

These articles analyze in depth several issues regarding taxation and optimal capital structure: M. Bradley, G. Jarrell, and E. Kim, "On the Existence of an Optimal Capital Structure: Theory and Evidence," *The Journal of Finance* 39 (1984): 857–878; M. Brennan and E. Schwartz, "Corporate Income Taxes, Valuation, and the Problem of Optimal Capital Structure," *Journal of Business* 51 (1978): 103–114; H. DeAngelo and R. Masulis, "Optimal Capital Structure Under Corporate and Personal Taxation," *Journal of Financial Economics* 8 (1980): 3–29; and S. Titman and R. Wessels, "The Determinants of Capital Structure Choice," *Journal of Finance* 43 (1988): 1–19.

The following articles contain information on what managers say about their capital structure decisions: J. Graham and C. Harvey, "How Do CFOs Make Capital Budgeting and Capital Structure Decisions?" *Journal of Applied Corporate Finance* 15 (2002): 8–23; R. Kamath, "Long-Term Financing Decisions: Views and Practices of Financial Managers of NYSE Firms," *Financial Review* 32 (1997): 331–356; E. Norton, "Factors Affecting Capital Structure Decisions," *Financial Review* 26 (1991): 431–446; and J. Pinegar and L. Wilbricht, "What Managers Think of Capital Structure Theory: A Survey," *Financial Management* 18 (1989): 82–91.

For additional insight into capital structure decisions internationally, see also F. Bancel and U. Mitroo, "Cross-Country Determinants of Capital Structure Choice: A Survey of European Firms," *Financial Management* 33 (2004): 103–132; R. La Porta, F. Lopez-de-Silanes, A. Shleifer, and R. Vishny, "Legal Determinants of External Finance," *Journal of Finance* 52 (1997): 1131–1152; and L. Booth, V. Aivazian, A. Demingug-Kunt, and V. Maksimovic, "Capital Structures in Developing Countries," *Journal of Finance* 56 (2001): 87–130.

## PROBLEMS

*Problems in this chapter are available in MyFinanceLab! An asterisk (\*) indicates problems with a higher level of difficulty.*

### The Interest Tax Deduction

1. Pelamed Pharmaceuticals has EBIT of \$325 million in 2006. In addition, Pelamed has interest expenses of \$125 million and a corporate tax rate of 40%.
  - a. What is Pelamed's 2006 net income?
  - b. What is the total of Pelamed's 2006 net income and interest payments?
  - c. If Pelamed had no interest expenses, what would its 2006 net income be? How does it compare to your answer in part (b)?
  - d. What is the amount of Pelamed's interest tax shield in 2006?
2. Grommit Engineering expects to have net income next year of \$20.75 million and free cash flow of \$22.15 million. Grommit's marginal corporate tax rate is 35%.
  - a. If Grommit increases leverage so that its interest expense rises by \$1 million, how will its net income change?
  - b. For the same increase in interest expense, how will free cash flow change?
3. Suppose the corporate tax rate is 40%. Consider a firm that earns \$1000 before interest and taxes each year with no risk. The firm's capital expenditures equal its depreciation expenses each year, and it will have no changes to its net working capital. The risk-free interest rate is 5%.
  - a. Suppose the firm has no debt and pays out its net income as a dividend each year. What is the value of the firm's equity?
  - b. Suppose instead the firm makes interest payments of \$500 per year. What is the value of equity? What is the value of debt?
  - c. What is the difference between the total value of the firm with leverage and without leverage?
  - d. The difference in part (c) is equal to what percentage of the value of the debt?

4. Braxton Enterprises currently has debt outstanding of \$35 million and an interest rate of 8%. Braxton plans to reduce its debt by repaying \$7 million in principal at the end of each year for the next five years. If Braxton's marginal corporate tax rate is 40%, what is the interest tax shield from Braxton's debt in each of the next five years?

