

Chapter 13 Capital Structure

Chapter Overview

The *What Companies Do* opening feature looks at the two debt issues by two different companies and how the financial credibility of the company can affect its capital structure. It tells the story of the issuing, by Seven West Media, a large Australian company, of \$440 million in shares in 2012. Seven West said it would be used for many purposes including the paying back of some outstanding debt. On the other side of the capital structuring coin, we find Westpac's restructuring its capital structure through the sale of some debt make investment opportunities easier for the capital markets. Companies use their capital structure to maintain and continue business and for many other reasons.

What Companies Do Discussion Questions

1. Seven West Media wishes to reduce its debt. How would a decrease in debt change its risk status to investors and creditors?
2. Why might a company try to offer simpler assets to the capital markets?

This chapter discusses:

- 13-1. What is Financial Leverage and What Are Its Effects?
- 13-2. The Modigliani & Miller Propositions
- 13-3. The M&M Capital Structure Model with Taxes
- 13-4. The Trade-Off Model of Capital Structure
- 13-5. The Pecking-Order Theory

Technology

1. **Smart Video.** Mitchell Petersen, NorthWestern University points out that when firms structure their business, they need to think about trading off operating a financial leverage.
2. **Smart Video.** John Graham of Duke University notes that most companies follow the static tradeoff model, balancing the costs and benefits of debt.
3. **Smart Video** features Keith Woodward, vice president of finance for General Mills, as he discusses his company's concerns with optimal capital structure.
4. **Smart Concepts** animation provides a step-by-step explanation of Miller and Modigliani's capital structure irrelevance proposition.
5. **Smart Solutions.** See the solution to Problem P13-7.

After studying this chapter you should be able to:

- explain how financial leverage increases both a company's risk and its returns
- understand how the Modigliani-Miller model indicates that capital structure is irrelevant in a world without taxes and other market frictions, but the use of debt is favoured when debt interest is deductible from corporate income taxes. Discuss how corporate and personal taxes affect capital structure
- explain how the costs of insolvency and financial distress affect capital structure decisions and explore the questions raised by the agency cost/tax shield tradeoff model of corporate leverage
- describe the most important capital structure patterns observed around the world and explain what factors may be driving leverage choices.

Lecture Guide

No one has been able to present a single theory that explains a company's optimal capital structure. Capital structure is still considered to be a puzzle, with competing theories explaining pieces of the puzzle. Each theory partially explains capital structure choice, and the theories are not mutually exclusive.

Table 13.1: 2011 Long-term Debt-to-Assets Ratios

13-1 What is Financial Leverage and What Are Its Effects?

Increasing *financial leverage* can be good for the company or can force the company into insolvency. The instructor could illustrate this with an example that may be familiar to students, one that at least students can expect to face in the future. Suppose you purchase a \$100,000 home with all equity and no mortgage loan. The house appreciates in value to \$150,000. You have a profit of $\$150,000 - \$100,000 = \$50,000$. Ignoring transaction costs like real estate agent commissions or taxes on the capital gain, the return is $50,000/100,000 = 50\%$. Next suppose the student acts more conventionally, and borrows to buy a house. Suppose you make a down payment of \$10,000 and take out a \$90,000 mortgage. Again, the home appreciates to \$150,000 for the same \$50,000 gain. Now the return is $50,000/10,000 = 500\%$. There is a huge advantage to borrowing, which has provided positive leverage in this example. Then illustrate the downside. Suppose the house declines in value to \$80,000, a loss of $\$20,000 = \$100,000 - \$80,000$. The purchaser who paid all cash for the home experiences a loss, and a negative return of $-20,000/100,000 = -20\%$. The purchaser who borrowed, on the other hand, has the same loss of \$20,000, but a negative return of $-20,000/10,000 = -200\%$. In fact, if this student wished to sell, they would owe the bank an additional \$10,000 to pay off the mortgage, potentially pushing the individual into personal insolvency. The company faces the same dilemma – the company wants to borrow to take advantage of positive financial leverage, but doesn't want to risk insolvency caused by borrowing too much.

Table 13.2: Current and Proposed Capital Structures for High-Tech Manufacturing Company

Table 13.3: Expected Cash Flows to Shareholders and Bondholders Under the Current and Proposed Capital Structures for High-Tech Manufacturing Company

Table 13.4: Expected Cash Flows to Shareholders and Bondholders Under the Current and Proposed Capital Structures for High-Tech Manufacturing Company for Three Equally Likely Outcomes

Section Example: Current and Proposed Capital Structure for HTMC

This section takes a company through a more complex decision than the homeowner had in the previous example. The company is considering going from no debt to 50% debt.

- **Return on Equity**
 - As with the homeowner who borrows, the company expects a considerably higher ROE when leveraged than with the all-equity capital structure. Return on equity has increased from 10% to 14%, solely because of the financing decision. Note that assets and operations are the same under both scenarios.
- **Cash Flows if Economy Experiences Normal Growth**
 - Note that ROE and EPS are both higher for the company under the debt scenario. This represents income per shareholder. While net income is higher under the all-equity scenario – \$1,000,000 versus \$700,000 – income per shareholder, as measured by earnings per share, is higher. Net income under the debt scenario because the

company has interest expense which lowers net income. EPS is higher because, assuming both companies have identical assets and operations, there are fewer shareholders to share net income.

- **Cash Flows if Economy Experiences Recession or Boom**
 - This numerically illustrates the upside and downside of financial leverage. If the economy goes into recession, then shareholders would be better off if the company remained all equity and did not borrow. ROE under the debt scenario is 4%, compared to 5% under the all-equity scenario. On the other hand, leverage magnifies returns in good times. If the economy booms, the company will earn a 24% return under the debt scenario, compared to only a 15% return under the all-equity scenario.

13-1a How Leverage Increases the Risk of Expected Earnings per Share

Figure 13.1: The Effect of Debt on the Volatility of Earnings

This EBIT-EPS graph paints a picture of the numbers in the previous example. If the company expects to earn more than the breakeven EBIT, in this case \$600,000, then the debt scenario provides more earnings per share. If EBIT is expected to be less than \$600,000, then the all-equity scenario will provide more income per shareholder. The greater the amount of debt, the steeper the slope of the debt line. This will lead to a greater advantage in good times and a greater disadvantage in bad times.

13-1b The Fundamental Principle of Financial Leverage

Substituting long-term debt for equity in a company's capital structure increases both the level of expected returns to shareholders – measured by earnings per share or ROE – and the risk (dispersion) of those expected returns.

13-1c Leverage Increases Expected Return – but Does It Increase Value?

Note that the market value of the company has not changed – the share price is the same under both scenarios. This is a good lead-in to explaining the major capital structure theories. The cornerstone of capital structure theory is Miller and Modigliani's capital structure irrelevance propositions.

13-2 The Modigliani & Miller Propositions

The value of the company is the discounted sum of its future expected cash flows. The cash flows it can expect from the projects it selects are important, along with the company's risk. The higher the risk, the higher the discount rate applied to those cash flows and the lower the company value. The company's discount rate reflects its choice of debt and equity financing. Debt financing is less costly up to a point – at some point the risk of insolvency makes debt financing too costly or even unavailable.

The assumptions in *Miller and Modigliani's* model are not realistic. Markets are not perfect – there are taxes, both corporate and personal, and transaction costs. One of the biggest transaction costs is insolvency. If a company takes on too much debt, it risks company failure. While *M&M* proved that theoretically capital structure didn't matter, it would be difficult to find an executive today who would agree that capital structure was irrelevant. *M&M* did though provide a valuable distinction between business risk and financial risk that is still very relevant.

13-2a M&M Proposition I: Capital Structure Irrelevance

For HTCM, under the all-equity scenario, the cash flow to equity holders is \$1,000,000. (Net income = EBIT – interest of \$0 minus taxes of \$0). The value of the company, assuming a perpetuity, is $\$1,000,000/0.10 = \$10,000,000$. The value of the company's equity is its net income of $\$700,000/0.14 = \$5,000,000$. The value of debt is the cash flow to debt holders of \$300,000 divided by the discount rate, the 6% cost of debt = \$5,000,000. The value of the levered company is \$5,000,000 equity plus \$5,000,000 debt, or \$10,000,000, the same value as the unlevered company.

- *Student Interaction:* Remind students that this comes from the equation for the balance sheet of the company – that debt plus shareholders' equity equals total assets.

13-2b Proposition II: How Increasing Leverage Affects the Cost of Equity

Proposition II states that equity holders require a higher return than debtholders. While this is seen everyday, it is important to remember.

- *Student Involvement:* Ask students why shareholders demand a higher return for a levered company? Most will recognise that debt places equity holders further behind in their claim on the company's assets. Without a tax benefit, WACC remains constant as leverage increases. The cost of equity increases as companies substitute debt for equity, but WACC stays the same.

