The present value of the land plus warehouse is again \$1.7 million. Other facts are as in Problem 11. You have a European call option. What is it worth?

22.15. You have an option to purchase all of the assets of the Overland Railroad for \$2.5 billion. The option expires in nine months. You estimate Overland’s current (month 0) present value (PV) as \$2.7 billion. Overland generates after-tax free cash flow (FCF) of \$50 million at the end of each quarter (i.e., at the end of each three-month period). If you exercise your option at the start of the quarter, that quarter’s cash flow is paid out to you. If you do not exercise, the cash flow goes to Overland’s current owners.

In each quarter, Overland’s PV either increases by 10% or decreases by 9.09%. This PV includes the quarterly FCF of \$50 million. After the \$50 million is paid out, PV drops by \$50 million. Thus the binomial tree for the first quarter is (figures in millions):



The risk-free interest rate is 2% per quarter.

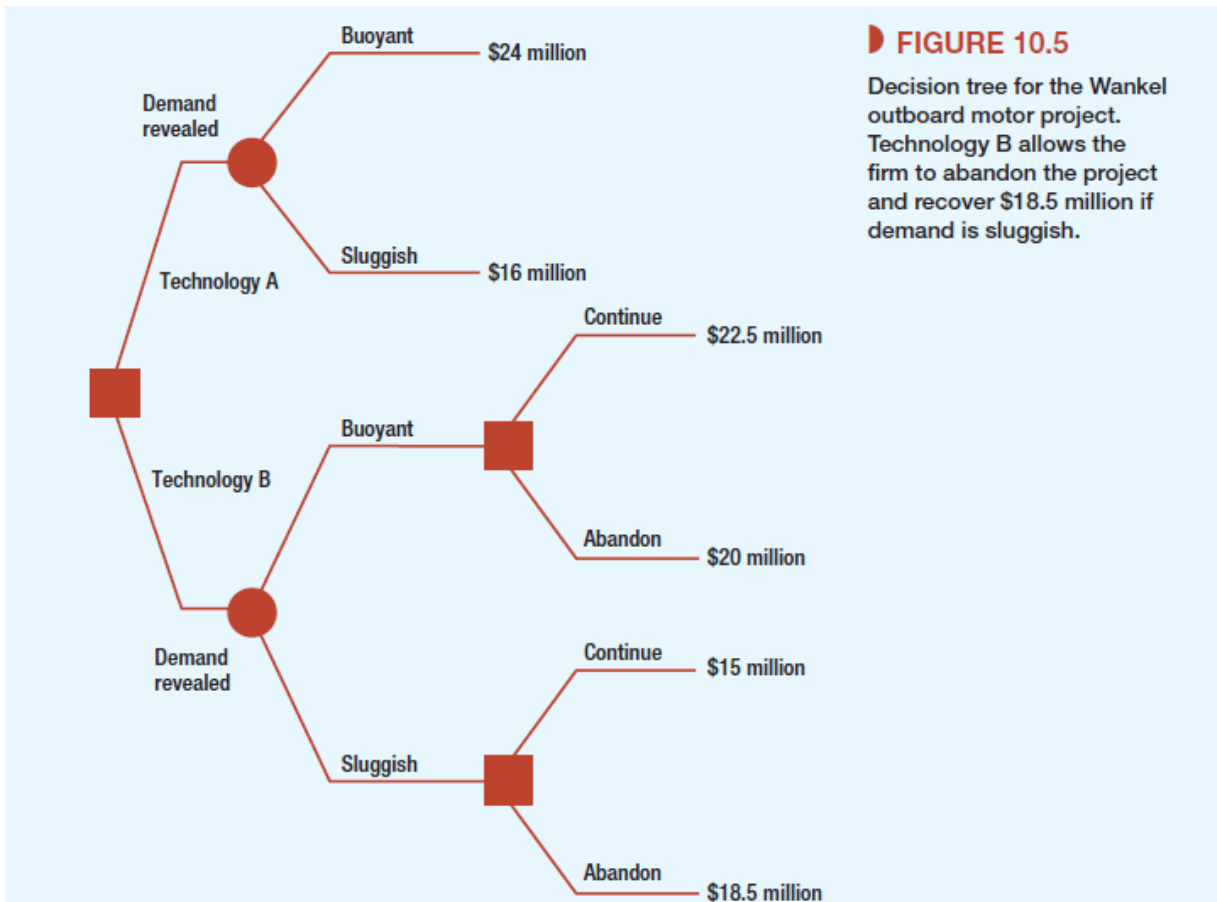
- Build a binomial tree for Overland, with one up or down change for each three-month period (three steps to cover your nine-month option).
- Suppose you can only exercise your option now, or after nine months (not at month 3 or 6). Would you exercise now?
- Suppose you can exercise now, or at month 3, 6, or 9. What is your option worth today? Should you exercise today, or wait?