### Valuing the Interest Tax Shield

5. Your firm currently has \$100 million in debt outstanding with a 10% interest rate. The terms of the loan require the firm to repay \$25 million of the balance each year. Suppose that the marginal corporate tax rate is 40%, and that the interest tax shields have the same risk as the loan. What is the present value of the interest tax shields from this debt?
6. Arnell Industries has just issued \$10 million in debt (at par). The firm will pay interest only on this debt. Arnell's marginal tax rate is expected to be 35% for the foreseeable future.
- a. Suppose Arnell pays interest of 6% per year on its debt. What is its annual interest tax shield?
- b. What is the present value of the interest tax shield, assuming its risk is the same as the loan?
- c. Suppose instead that the interest rate on the debt is 5%. What is the present value of the interest tax shield in this case?
7. Ten years have passed since Arnell issued \$10 million in perpetual interest only debt with a 6% annual coupon, as in Problem 6. Tax rates have remained the same at 35% but interest rates have dropped so Arnell's current cost of debt capital is 4%.
- a. What is Arnell's annual interest tax shield?
- b. What is the present value of the interest tax shield today?
8. Bay Transport Systems (BTS) currently has \$30 million in debt outstanding. In addition to 6.5% interest, it plans to repay 5% of the remaining balance each year. If BTS has a marginal corporate tax rate of 40%, and if the interest tax shields have the same risk as the loan, what is the present value of the interest tax shield from the debt?
9. Safeco Inc. has no debt, and maintains a policy of holding \$10 million in excess cash reserves, invested in risk-free Treasury securities. If Safeco pays a corporate tax rate of 35%, what is the cost of permanently maintaining this \$10 million reserve? (*Hint:* what is the present value of the additional taxes that Safeco will pay?)
10. Rogot Instruments makes fine Violins and Cellos. It has \$1 million in debt outstanding, equity valued at \$2 million, and pays corporate income tax at rate 35%. Its cost of equity is 12% and its cost of debt is 7%.
- a. What is Rogot's pretax WACC?
- b. What is Rogot's (effective after-tax) WACC?
11. Rumolt Motors has 30 million shares outstanding with a price of \$15 per share. In addition, Rumolt has issued bonds with a total current market value of \$150 million. Suppose Rumolt's equity cost of capital is 10%, and its debt cost of capital is 5%.
- a. What is Rumolt's pretax weighted average cost of capital?
- b. If Rumolt's corporate tax rate is 35%, what is its after-tax weighted average cost of capital?
12. Summit Builders has a market debt-equity ratio of 0.65 and a corporate tax rate of 40%, and it pays 7% interest on its debt. The interest tax shield from its debt lowers Summit's WACC by what amount?
13. NatNah, a builder of acoustic accessories, has no debt and an equity cost of capital of 15%. Suppose NatNah decides to increase its leverage and maintain a market debt-to-value ratio of 0.5. Suppose its debt cost of capital is 9% and its corporate tax rate is 35%. If NatNah's pretax WACC remains constant, what will its (effective after-tax) WACC be with the increase in leverage?