Figure 13.2: M&M Proposition II Illustrated – The Cost of Equity, Cost of Debt and Weighted Average Cost of Capital for a Company in a World Without Taxes

This graph illustrates that WACC is independent of capital structure. Since WACC is the discount rate applied to the company's cash flows, it follows that company value must remain the same under all capital structures. The cost of equity has a direct linear relationship with the amount of debt in the capital structure. As debt increases, the cost of equity increases.

13-c Does Debt Policy Matter?

M&M asserts that capital structure does not matter but is that necessarily true in the marketplace? Most companies would not agree that capital structure is irrelevant. The next section adds taxes to the perfect world M&M created.

Figure 13.3: Do Companies Have Target Capital Structures?

13.3 The M&M Capital Structure Model with Taxes

Most will agree that the M&M assumptions are very unrealistic and can apply only in theory. However, the benefit of M&M is that if capital structure matters – and it does matter – then taxes or transaction (insolvency) costs exist or the real investment policy of the company is not fixed and can impact capital structure choice.

- *Student Involvement:* Ask students what should the real investment policy of the company be – investing in all positive net present value projects. Many companies do not follow this policy. Perhaps they do not have the financing, the resources or the managerial expertise to take on all positive net present value projects.

Table 13.5 Cash Flows to Shareholders and Bondholders Under the Current and Proposed Capital Structure for HTMC – with Corporate Taxation

13-3a The M&M Model with Corporate Taxes

Use circles as an illustration to show students that company size is fixed. If you show two circles representing the company with debt and without debt – both circles would be the same size, regardless of the capital structure. This is because the size of the company is fixed. It is fixed because M&M assume that the company's investment policy is fixed. Optimal investment policy is to accept all positive net present value projects. Company value is the sum of all of the company's net present values. Since both companies have the same operations, the size of the company, or value of the company's assets is the same. In the no tax case, shareholders and bondholders share in the value of the company. In the tax case, the government takes a slice of the company in the form of taxes. The more debt, the more interest expense, the less the taxable income and the less taxes. In other words, the government's share of the company is lower when the company carries more debt.

The ability to calculate a tax shield for permanent debt (corporate tax rate times the amount of debt) is an important result of M&M with taxes. Note that this is an upper bound to the tax shield. This is a good time to review the calculations for a tax shield for non-permanent debt. In this case the yearly tax

shield: interest rate \times amount of debt \times tax rate must be computed. This amount is discounted back to the present using the after-tax cost of debt as the discount rate.

- **Student Interaction:** Ask students whether long-term or short-term debt is riskier, and to whom. Most will say that short-term debt is safer for the lender (better able to predict short-term than long-term inflation) and riskier to the company (more of a possibility that their investment projects will not have returned enough money to pay back the debt). Most companies would prefer to borrow long and lenders to lend short. This leads to the typical upward sloping yield curve – that long-term debt is riskier to the lender who in turn demands an extra premium to compensate for that risk.

There are significant tax benefits to debt. A 2000 Graham study found that the tax benefits of debt are 9.7% of company value, which falls to 4-7% when adjusted for personal taxes. The benefits can be larger – when Safeway and RJR Nabisco did leveraged buyouts, the tax benefits amounted to about 20% of asset value. Tax benefits fall as interest expense increases. Interest deductions decrease taxable income, which in turn decreases the chance that a company will be fully taxable in all current and future states, which in turn reduces the tax benefit from the incremental deductions.

13-3b Determining the Present Value of Interest Tax Shields

This section uses an illustration to show that interest rate tax shields provide benefits that will add value back to the company. This is sometimes difficult for students to see so showing the students the example can help.

13-3c The M&M Model with Corporate and Personal Taxes

M&M's tax case yields an equally unrealistic result – that companies would want to have 100% debt in the capital structure. No company could be all debt, so there must be other reasons to explain this. The existence of personal tax is one explanation.

Figure 13.4: Pie Chart Models of Capital Structure With and Without Corporate Income Taxes

13-4 The TradeOff Model of Capital Structure

13-4a Costs of Insolvency and Financial Distress

Three executives just finished lunch and were arguing over the bill. 'I want it,' said the first. 'I'll write it off my taxes.' The second exec said, 'No. I'll take it. I'll charge it to my expense account.' 'No. No,' the third exec said. 'I'll pay. I'm filing for insolvency tomorrow.'

While the insolvency allows a company to restructure or discharge its debts, unlike the implication in the above joke, there are costs associated with insolvency. *Direct costs* – actual cheques written for lawyers, accountants, consultants, court costs, etc. – tend to be low as a percentage of total value of the company. (However, the large Enron and WorldCom insolvencies (or bankruptcies, in US terminology) may change this perception. Six legal companies plus Lazard Freres investment banking company are involved in WorldCom's insolvency filing. Three are billing at rates of over \$700 an hour. Bill McLucas of Wilmer, Cutler and Pickering will receive \$715 an hour to investigate the company's accounting practices, which is \$65 more an hour than he received for doing the same for Enron. Lazard wants a \$15 million success fee if it ends up restructuring WorldCom. The fees may end up being the largest insolvency fees on record. However, these costs will still likely be a relatively small amount of the total costs of the insolvencies.)

There are a number of potential conflicts between bondholders and equity holders that may surface when a company is financially distressed. A *distressed company* will have the incentive to pay out dividends if it can to transfer wealth from bondholders to shareholders. Management also has an incentive to take on money-losing and potentially negative NPV projects during insolvency.

Similarly, companies have no incentive to take on less risky, positive NPV projects if it means they must invest additional equity into the company. If any part of the return from such projects transfers wealth from shareholders to bondholders, shareholders will not invest more in a failing company.

13-4b Agency Costs and Capital Structure

Note that bondholders will control management's propensity to transfer wealth from bondholders to shareholders through restrictive covenants. An example of a real world wealth transfer, made by a non-distressed company, is Marriott Corporation. Marriott Corp. spun off its hotel management operations into Marriott International, and left the real estate company remainder, Host Marriott, with almost all of the company's debt. Some bonds lost 30% of their value on the announcement, dropping from investment grade to junk bond status. Marriott bondholders sued, and received a settlement from the company, but the spinoff largely took place as Marriott originally intended. In many bond covenants, dividends must be paid from current earnings or new equity – the company usually cannot sell (or spin off) assets to pay dividends. Marriott's bonds were very weakly protected and did not contain this covenant. Ask students what is the tradeoff in a situation like this? Most will answer that if bonds are more protected, a disadvantage for the company, they will carry a lower coupon rate. With fewer protections, bonds are riskier, and should receive a higher coupon payment.

13-4c The TradeOff Model Revisited

The static tradeoff model expands the M&M model, noting that while debt increases income per shareholder, it comes with a cost, in particular higher insolvency and agency costs. There is some empirical support for this theory – companies will lever up to a certain amount, and then when they, or the external markets, consider them to be too risky, they will no longer take on debt.

Figure 13-5: TradeOff Model of Corporate Leverage

13-5 The Pecking-Order Theory

There have been several irregularities identified with the tradeoff model. A number of relationships between company value, leverage and factors influencing leverage have been documented. These factors can be categorised into tax effects, insolvency and agency factors. For example, non-debt tax shields and the effective tax rate directly impact the tax shield of debt. Company size, asset tangibility, and growth rate are indicators of the risk, and therefore, the insolvency costs, the company faces. Insider share ownership and managerial entrenchment are indicators of potential agency costs.

- Student Involvement: Students can look for examples of which industries and companies are more impacted by these factors. For example, the technology sector is high growth with few tangible assets. Companies like Cochlear would be expected to – and indeed do – have low leverage.

13-5a Assumptions Underlying the Pecking-Order Theory

13-5b Evidence on Pecking-Order and Trade-Off Theories

Capital Structure, Summary

Companies' use of bank financing vs capital markets may also be a factor. If your class includes international students, this is a good opportunity to bring them into the discussion, asking what factors might influence capital structures among companies in their countries.

Chapter 13 Resource Articles

'Debt is Good for You,' *The Economist*, 27 January 2001. This article talks about M&M's theory as they apply to companies. It notes that the current theories don't do a very good job of explaining companies' behavior.

'Debt Reduction in Telecom Area May Hurt Stocks,' *Wall Street Journal*, 10 September 2001. This article looks at telecom companies that are replacing debt with equity. While this could be seen as responsible financing in troubled markets, this is placing shareholders further down in their claim on the company's assets.

'Aggressive Debt Issuance to Boost Return on Equity May be Ending, as Balance Sheets Draw Scrutiny,' *Wall Street Journal*, 22 February 2002. Companies are not cutting back on share buybacks and issuing more equity. The move is in response to perhaps overly high debt levels.