22.16. In Section 10-4 we considered two production technologies for a new Wankel-engined outboard motor. Technology A was the most efficient but had no salvage value if the new outboards failed to sell. Technology B was less efficient but offered a salvage value of \$17 million.

Figure 10.5 shows the present value of the project as either \$24 or \$16 million in year 1 if Technology A is used. Assume that the present value of these payoffs is \$18 million at year 0.

- With Technology B, the payoffs at year 1 are \$22.5 or \$15 million. What is the present value of these payoffs in year 0 if Technology B is used? (Hint: The payoffs with Technology B are 93.75% of the payoffs from Technology A.)

- b) Technology B allows abandonment in year 1 for \$17 million salvage value. You also get cash flow of \$1.5 million, for a total of \$18.5 million. Calculate abandonment value, assuming a risk-free rate of 7%.



Credit Risk and the Value of Corporate Debt

- 23.1.** You own a 5% bond maturing in two years and priced at 87%. Suppose that there is a 10% chance that at maturity the bond will default and you will receive only 40% of the promised payment. What is the bond's promised yield to maturity? What is its expected yield?
- 23.2.** Other things equal, would you expect the difference between the price of a Treasury bond and a corporate bond to increase or decrease with
- The company's business risk?
 - The degree of leverage?
- 23.3.** The difference between the value of a government bond and a simple corporate bond is equal to the value of an option. What is this option and what is its exercise price?
- 23.4.** The following table shows some financial data for two companies:

| | A | B |
|-----------------------|-----------|-----------|
| Total assets | \$1,552.1 | \$1,565.7 |
| EBITDA | -60 | 70 |
| Net income + interest | -80 | 24 |
| Total liabilities | 814.0 | 1,537.1 |

Use the formula shown in Section 23-4 to calculate which has the higher probability of default.

- 23.5.** What variables are required to use a market-based approach to calculate the probability that a company will default on its debt?
- 23.6.** You have a B-rated bond. On past evidence, what is the probability that it will continue to be rated B in one year's time? What is the probability that it will have a lower rating?
- 23.7.** Ratings transition You have an A-rated bond. Is a rise in rating more likely than a fall? Would your answer be the same if the bond were B-rated?
- 23.8.** Why is it more difficult to estimate the value at risk for a portfolio of loans rather than for a single loan?
- 23.9.** Company A has issued a single zero-coupon bond maturing in 10 years. Company B has issued a coupon bond maturing in 10 years. Explain why it is more complicated to value B's debt than A's.
- 23.10.** Company X has borrowed \$150 maturing this year and \$50 maturing in 10 years. Company Y has borrowed \$200 maturing in five years. In both cases asset value is \$140. Sketch a scenario in which X does not default but Y does.
- 23.11.** Discuss the problems with developing a numerical credit scoring system for evaluating personal loans. You can only test your system using data for applicants who have in the past been granted credit. Is this a potential problem?

23.13. How much would it cost you to insure the bonds of Backwoods Chemical against default? (See Section 23-1.)

23.14 Look back to the first Backwoods Chemical example at the start of Section 23-1. Suppose that the firm's book balance sheet is

| | | | |
|----------------------------|----------------|----------------|---------------------------|
| Net working capital | \$ 400 | \$1,000 | Debt |
| Net fixed assets | 1,600 | 1,000 | Equity (net worth) |
| Total assets | \$2,000 | \$2,000 | Total value |

The debt has a one-year maturity and a promised interest payment of 9%. Thus, the promised payment to Backwoods's creditors is \$1,090. The market value of the assets is \$1,200 and the standard deviation of asset value is 45% per year. The risk-free interest rate is 9%. Calculate the value of Backwoods debt and equity.