14. Restex maintains a debt-equity ratio of 0.85, and has an equity cost of capital of 12% and a debt cost of capital of 7%. Restex's corporate tax rate is 40%, and its market capitalization is \$220 million.
- If Restex's free cash flow is expected to be \$10 million in one year, what constant expected future growth rate is consistent with the firm's current market value?
  - Estimate the value of Restex's interest tax shield.
15. Acme Storage has a market capitalization of \$100 million and debt outstanding of \$40 million. Acme plans to maintain this same debt-equity ratio in the future. The firm pays an interest rate of 7.5% on its debt and has a corporate tax rate of 35%.
- If Acme's free cash flow is expected to be \$7 million next year and is expected to grow at a rate of 3% per year, what is Acme's WACC?
  - What is the value of Acme's interest tax shield?
16. Milton Industries expects free cash flow of \$5 million each year. Milton's corporate tax rate is 35%, and its unlevered cost of capital is 15%. The firm also has outstanding debt of \$19.05 million, and it expects to maintain this level of debt permanently.
- What is the value of Milton Industries without leverage?
  - What is the value of Milton Industries with leverage?
17. Suppose Microsoft has 8.75 billion shares outstanding and pays a marginal corporate tax rate of 35%. If Microsoft announces that it will payout \$50 billion in cash to investors through a combination of a special dividend and a share repurchase, and if investors had previously assumed Microsoft would retain this excess cash permanently, by how much will Microsoft's share price change upon the announcement?
18. Kurz Manufacturing is currently an all-equity firm with 20 million shares outstanding and a stock price of \$7.50 per share. Although investors currently expect Kurz to remain an all-equity firm, Kurz plans to announce that it will borrow \$50 million and use the funds to repurchase shares. Kurz will pay interest only on this debt, and it has no further plans to increase or decrease the amount of debt. Kurz is subject to a 40% corporate tax rate.
- What is the market value of Kurz's existing assets before the announcement?
  - What is the market value of Kurz's assets (including any tax shields) just after the debt is issued, but before the shares are repurchased?
  - What is Kurz's share price just before the share repurchase? How many shares will Kurz repurchase?
  - What are Kurz's market value balance sheet and share price after the share repurchase?
19. Rally, Inc., is an all-equity firm with assets worth \$25 billion and 10 billion shares outstanding. Rally plans to borrow \$10 billion and use these funds to repurchase shares. The firm's corporate tax rate is 35%, and Rally plans to keep its outstanding debt equal to \$10 billion permanently.
- Without the increase in leverage, what would Rally's share price be?
  - Suppose Rally offers \$2.75 per share to repurchase its shares. Would shareholders sell for this price?
  - Suppose Rally offers \$3.00 per share, and shareholders tender their shares at this price. What will Rally's share price be after the repurchase?
  - What is the lowest price Rally can offer and have shareholders tender their shares? What will its stock price be after the share repurchase in that case?


### Personal Taxes

20. Suppose the corporate tax rate is 40%, and investors pay a tax rate of 15% on income from dividends or capital gains and a tax rate of 33.3% on interest income. Your firm decides to add debt so it will pay an additional \$15 million in interest each year. It will pay this interest expense by cutting its dividend.



- a. How much will debt holders receive after paying taxes on the interest they earn?  
 b. By how much will the firm need to cut its dividend each year to pay this interest expense?  
 c. By how much will this cut in the dividend reduce equity holders' annual after-tax income?  
 d. How much less will the government receive in total tax revenues each year?  
 e. What is the effective tax advantage of debt  $\tau^*$ ?
- 21.** Apple Corporation had no debt on its balance sheet in 2008, but paid \$2 billion in taxes. Suppose Apple were to issue sufficient debt to reduce its taxes by \$1 billion per year permanently. Assume Apple's marginal corporate tax rate is 35% and its borrowing cost is 7.5%.  
 a. If Apple's investors do not pay personal taxes (because they hold their Apple stock in tax-free retirement accounts), how much value would be created (what is the value of the tax shield)?  
 b. How does your answer change if instead you assume that Apple's investors pay a 15% tax rate on income from equity and a 35% tax rate on interest income?
- 22.** Markum Enterprises is considering permanently adding \$100 million of debt to its capital structure. Markum's corporate tax rate is 35%.  
 a. Absent personal taxes, what is the value of the interest tax shield from the new debt?  
 b. If investors pay a tax rate of 40% on interest income, and a tax rate of 20% on income from dividends and capital gains, what is the value of the interest tax shield from the new debt?
- \*23.** Garnet Corporation is considering issuing risk-free debt or risk-free preferred stock. The tax rate on interest income is 35%, and the tax rate on dividends or capital gains from preferred stock is 15%. However, the dividends on preferred stock are not deductible for corporate tax purposes, and the corporate tax rate is 40%.  
 a. If the risk-free interest rate for debt is 6%, what is cost of capital for risk-free preferred stock?  
 b. What is the after-tax debt cost of capital for the firm? Which security is cheaper for the firm?  
 c. Show that the after-tax debt cost of capital is equal to the preferred stock cost of capital multiplied by  $(1 - \tau^*)$ .
- \*24.** Suppose the tax rate on interest income is 35%, and the average tax rate on capital gains and dividend income is 10%. How high must the marginal corporate tax rate be for debt to offer a tax advantage?