'Lower Corporate Debt, More Available Cash Boost Prospects for US M&A Activity, KPMG Study Finds Deal Making Capacity Expected to Rise,' *PR Newswire*, 4 August 2011. US debt is less than global debt according to a KPMG study. This lower debt and higher cash balance could lead to higher than normal merger and acquisition activity as US companies look for ways to increase the bottom line.

Enrichment Exercises

Break students into groups, each with a question to answer about capital structure theory. Ask each group to report back to the class. Some suggested questions are:

1. What would happen if the Australian Government increased the tax rate on personal income?
2. What would happen if the Australian Government increased the tax rate on corporate income?
3. What would happen if the Australian Government increased the amount of government debt outstanding?
4. What would happen if a company's deductions increased for depreciation?
5. What would happen if a company's deductions increased because of greater tax loss carry-forwards?
6. What if the tax structure were simplified to a straight tax system, would this change corporate behavior toward capital structure?

Answers to Concept Review Questions

1. A recapitalisation occurs when a company changes the mix of debt and equity in its capital structure – leaving total capitalisation unchanged. The most common practice is for a company to issue debt and use the proceeds raised to buy (and retire) an equal value of the company's outstanding ordinary shares, though issuing shares and retiring debt is also possible. A recapitalisation is a pure capital structure change because it does not affect the company's operating cash flows (EBIT) and does not change the overall value of the company's debt and equity capital – just the overall mix of debt and equity.
2. The fundamental principle of financial leverage says that substituting long-term debt for equity in a company's capital structure increases both the level of expected returns to shareholders – measured by earnings per share – and the risk (dispersion) of those expected returns. Managers might be tempted to increase leverage because this will increase expected earnings per share for shareholders.
3. M&M Propositions I and II both support the conclusion that capital structure doesn't matter. Proposition I states that company value stays the same at every level of capital structure. Proposition II supports I by allowing a new cost of equity to be calculated as debt is added to the capital structure. Using this cost of equity to discount cash flows to equity holders, and using the cost of debt to discount cash flows (interest) to debt holders provides a company value identical to the no-leverage company value. Proposition II states that as companies switch from equity, which has a relatively high required return, to debt, which has a relatively low required return, the required return on equity increases just enough to offset the cost savings of switching from equity to debt. The cost of capital does not change as capital structure changes. Intuitively, this makes sense as long as changes in capital structure do not result in changes in the company's investment projects.
4. Levered equity means equity in a company that also uses debt financing. Unlevered equity is equity financing for an all-equity company. Substituting debt for equity increases the required return on equity in a linear manner so that the weighted average cost of capital remains the same for all leverage levels.

5. Accounting for corporate income taxes negates the M&M capital structure irrelevance hypothesis, and instead gives companies an incentive to use 'maximum leverage.' Interest payments are a tax-deductible business expense, while dividends must be paid out of after-tax net income. Thus if companies substitute debt for equity, they can minimise tax payment outflows and make higher net cash payments to private investors by paying interest rather than dividends.
6. By equalising the after-tax returns to Australian resident bondholders and shareholders of Australian companies for a given dollar of pre-tax earnings, the price of equity (which is riskier than debt for the investor) would be expected to have fallen.
7. Direct costs of insolvency are out-of-pocket cash expenses directly related to insolvency filing and administration. Document printing and filing expenses, as well as professional fees paid to lawyers, accountants, investment bankers, and court personnel are all examples of direct insolvency costs. These costs can run to several million dollars per month for complex cases. However, empirical research indicates that direct costs are much too small, relative to the pre-insolvency market value of large companies, to truly discourage the use of debt financing. Indirect insolvency costs, as the name implies, are economic losses that result from insolvency but are not cash expenses spent on the process itself. These include the diversion of management's time while insolvency is underway, lost sales during and after insolvency, constrained capital investment and R&D spending, and the loss of key employees after a company becomes insolvent. Even though indirect insolvency costs are inherently difficult to measure, empirical research clearly suggests they are significant – significant enough in many cases to reduce the incentive for corporate managers to employ financial leverage.
8. The car owner has no incentive to invest in preventive maintenance if he/she expects the bank to repossess the car soon – no oil and filter changes, new tyres, high-grade gasoline, etc. The owner has no incentive to spend any money on the car, other than low-grade gasoline as needed.
9. This problem did occur with savings and loans during the real estate crisis in the US in the late 1980s. Banks, needing to increase their returns partially because of losses on loans, had the incentive to invest in even riskier loans – loans that had a low probability of payoff, but a high payoff if they did succeed. Bank regulators could try to control these problems through more frequent checks of the quality of the commercial bank's loan portfolio or setting standards for loans that creditors must meet before the loans could be made. Regulators can also impose risk-based capital requirements, meaning that a bank must have more equity on its balance sheet if it chooses to make riskier loans.
10. Managers could justify perks on the grounds that the perks make them more productive. For example, the CEO's time is very valuable. It might be better spent on a private company jet than standing in long security queues at public airports, waiting for commercial flights. A plush office might impress potential customers and make them more likely to do business with the company. Sports arena luxury boxes may be used to attract and retain key clients who provide more in new business than the cost of the box.
11. Undervalued, reflecting the executives' view that the external capital market does not understand the true value of the company. The Pecking-order Theory asserts that the capital markets suffer from asymmetric information, in that managers know more than the market about the operations and plans of the company, both good and bad news.
12. Almost every published empirical study shows that share prices rise when a company announces leverage-increasing events, such as debt-for-equity exchange offers, debt-financed share repurchase programs, and debt-financed cash tender offers to acquire control of another company. On the other hand, leverage-decreasing events such as equity-for-debt exchange offers, new share offerings, and acquisition offers involving payment with a company's own shares almost always yield

share price declines. This suggests that shareholders consider leverage-increasing events to be 'good news' and leverage-decreasing events to be 'bad news.'

Solutions to Self-Test Problems

ST13-1. As Chief Financial Officer of the Uptown Service Company (USC), you are considering a recapitalisation plan that would convert USC from its current all-equity capital structure to one including substantial financial leverage. USC now has 150,000 ordinary shares outstanding, which are selling for \$80.00 each. The recapitalisation proposal is to issue \$6,000,000 worth of long-term debt at an interest rate of 7.0 per cent and use the proceeds to repurchase 75,000 shares worth \$6,000,000. USC's earnings in the next year will depend on the state of the economy. If there is normal growth, EBIT will be \$1,200,000. EBIT will be \$600,000 if there is a recession, and EBIT will be \$1,800,000 if there is an economic boom. You believe that each economic outcome is equally likely. Assume there are no market frictions such as corporate or personal income taxes.

- If the proposed recapitalisation is adopted, calculate the number of shares outstanding, the per-share price and the debt-to-equity ratio for USC if the proposed recapitalisation is adopted.
- Calculate the earnings per share (EPS) and return on equity for USC shareholders under all three economic outcomes (recession, normal growth and boom), for both the current all-equity capitalisation and the proposed mixed debt/equity capital structure.
- Calculate the break-even level of EBIT, where earnings per share for USC shareholders are the same, under the current and proposed capital structures.
- At what level of EBIT will USC shareholders earn zero EPS, under the current and the proposed capital structures?

A:

- If USC issues \$6,000,000 worth of debt and repurchases 75,000 shares worth \$6,000,000, this implies that the shares will be repurchased at a price of \$80 each ($\$6,000,000 \div 75,000$ shares). After this transaction, 75,000 shares will remain outstanding, each worth \$80, for a total equity value of \$6,000,000. The debt-to-equity ratio will therefore be 1.0 ($\$6,000,000$ debt \div $\$6,000,000$ equity).

b.

Expected Operating Profits Cash Flows to Shareholders and Bondholders Under Current and Proposed Capital Structure for USC For Three Equally Likely Economic Outcomes						
	Recession		Normal Growth		Boom	
EBIT	\$600,000		\$1,200,000		\$1,800,000	
	All Equity Financing	50% Debt: 50% Equity	All Equity Financing	50% Debt: 50% Equity	All Equity Financing	50% Debt: 50% Equity
Interest (7.0%)	\$ 0	\$ 420,000	\$ 0	\$420,000	\$ 0	\$420,000
Net income	\$600,000	\$180,000	\$1,200,000	\$780,000	\$1,800,000	\$1,380,000
Shares outstanding	150,000	75,000	150,000	75,000	150,000	75,000
Earnings per share	\$4.00	\$2.40	\$8.00	\$10.40	\$12.00	\$18.40
% Return on shares ($P_0 = \$80.00/\text{share}$)	5.0%	3.0%	10.0%	13.00%	15.0%	23.0%

- The break-even point is EBIT equal to twice the interest payment, or \$840,000 (2 x \$420,000 interest). At that level of EBIT, earnings per share will be \$5.60 per share under both the current all-equity capitalisation ($\$840,000$ EBIT \div 150,000 shares O/S) and under the 50% debt, 50% equity capital structure [$(\$840,000$ EBIT $-$ $\$420,000$ Interest) \div 75,000 shares O/S].

- d. Under the current all-equity capitalisation, shareholders will earn positive EPS for any EBIT above zero, so EBIT = \$0 is where EPS = \$0. Under the proposed capital structure, EPS = \$0 where EBIT = Interest payments = \$420,000.

ST13-2. An unlevered company operates in perfect markets and has net operating income (EBIT) of \$2,000,000. Assume that the required return on assets for companies in this industry is 8 per cent. The company issues \$10 million worth of debt with a required return of 6.5 per cent, and uses the proceeds to repurchase outstanding shares. There are no corporate or personal taxes.

- What is the market value and required return of this company's shares before the repurchase transaction, according to M&M Proposition I?
- What is the market value and required return of this company's remaining shares after the repurchase transaction according to M&M Proposition II?

A:

- Before the share repurchase, the value of the company under M&M Proposition I is $EBIT/r = \$2,000,000/0.08 = \$25,000,000$. The required return on the shares (all-equity financing) is 8.0%.
- After the repurchase, the company has \$10,000,000 debt and \$15,000,000 equity, so the debt-to-equity ratio is 0.6667 and the new required return on equity according to M&M Proposition II is:

$$r_1 = r + (r - r_d)D/E = 0.08 + (0.08 - 0.065) \times 0.6667 = 0.08 + 0.01 = 0.09 \text{ or } 9\%.$$

ST13-3. Westside Manufacturing has EBIT of \$10 million; the company has \$60 million of debt outstanding, with a required rate of return of 6.5 per cent. The required rate of return on the industry is 10 per cent. The corporate tax rate is 30 per cent. Assume corporate taxes but no personal taxes.

- Determine the present value of the interest tax shield of Westside Manufacturing, as well as the total value of the company.
- Determine the gain from leverage, if personal taxes of 10 per cent on share income and 35 per cent on debt income exist.

A:

	Levered	Unlevered
EBIT	\$10,000,000	\$10,000,000
– Interest paid ($0.065 \times \$60,000,000$)	<u>(3,900,000)</u>	<u>0</u>
= Taxable income	\$ 6,100,000	\$10,000,000
– Taxes ($T_c = 0.30$)	<u>(1,830,000)</u>	<u>(3,000,000)</u>
= Net income	\$ 4,270,000	\$ 7,000,000
+ Interest paid	<u>3,900,000</u>	<u>0</u>
= Total income available to investors	<u>\$ 8,170,000</u>	<u>\$ 7,000,000</u>

- Present value of tax shield = Debt $\times T_c = \$60,000,000 \times 0.30 = \$18,000,000$

$$\begin{aligned} \text{Value unlevered company} &= \text{Net income} \div \text{Capitalisation rate} \\ &= \$7,000,000 \div 0.10 \\ &= \$70,000,000 \end{aligned}$$

$$\begin{aligned} \text{Value of levered company} &= \text{Value unlevered company} + \text{PV tax shields} \\ &= \$70,000,000 + \$18,000,000 \\ &= \$88,000,000. \end{aligned}$$

$$b. \quad G_L = \left[1 - \frac{(1 - T_c)(1 - T_{ps})}{(1 - T_{pd})} \right] \times D = \{1 - [(1 - 0.3)(1 - 0.1)] \div (1 - 0.35)\} \times \$60,000,000$$

$$\begin{aligned}
 &= \{1 - [(0.7)(0.0)] \div 0.65\} \times \$60,000,000 \\
 &= 0.0308 \times \$60,000,000 \\
 &= \$1,846,153.85
 \end{aligned}$$

- ST13-4.** You are the manager of a financially distressed company, with \$10 million in debt outstanding. This debt will mature in one month. Your company currently has \$7 million cash on hand. Assume that you are offered the opportunity to invest in either of the two projects described below.

Project 1: The opportunity to invest \$7 million in risk-free Treasury bills, with a 4 per cent annual interest rate (or a 0.333% per month interest rate)

Project 2: A high-risk gamble, which will pay off \$12 million in one month, if successful (probability = 0.25), but will only pay \$4,000,000, if unsuccessful (probability = 0.75)

- Compute the expected payoff for each project, and state which one you would adopt if you were operating the company in the shareholders' best interests? Why?
- Which project would you accept if the company was unlevered? Why?
- Which project would you accept if the company was organised as a partnership rather than a company? Why??

- A:**
- Payoff for Project 1: $\$7,000,000 \times 1.00333 = \$7,023,333$
Payoff for Project 2: $0.25 \times \$12,000,000 + 0.75 \times \$4,000,000 = \$6,000,000$

If you were operating in the shareholders' interests, project 2 would be accepted. It gives a higher potential payoff to shareholders if the project does well. Project 1 has a sure, but lower return, but its payoff will accrue to bondholders, rather than shareholders. This is in spite of the fact that project 2 clearly has a negative NPV – it pays off only \$6,000,000 and requires a \$7 million investment. Note that these are future payoffs – they need to be discounted at the appropriate cost of capital to determine NPV.

- If the company were unlevered, the company would prefer project 1. The payoff for project 1 is higher than the payoff for project 2. If the company is unlevered, all of the return will accrue to shareholders, since there are no bondholders. An unlevered company would reject project 2.
- If the company were organised as a partnership rather than a company, then it would accept Project 1. In partnerships, the owners do not have the option to default on the company's debt (i.e., they don't have limited liability), leaving the company's assets in the hands of creditors. Therefore, without the option to default, partners have no incentive to under-invest. They will accept Project 1 because doing so reduces their expected losses when the company becomes insolvent.

- ST13-5.** Run-and-Hide Detective Company currently has no debt and expects to earn \$5 million in EBIT each year for the foreseeable future. The required return on assets for detective companies of this type is 10.0 per cent, and the corporate tax rate is 35 per cent. No taxes accrue on dividends or interest at the personal level. Run-and-Hide calculates a 5 per cent chance that the company will fall into insolvency in any given year. If insolvency does occur, it will impose direct and indirect costs totaling \$8 million. If necessary, they will use the industry required return for discounting insolvency costs.
- Compute the present value of insolvency costs for Run-and-Hide.
 - Compute the overall value of the company.
 - Re-calculate the value of the company, assuming that the company's shareholders face a 15 per cent personal tax rate on equity income.

- A:**
- For any given year, the expected value of insolvency costs will be equal to the probability of insolvency ($p = 0.05$) times the cost to the company if insolvency occurs (\$8,000,000), or \$400,000 per year. Since direct insolvency (B/R) costs are usually only incurred by

unprofitable companies – those that are not currently paying corporate income taxes – and since indirect B/R costs are things such as opportunity costs such as lost sales, loss of reputation capital and loss of key personnel, we will assume that all B/R costs are after-tax costs. The present value of insolvency costs, PV_{BR} , will then be equal to the sum of the stream of discounted expected annual insolvency costs, where the discount rate will be the industry required return ($r = .10$). Since this stream is a perpetuity, PV_{BR} will simply be the expected annual B/R costs divided by the discount rate:

$$PV_{BR} = \left[\frac{\$400,000}{0.10} \right] = \$4,000,000$$

b. The overall value of the company is computed using equation 13.7, where V_U is the value of an unlevered company (computed using equation 13.3), V_L is the value of a levered company, and PV_{TS} equals the present value of debt tax shields. Since there are, at present, no debt tax shields, we will simply compute company value, V :

$$V_L = V = V_U + PV_{TS} - PV_{BR} \quad (\text{Eq 13.7})$$

$$V_U = \left[\frac{EBIT(1 - T_c)}{r} \right] = \frac{\$5,000,000 (0.65)}{0.10} = \frac{\$3,250,000}{0.10} = \$32,500,000$$

$$V = V_U - PV_{BR} = \$32,500,000 - \$4,000,000 = \$28,500,000$$

c. Incorporating a personal tax rate on equity income into the valuation model of an unlevered company presented in equation 13.3 yields:

$$V_U = \left[\frac{EBIT(1 - T_c)(1 - T_{ps})}{r} \right] = \frac{\$5,000,000 (0.65) (0.85)}{0.10} = \frac{\$2,762,500}{0.10} = \$27,625,000$$

And the new value of the company, V , taking account of insolvency costs as well, becomes:

$$V = V_U - PV_{BR} = \$27,625,000 - \$4,000,000 = \$26,400,000$$

Answers to End-of-Chapter Questions

Q13-1. Why is use of long-term debt financing referred to as using *financial leverage*?