### Optimal Capital Structure with Taxes

- 25.** With its current leverage, Impi Corporation will have net income next year of \$4.5 million. If Impi's corporate tax rate is 35% and it pays 8% interest on its debt, how much additional debt can Impi issue this year and still receive the benefit of the interest tax shield next year?
- \*26.** Colt Systems will have EBIT this coming year of \$15 million. It will also spend \$6 million on total capital expenditures and increases in net working capital, and have \$3 million in depreciation expenses. Colt is currently an all-equity firm with a corporate tax rate of 35% and a cost of capital of 10%.  
 a. If Colt is expected to grow by 8.5% per year, what is the market value of its equity today?  
 b. If the interest rate on its debt is 8%, how much can Colt borrow now and still have non-negative net income this coming year?  
 c. Is there a tax incentive for Colt to choose a debt-to-value ratio that exceeds 50%? Explain.
- \*27.**  PMF, Inc., is equally likely to have EBIT this coming year of \$10 million, \$15 million, or \$20 million. Its corporate tax rate is 35%, and investors pay a 15% tax rate on income from equity and a 35% tax rate on interest income.  
 a. What is the effective tax advantage of debt if PMF has interest expenses of \$8 million this coming year?  
 b. What is the effective tax advantage of debt for interest expenses in excess of \$20 million? (Ignore carryforwards.)  
 c. What is the expected effective tax advantage of debt for interest expenses between \$10 million and \$15 million? (Ignore carryforwards.)  
 d. What level of interest expense provides PMF with the greatest tax benefit?

**DATA CASE**

Your boss was impressed with your presentation regarding the irrelevance of capital structure from Chapter 14 but, as expected, has realized that market imperfections like taxes must be accounted for. You have now been asked to include taxes in your analysis. Your boss knows that interest is deductible and has decided that the stock price of Home Depot should increase if the firm increases its use of debt. Thus, your boss wants to propose a share repurchase program using the proceeds from a new debt issue and wants to present this plan to the CEO and perhaps to the Board of Directors.

Your boss would like you to examine the impact of two different scenarios, adding a modest level of debt and adding a higher level of debt. In particular, your boss would like to consider issuing \$1 billion in new debt or \$5 billion in new debt. In either case, Home Depot would use the proceeds to repurchase stock.

1. Using the financial statements for Home Depot that you downloaded in Chapter 14, determine the average corporate tax rate for Home Depot over the last four years by dividing Income Tax by Earnings before Tax for each of the last four years.
2. Begin by analyzing the scenario with \$1 billion in new debt. Assuming the firm plans to keep this new debt outstanding forever, determine the present value of the tax shield of the new debt. What additional assumptions did you need to make for this calculation?
3. Determine the new stock price if the \$1 billion in debt is used to repurchase stock.
  - a. Use the current market value of Home Depot's equity that you calculated in Chapter 14.
  - b. Determine the new market value of the equity if the repurchase occurs.
  - c. Determine the new number of shares and the stock price after the repurchase is announced.
4. What will Home Depot's D/E ratio based on book values be after it issues new debt and repurchases stock? What will its market value D/E ratio be?
5. Repeat Steps 2–4 for the scenario in which Home Depot issues \$5 billion in debt and repurchases stock.
6. Based on the stock price, does the debt increase and stock repurchase appear to be a good idea? Why or why not? What issues might the executives of Home Depot raise that aren't considered in your analysis?