A13-1. Just as a lever is used in the physical world to magnify the effect of a given force on an object, debt financing is used to magnify the impact of a change in EBIT on earnings per share. If a profitable company's EBIT comes in as expected, or higher, employing debt financing will increase earnings per share for the company's shareholders. However, the reverse also holds. If EBIT falls below expectations, that company's shareholders will be harmed if the company uses debt financing.

Q13-2. What is the fundamental principle of financial leverage?

A13-2. The fundamental principle of financial leverage asserts that substituting long-term debt for equity in a profitable company's capital structure increases both the level of expected returns to shareholders – measured by earnings per share--and the risk (dispersion) of those expected returns.

Q13-3. What is the basic conclusion of the original Modigliani and Miller *Proposition I*?

A13-3. Miller and Modigliani Proposition I concludes that capital structure doesn't matter – a company has the same value whether it is unlevered or highly levered.

- Q13-4.** Following from the conclusion of Proposition I, what is the crux of M&M *Proposition II*? What is the natural relationship between the required returns on debt and equity that results from Proposition II?
- A13-4.** Proposition II states that the cost of equity increases as the amount of debt in the capital structure increases. Debt financing costs less than equity financing, and as company WACC stays the same even as capital structure changes, the increase in the required return on equity is exactly offset by the decrease in the cost of equity financing, resulting from substituting debt for equity. WACC must stay the same, since company value is unchanged at all levels of debt financing.
- Q13-5.** In what way did M&M change their conclusion regarding capital structure choice with the additional assumption of corporate taxes? In this context, what explains the difference in value between levered and unlevered companies?
- A13-5.** Corporate taxes provide an advantage to corporate debt financing because of the tax deductibility of interest payments. Company value increases by the value of the tax shield as the company adds more debt to the capital structure, leading to the conclusion that a company should have 100% debt in its capital structure. The difference between levered and unlevered companies is the value of the tax shield, T_c times the amount of debt in the capital structure.
- Q13-6.** By introducing personal taxes into the model for capital structure choice, how did Miller alter the previous M&M conclusion that 100 per cent debt is optimal? What happens to the gains from leverage if personal tax rates on interest income are significantly higher than those on share-related income?
- A13-6.** The existence of personal taxes decreases the value of the corporate tax shield under current tax rates. It is theoretically possible for the combination of corporate tax rates, personal tax rate on debt income and personal tax rate on equity income to lead to the result that capital structure is irrelevant (the original M&M theory). It would also be theoretically possible for there to be a negative tax shield associated with debt financing, again depending on the relationship among the three tax rates. If personal tax rates on interest income are higher, relative to taxes on equity related income, then there will be less demand for debt financing. Companies that want to attract new debt financing will have to offer higher interest rates to attract investors.
- Q13-7.** Why do a company's shareholders hold a valuable 'default option'? How could this option induce shareholders to employ high levels of financial leverage?
- A13-7.** Limited liability is shareholders' valuable default option. Shareholders have the right to walk away from a failed company. The most that they can lose is their investment in the company. Creditors cannot claim shareholders' personal assets. In the event of insolvency, creditors must be satisfied with the value of the company as their payment, even if that value is less than the face value of their original debt. The more a company borrows, the less equity financing it requires. With a relatively low investment in the company, the default option becomes quite valuable. If a company invests in a risky project that turns out well, shareholders may enjoy a large positive gain. But if the project fails, shareholders only lose their original investment in the company.
- Q13-8.** All else equal, which company would face a greater level of financial distress, a software-development company or a hotel chain? Why would financial distress costs affect the companies so differently?

- A13-8.** A software development company would face higher costs of financial distress than the hotel chain. The main asset of the software development company is the expertise of its programmers, an intangible asset. The hotel chain's assets are its hotel properties. A lender can repossess and sell physical assets like hotels; it cannot repossess and sell human capital. In distress, the software company's programmers may jump ship and move to another, healthier software business, and the company will lose even more in value as its human assets leave.
- Q13-9.** Describe how managers that have companies with debt outstanding and face financial distress could jeopardise the investments of creditors with the 'games' of asset substitution and under-investment.
- A13-9.** Managers of financially distressed companies will have incentive to gamble with bondholders' money. If little value will accrue to shareholders in the event of liquidation, management, while still in control of the distressed company, may invest in highly risky projects (asset substitution) that have a small probability of a large payoff and a high probability of a zero or low payoff. This may give shareholders a small probability of increasing their wealth at the expense of bondholders. Shareholders also have little to no incentive to invest more equity into a failing company. Management may pass up good, positive net present value projects if their only source of funding is new equity financing.
- Q13-10.** Differentiate between direct and indirect costs of insolvency. Which of the two is generally more significant?
- A13-10.** Indirect costs of insolvency are considered to be higher than direct costs. Direct costs include management time, legal fees, and court costs. Indirect costs include loss of company value because of actions taken by the insolvency judge, management, customers or suppliers. For example, if the company sells a product where a long-term warranty is important, customers may abandon the company because they are afraid they will be unable to obtain future service on their product. Suppliers might refuse to supply the company on reasonable terms, making it impossible to continue business. Managers or judges may make poor business decisions, for example, continuing a money-losing business model after it should have been shut down.
- Q13-11.** How can restrictive covenants in bonds be both an agency cost of debt and a way to prevent agency costs of debt?
- A13-11.** Restrictive covenants can be an agency cost to the company if they prevent the company from taking on desired positive net present value projects or otherwise sub-optimally constrict the company's operations. Covenants can reduce agency costs because bondholders who are more confident the management won't play games like asset substitution and under-investment may offer the company a lower coupon rate for providing debt financing.
- Q13-12.** What are the tradeoffs in the agency cost/tax shield tradeoff model? How is the company's optimal capital structure determined under the assumptions of this model? Does empirical evidence support this model?
- A13-12.** The tradeoffs between agency costs and tax benefits are 1) increasing debt, increasing the tax shield, but also increasing agency costs or 2) decreasing debt, decreasing agency costs, but then reducing the tax shield benefit of debt. Optimal capital structure is found by determining the best balance between the agency costs vs the tax benefit. Optimal capital structure is the debt ratio that provides a minimum weighted average cost of capital – the best combination of insolvency costs vs the tax benefits of debt. The company is leveraging up until the point where the marginal tax benefit is equal to the marginal cost of more leverage. The

empirical evidence is mixed. For example, a company with a high percentage of insider ownership would be expected to have lower agency costs. Studies found neither a positive or negative relationship between percentage of insiders and leverage.

- Q13-13.** What is the observed relationship between debt ratios and profitability and the perceived costs of financial distress?
- A13-13.** In general, more profitable companies will have less debt in their capital structures. This is because they rely more on internally generated funds, and need less external financing.
- Q13-14.** How influential are corporate and personal taxes on capital structure?
- A13-14.** Corporate and personal taxes do influence capital structures, but are not the only factors that explain differences in capital structures. There have been gradual changes in leverage, even though the tax law changes tend to be sudden. Research has shown that increases in corporate taxes are associated with increased debt usage and decreases in the personal tax rates on equity income relative to personal taxes on interest income are associated with less debt in capital structures.
- Q13-16.** What is the pecking-order theory, and what facts does it seem to explain better than the tradeoff model does?
- A13-15.** The pecking-order theory predicts that managers will operate their companies in such a way as to minimise the need to secure outside financing – for example, by retaining profits to build up financial slack. These same managers will use the safest source of funding, usually senior debt, when they must secure outside financing. The pecking-order theory is consistent with the observation that the majority of corporate investments in Australia and many other developed countries are funded internally through retained earnings.

Solutions to End-of-Chapter Problems

Financial Leverage and Expected Returns to Shareholders

- P13-1.** As Chief Financial Officer of the Magnificent Electronics Company (MEC), you are considering a recapitalisation plan that would convert MEC from its current all-equity capital structure to one including substantial financial leverage. MEC now has 500,000 ordinary shares outstanding, which are selling for \$60 each, and you expect the company's EBIT to be \$2,400,000 per year for the foreseeable future. The recapitalisation proposal is to issue \$15,000,000 worth of long-term debt at an interest rate of 6.0 per cent and use the proceeds to repurchase 250,000 ordinary shares worth \$15,000,000. Assuming there are no market frictions such as corporate or personal income taxes, calculate the expected return on equity for MEC shareholders under both the current all-equity capital structure and under the recapitalisation plan.

A13-1.

Cash Flows to Shareholders and Bondholders
Under Current and Proposed Capital Structure for the Magnificent Electronics Company
Assuming EBIT = \$2,400,000

	Current capital structure: All equity financing	Proposed capital structure: 50% debt: 50% equity
EBIT	\$2,400,000	\$2,400,000
Interest (6.0%)	\$0	\$900,000
Net income	\$2,400,000	\$1,500,000
Shares outstanding	500,000	250,000
Earnings per share	\$4.80	\$6.00
Return on equity	8.0%	10.0%

(P₀ = \$60.00/share)

- P13-2.** The All-Star Pacific Company (APC) is considering a recapitalisation plan that would convert APC from its current all-equity capital structure to one including some financial leverage. APC now has 10,000,000 ordinary shares outstanding, which are selling for \$40.00 each, and you expect the company's EBIT to be \$50,000,000 per year for the foreseeable future. The recapitalisation proposal is to issue \$100,000,000 worth of long-term debt at an interest rate of 6.50 per cent and use the proceeds to repurchase as many shares as possible at a price of \$40.00 per share. Assume there are no market frictions such as corporate or personal income taxes. Calculate the expected return on equity for APC shareholders under both the current all-equity capital structure and under the recapitalisation plan.
- Calculate the number of shares outstanding, the per-share price and the debt-to-equity ratio for APC if the proposed recapitalisation is adopted.
 - Calculate the earnings per share (EPS) and return on equity for APC shareholders under both the current all-equity capitalisation and the proposed mixed debt/equity capital structure.
 - Calculate the break-even level of EBIT where earnings per share for APC shareholders are the same under the current and proposed capital structures.
 - At what level of EBIT will APC shareholders earn zero EPS under the current and the proposed capital structures?
- A13-2.** a. If APC issues \$100,000,000 worth of debt and repurchases as many shares as possible at \$40/share, the company will repurchase 2,500,000 shares worth \$100,000,000, (\$100,000,000 ÷ \$40/share = 2,500,000 shares). After this transaction, 7,500,000 shares will remain outstanding, each worth \$40, for a total equity value of \$300,000,000. The debt-to-equity ratio will therefore be 0.333 (\$100,000,000 debt ÷ \$300,000,000 equity).
- b.

Cash Flows to Shareholders and Bondholders
Under Current and Proposed Capital Structure for the All-Star Production Corp.
Assuming EBIT = \$50,000,000

	Current capital structure: All equity financing	Proposed capital structure: 25% debt: 75% equity
EBIT	\$50,000,000	\$50,000,000
Interest (6.50%)	\$0	\$6,500,000
Net Income	\$50,000,000	\$43,500,000
Shares outstanding	10,000,000	7,500,000
Earnings per share	\$5.00	\$5.80
Return on equity (P₀ = \$40.00/share)	12.50%	14.50%

- c. Since the recapitalisation does not create a 50% debt, 50% equity capital structure, the break-even point for EBIT cannot be determined simply by doubling the interest payment, but an answer can be deduced by reason. Begin by noting that the BEP occurs where EBIT divided by the number of shares outstanding under the all-equity plan (10,000,000 shares) is equal to [EBIT – Interest] divided by the number of shares outstanding under the 25% debt, 75% equity plan:

$$(X \div 10,000,000 \text{ shares}) = [(X - \$6,500,000 \text{ Interest}) \div 7,500,000 \text{ shares}]$$

Multiply through by 10,000,000 to leave X alone on the left-hand side:

$$X = 10,000,000/7,500,000 (X - \$6,500,000) = 4/3 (X - \$6,500,000)$$

Then multiply through by 3 and simplify the equation:

$$3X = 4X - \$26,000,000$$

Finally, solve for X:

$$4X - 3X = X = \$26,000,000 = \text{Break-even EBIT}$$

At that level of EBIT, earnings per share will be \$2.60 per share under both the current all-equity capitalisation (\$26,000,000 EBIT ÷ 10,000,000 shares O/S) and under the 25% debt, 75% equity capital structure [(\$26,000,000 EBIT – \$6,500,000 Interest) ÷ 7,500,000 shares O/S].

- d. Under the current all-equity capitalisation, shareholders will earn positive EPS for any EBIT above zero, so EBIT = \$0 is where EPS = \$0. Under the proposed capital structure, EPS = \$0 where EBIT = Interest payments = \$6,500,000.

P13-3. As Chief Financial Officer of the Campus Supply Corporation (CSC), you are considering a recapitalisation plan that would convert CSC from its current all-equity capital structure to one including substantial financial leverage. CSC now has 250,000 ordinary shares outstanding, which are selling for \$60.00 each, and the recapitalisation proposal is to issue \$7,500,000 worth of long-term debt at an interest rate of 6.0 per cent and use the proceeds to repurchase 125,000 ordinary shares worth \$7,500,000. CSC's earnings next year will depend on the state of the economy. If there is normal growth, EBIT will be \$2,000,000; EBIT will be \$1,000,000 if there is a recession and EBIT will be \$3,000,000 if there is an economic boom. You believe that each economic outcome is equally likely. Assume there are no market frictions such as corporate or personal income taxes.

- Calculate the number of shares outstanding, the per-share price and the debt-to-equity ratio for CSC if the proposed recapitalisation is adopted.
- Calculate the expected earnings per share (EPS) and return on equity for CSC shareholders under all three economic outcomes (recession, normal growth and boom), for both the current all-equity capitalisation and the proposed mixed debt/equity capital structure.
- Calculate the break-even level of EBIT where earnings per share for CSC shareholders are the same under the current and proposed capital structures.
- At what level of EBIT will CSC shareholders earn zero EPS under the current and the proposed capital structures?

A13-3. a. If CSC issues \$7,500,000 worth of debt and repurchases 125,000 shares worth \$7,500,000, this implies that the shares will be repurchased at a price of \$60 each (\$7,500,000 ÷ 125,000 shares). After this transaction, 125,000 shares will remain outstanding, each worth \$60, for a total equity value of \$7,500,000. The debt-to-equity ratio will therefore be 1.0 (\$7,500,000 debt ÷ \$7,500,000 equity).

b.

Expected Operating Profits Cash Flows to Shareholders and Bondholders Under Current and Proposed Capital Structure for USC For Three Equally Likely Economic Outcomes						
	Recession		Normal Growth		Boom	
EBIT	\$1,000,000		\$2,000,000		\$3,000,000	
	All Equity Financing	50% Debt: 50% Equity	All Equity Financing	50% Debt: 50% Equity	All Equity Financing	50% Debt: 50% Equity
Interest (6.0%)	\$0	\$450,000	\$0	\$450,000	\$0	\$450,000
Net Income	\$1,000,000	\$550,000	\$2,000,000	\$1,550,000	\$3,000,000	\$2,550,000
Shares outstanding	250,000	125,000	250,000	125,000	250,000	125,000
Earnings per share	\$4.00	\$4.40	\$8.00	\$12.40	\$12.00	\$20.40
% Return on shares ($P_0 = 60.00/\text{share}$)	6.67%	7.33%	13.33%	20.67%	20%	34%

- c. The break-even point is EBIT equal to twice the interest payment, or \$900,000 ($2 \times \$450,000$ interest). At that level of EBIT, earnings per share will be \$3.60 per share under both the current all-equity capitalisation ($\$900,000 \text{ EBIT} \div 250,000 \text{ shares O/S}$) and under the 50% debt, 50% equity capital structure [$(\$900,000 \text{ EBIT} - \$450,000 \text{ Interest}) \div 125,000 \text{ shares O/S}$].
- d. Under the current all-equity capitalisation, shareholders will earn positive EPS for any EBIT above zero, so $\text{EBIT} = \$0$ is where $\text{EPS} = \$0$. Under the proposed capital structure, $\text{EPS} = \$0$ where $\text{EBIT} = \text{Interest payments} = \$450,000$.

The Modigliani & Miller Propositions

P13-4. An unlevered company operates in perfect markets and has net operating income (EBIT) of \$250,000. Assume that the required return on assets for companies in this industry is 12.5 per cent and that the company issues \$1 million worth of debt with a required return of 5 per cent and uses the proceeds to repurchase outstanding shares.

- What is the market value and required return of this company's shares before the repurchase transaction?
- What is the market value and required return of this company's remaining shares after the repurchase transaction?

A13-4. a. Before the share repurchase, the value of the company is $\text{EBIT}/r = \$250,000/0.125 = \$2,000,000$. The required return on the shares (all-equity financing) is 12.5%.

- b. After the repurchase, the company is 50/50 debt and equity financed. The new required return on equity is

$$r_i = r + (r - r_d)D/E = 0.125 + (0.125 - 0.05) \times 0.5/0.5 = 0.125 + 0.075 = 0.20 \text{ or } 20\%$$

P13-5. Assume that capital markets are perfect. A company finances its operations with \$50 million in shares, with a required return of 15 per cent, and \$40 million in bonds with a required return of 9 per cent. Assume the company could issue \$10 million in additional bonds, at 9 per cent. Using the proceeds to retire \$10 million worth of equity, what would happen to the company's WACC? What would happen to the required return on the company's shares?

A13-5. $r_i = r + (r - r_d) \times D/E$ Plug in known values to calculate WACC

$$\begin{aligned} 0.15 &= r + (r - 0.09) (40/50) \\ &= r + (r - 0.09)(0.8) \end{aligned}$$

$$\begin{aligned}
 &= r + 0.8r - 0.072 \\
 0.222 &= 1.8r \\
 r &= 0.1233 = 12.33\% \text{ WACC}
 \end{aligned}$$

If \$10 million new debt issued and proceeds used to retire equity, D/E ratio rises to 50/40 = 1.25. Plug this into Equation 13.2 and rearrange to compute new required return on equity, assuming WACC remains unchanged at $r = 0.1233$

$$\begin{aligned}
 r_E &= r + (r - r_D) \times D/E = 0.1233 + (0.1233 - 0.09) (50/40) \\
 r_E &= 0.165 = 16.5\%
 \end{aligned}$$

Substituting \$10 million debt for equity would cause the cost of equity would increase to 16.5%.

P13-6. A company operates in perfect capital markets. The required return on its outstanding debt is 6 per cent, the required return on its shares is 14 per cent, and its WACC is 10 per cent. What is the company's debt-to-equity ratio?

A13-6. From equation 13.2 we know the relationship between the cost of equity for a levered company, the WACC, the cost of debt and the debt-to-equity ratio. We can plug in the values we know, then rearrange to compute the debt-to-equity ratio, as follows:

$$\begin{aligned}
 r_E &= r + (r - r_D) \times D/E \\
 0.14 &= 0.10 + (0.10 - 0.06) \times D/E \\
 0.14 - 0.10 &= (0.10 - 0.06) \times D/E \\
 0.04 &= 0.04 \times D/E \\
 D/E &= 1.00.
 \end{aligned}$$

P13-7. Assume that two companies, U and L, are identical in all respects except that Company U is debt free and Company L has a capital structure that is 50 per cent debt and 50 per cent equity by market value. Further suppose that the assumptions of the Modigliani & Miller capital structure irrelevance proposition hold (no taxes or transactions costs, no insolvency costs, etc.) and that each company will have net operating income (EBIT) of \$800,000. If the required return on assets, r , for these companies is 12.5 per cent and risk-free debt yields 5 per cent, calculate the following values for both Company U and Company L: (1) total company value, (2) market value of debt and equity, and (3) required return on equity.

A13-7. The market value of company U and company L is $800,000 \div 0.125 = \$6,400,000$. The market value of equity for company U is \$6,400,000, an all equity company. Company L's debt has a market value of $(\$3,200,000 \times 0.05) \div 0.05 = \$3,200,000$. The cost of equity for company L is $r_E = r + (r - r_D)D/E = 0.125 + (0.125 - 0.05) \times 3,200,000/3,200,000 = 0.20$ or 20%. The value of the company's equity is cash flow to equity holders divided by the cost of equity:

EBIT:	\$800,000
Interest	160,000
Net income	640,000

The value of the company's equity is $\$640,000 \div 0.2 = \$3,200,000$.

P13-8. Hearthstone Corp. and You Beauty Ltd are companies that compete in the luxury consumer goods market. The two companies are virtually identical, except that Hearthstone is financed entirely with equity and You Beauty Ltd uses equal amounts of debt and equity. Suppose that each company has assets with a total market value of \$100 million. Hearthstone has 4 million shares outstanding worth \$25 each. You Beauty Ltd has 2 million shares outstanding, and it also has publicly traded debt, with a market value of \$50 million. Both companies operate in a

world with perfect capital markets (no taxes, etc.). The WACC for each company is 12 per cent. The cost of debt is 8 per cent.

- What is the price of You Beauty Ltd shares?
- What is the cost of equity for Hearthstone? For You Beauty Ltd?

A13-8.

	Hearthstone	You Beauty Ltd
Net operating income (EBIT = $V \times r$)	\$12,000,000	\$12,000,000
Interest paid ($r_d \times D$)	0	(4,000,000)
Net income (NI = EBIT – $r_d D$)	\$12,000,000	\$8,000,000
Required return on assets (r)	0.12	0.12
Total company value (V)	\$100,000,000	\$100,000,000
Reqd return on equity (r_u or $r_l = NI \div E$)	0.12	0.16
Market value of equity ($E = V - D$)	\$100,000,000	\$50,000,000
Interest rate on debt (r_d)	—	0.08
Market value of debt (D)	0	\$50,000,000

- You Beauty Ltd share price = MV equity (E) \div # shares O/S = $\$50,000,000 \div 2,000,000 = \$25/\text{share}$
- Cost of equity, You Beauty Ltd = $r_l = NI \div E = \$8,000,000 \div \$50,000,000 = 0.16 = 16.0\%$
Cost of equity, Hearthstone = $r_u = r = 0.12 = 12.0\%$

P13-9. In the mid-1980s, Michael Milken and his company, Drexel Burnham Lambert, made the term 'junk bonds' a household word. Many of Drexel's clients issued junk bonds (bonds with low credit ratings) to the public to raise money to conduct a leveraged buyout (LBO) of a target company. After the LBO, the target company would have an extremely high debt-to-equity ratio, with only a small portion of equity financing remaining. Many politicians and members of the financial press worried that the increase in junk bonds would bring about an increase in the risk to the economy because so many large companies had become highly leveraged. Merton Miller disagreed. See if you can follow his argument by assessing whether each of the statements below is true or false:

- The junk bonds issued by acquiring companies were riskier than investment-grade bonds.
- The remaining equity in highly leveraged companies was more risky than it had been before the LBO.
- After an LBO, the target company's capital structure would consist of very risky junk bonds and very risky equity. Therefore, the risk of the company would increase after the LBO.
- The junk bonds issued to conduct the LBO were less risky than the equity they replaced.

- A13-9.**
- True: these bonds would have significant business risk and thus be similar to equity finance.
 - True: substituting debt for equity leaves the remaining equity riskier.
 - False: In the absence of tax effects, the risk of the company is based solely on the risk of the company's assets, which do not change after the pure capital structure change of an LBO. With tax deductibility of interest payments at the corporate level, adding leverage would, if anything, increase the value of the company. Thus the company's business risk (risk of the asset's return) would not increase after the LBO.
 - True: The junk bonds are less risky than the equity they replaced, though they are more risky than any more senior bonds that remain outstanding. Overall, the company's risk will remain unchanged regardless of capital structure changes.

The M&M Capital Structure Model with Taxes

- P13-10.** Hercutio Mining has net operating income of \$5 million; there is \$50 million of debt outstanding with a required rate of return of 6 per cent; the required rate of return on the industry is 12 per cent; and the corporate tax rate is 40 per cent. Assume there are corporate taxes but no personal taxes.
- Determine the present value of the interest tax shield of Hercutio Mining, as well as the total value of the company.
 - Determine the gain from leverage if there are personal taxes of 20 per cent on share income and 30 per cent on debt income.

A13-10.

	Levered	Unlevered
EBIT	\$5,000,000	\$5,000,000
– Interest paid ($0.06 \times \$50,000,000$)	<u>3,000,000</u>	<u>0</u>
= Taxable income	\$2,000,000	\$5,000,000
– Taxes ($T_c = 0.40$)	<u>800,000</u>	<u>2,000,000</u>
= Net income	\$1,200,000	\$3,000,000
+ Interest paid	<u>3,000,000</u>	<u>0</u>
= Total income available to investors	\$4,200,000	\$3,000,000

- a. Present value of tax shield = Debt $\times T_c = \$50,000,000 \times 0.40 = \$20,000,000$

$$\begin{aligned} \text{Value unlevered company} &= \text{Net income} \div \text{Capitalisation rate} \\ &= \$3,000,000 \div 0.12 \\ &= \$25,000,000 \end{aligned}$$

$$\begin{aligned} \text{Value of levered company} &= \text{Value unlevered company} + \text{PV tax shields} \\ &= \$25,000,000 + \$20,000,000 \\ &= \$45,000,000 \end{aligned}$$

$$\begin{aligned} \text{b. } G_L &= \left[1 - \frac{(1 - T_c)(1 - T_{ps})}{(1 - T_{pd})} \right] \times D = \{1 - [(1 - 0.4)(1 - 0.2)] \div (1 - 0.3)\} \times \$50,000,000 \\ &= \{1 - [(0.6)(0.8)] \div 0.7\} \times \$50,000,000 \\ &= 0.3142 \times \$50,000,000 = \$15,714,285.72 \end{aligned}$$

- P13-11.** An all-equity company is subject to a 30 per cent tax rate. Its total market value is initially \$3,500,000. There are 175,000 shares outstanding. The company announces a program to issue \$1 million worth of bonds at 10 per cent interest and to use the proceeds to buy back ordinary shares.
- What is the value of the tax shield that the company acquires through the bond issue?
 - According to Modigliani & Miller, what is the likely increase in market value per share of the company after the announcement (assuming efficient markets)?
 - How many shares will the company be able to repurchase?

- A13-11.**
- The value of the tax shield is the corporate tax rate \times the amount of debt = $0.3 \times \$1,000,000 = \$300,000$.
 - Assuming efficient markets, the value of the company should increase by the amount of the tax shield, \$300,000, or \$1.71 per share.
 - The number of shares repurchased and the price per share will depend on your assumptions concerning market efficiency.

Case 1 – Information is not known about the new debt. In this case, shareholders who do not tender their shares in the repurchase will benefit, at the expense of shareholders who tender their shares. The company's share price is $3,500,000/175,000 = \$20/\text{share}$, so the \$1,000,000 raised by issuing bonds will allow the company to repurchase 50,000 shares ($\$1,000,000 \div \$20/\text{share}$), leaving 125,000 shares outstanding that are worth \$2,500,000. After the shares are repurchased, the value of the debt tax shield (\$300,000) becomes apparent, and so the value of the equity will be $\$2,500,000 + \$300,000 = \$2,800,000$. In this case, remaining shareholders will have shares worth $\$2,800,000/125,000 \text{ shares left} = \22.40 .

Case 2 – Markets are efficient, and as soon as the repurchase announcement is made, company value will rise to \$3,800,000. Shares will be worth $\$3,800,000/175,000 = \21.71 . The company will not be able to purchase shares at the old price of \$20, but instead will have to pay \$21.71. They will be able to repurchase $1,000,000/21.71 = 46,062$ shares. The new number of shares will be $175,000 - 46,062 = 128,938$ shares. The new value of equity will be $\$3,800,000 - \$1,000,000 = \$2,800,000$. The per share value will be $\$2,800,000/128,938 = \21.71 . In this case, all shareholders, both those tendering and those keeping their shares will share the \$300,000 increase in company value.

- P13-12.** Intel Corp. is a company that uses almost no debt and had a total market capitalisation of about \$109 billion in April 2010. Assume that Intel faces a 35 per cent tax rate on corporate earnings. Ignore all elements of the decision except corporate tax savings.
- By how much could Intel managers increase the value of the company by issuing \$50 billion in bonds (which would be rolled over in perpetuity) and simultaneously repurchasing \$50 billion in shares? Why do you think that Intel has not taken advantage of this opportunity?
 - Suppose that the personal tax rate on equity income faced by Intel shareholders is 10 per cent, and the personal tax rate on interest income is 40 per cent. Recalculate the gains to Intel from replacing \$50 billion of equity with debt.

- A13-12.** a. If Intel issued \$50 billion in debt, and used the proceeds to repurchase \$50 billion of equity, leaving total assets unchanged and assuming only tax effects mattered, the market value of Intel would increase by the PV of the interest tax shields:

$$\text{PV interest tax shields} = T_c \times D = 0.35 \times \$50 \text{ billion} = \$17.5 \text{ billion}$$

Intel does not do this because the costs of financial distress and other non-tax costs of leverage would be too high.

$$\begin{aligned} \text{b. } G_L &= \left[1 - \frac{(1 - T_c)(1 - T_{ps})}{(1 - T_{pd})} \right] D = \{1 - [(1 - 0.35)(1 - 0.10)] \div (1 - 0.40)\} \times \$50 \text{ billion} \\ &= \{1 - [(0.65)(0.90)] \div 0.6\} \times \$50 \text{ billion} \\ &= 0.025 \times \$50 \text{ billion} = \$1.25 \text{ billion} \end{aligned}$$

- P13-13.** SoonerCo has net operating income of \$2.5 million per year, and \$15 million of debt outstanding with a required return (interest rate) of 8 per cent. The required rate of return on assets in this industry is 12.5 per cent, and the corporate tax rate is 35 per cent. Within the M&M framework of corporate taxes but no personal taxes, determine the present value of the interest tax shield of SoonerCo, as well as the total value of the company. Finally, determine the gain from leverage if there are personal tax rates of 15 per cent on shares income and 25 per cent on debt income.

- A13-13.** The present value of the tax shield is the corporate tax rate \times the amount of debt $= .35 \times \$15,000,000 = \$5,250,000$. The value of the company is the value of the unlevered company $[\text{EBIT} \times (1-T)] \div \text{discount rate}$, or $2,500,000(1-0.35) \div 0.125 = \$1,625,000/0.125 = \$13,000,000$. The value of the levered company is the value of the unlevered company plus the value of the tax shield: $\$13,000,000 + \$5,250,000 = \$18,250,000$.

With personal taxes the gain from leverage is

$$G_L = \left[1 - \frac{(1 - T_c)(1 - T_{ps})}{(1 - T_{pd})} \right] D = \{1 - [(1-0.35)(1-0.15)] \div (1-0.25)\} \times \$15 \text{ million}$$

$$= .264 \times \$15,000,000 = \$3,950,000$$

The Tradeoff Model

- P13-14.** Assume that you are the manager of a financially distressed company with \$1.5 million in debt outstanding that will mature in two months. Your company currently has \$1 million cash on hand. Assuming that you are operating the company in the shareholders' best interests and that debt covenants prevent you from simply paying out the cash to shareholders as cash dividends, what should you do?

- A13-14.** If your company is financially distressed and has excess cash that it does not need immediately for payments, you have the incentive to invest in very risky projects, projects that have low probabilities of high payoffs.

- P13-15.** You are the manager of a financially distressed company with \$1.5 million in debt outstanding that will mature in three months. Your company currently has \$1 million cash on hand. Assume that you are offered the opportunity to invest in either of the two projects described below.

Project 1: the opportunity to invest \$1 million in risk-free Treasury bills, with a 4 per cent annual interest rate (a quarterly interest rate of 1 per cent $= 4\%$ per year $\div 4$ quarters per year)

Project 2: a high-risk gamble, which will pay off \$1.6 million in two months if successful (probability $= 0.4$), but will only pay \$400,000 if unsuccessful (probability $= 0.6$)

- Compute the expected payoff for each project. If you were operating the company in the shareholders' best interests, which one would you adopt, and why?
- Which project would you accept if the company was unlevered? Why?
- Which project would you accept if the company was organised as a partnership rather than a company? Why?

- A13-15.** a. Payoff for Project 1: $\$1,000,000 \times 1.01 = \$1,010,000$
Payoff for Project 2: $0.4 \times \$1,600,000 + 0.6 \times \$400,000 = \$880,000$

If you were operating in the shareholders' interests, project 2 would be accepted. It gives a higher potential payoff to shareholders if the project does well. Project 1 has a sure, but lower return, but its payoff will accrue to bondholders, rather than shareholders. This is spite of the fact that project 2 clearly has a negative NPV – it pays off only \$880,000 and requires a \$1 million investment. Note that these are future payoffs – they need to be discounted at the appropriate cost of capital to determine NPV.

- If the company were unlevered, the company would prefer project 1. The payoff for project 1 is higher than the payoff for project 2. If the company is unlevered all of the return will accrue to shareholders, since there are no bondholders. An unlevered company would reject project 2.

- c. If the company were organised as a partnership rather than a company, then it would accept Project 1. In partnerships, the owners do not have the option to default on the company's debt (i.e., they don't have limited liability), leaving the company's assets in the hands of creditors. Therefore, without the option to default, partners have no incentive to underinvest. They will accept Project 1 because doing so reduces their expected losses when the company becomes insolvent.

P13-16. A company has the choice of investing in one of two projects. Both projects last one year. Project 1 requires an investment of \$11,000 and yields \$11,000 with a probability of 0.5 and \$13,000 with a probability of 0.5. Project 2 also requires an investment of \$11,000 and yields \$5,000 with a probability of 0.5 and \$20,000 with a probability of 0.5. The company is capable of raising \$10,000 of the investment required through a bond issue carrying an annual interest rate of 10 per cent.

(a) Assuming that the investors are concerned only about expected returns, which project would shareholders prefer? Why?

(b) Which project would bondholders prefer? Why?

A13-16. (a) Consider Project 1 first. In either scenario, the payoff on the project is sufficient to repay bondholders in full, \$11,000. Bondholders earn their 10% return. The expected payoff to shareholders is

$$0.5 \times (\$11,000 - \$11,000) + 0.5 \times (\$13,000 - \$11,000) = \$1,000$$

Given that shareholders have to put up \$1,000 to make this investment, their expected return is 0%.

(b) Now consider Project 2. If the project payoff is just \$5,000, then that is all that bondholders will receive. Therefore, bondholders will prefer project 1. The expected payoff to bondholders is

$$0.5 \times \$5,000 + 0.5 \times \$11,000 = \$8,000$$

Given that bondholders invest \$10,000, their expected return is -20%.

The expected payoff to shareholders is

$$0.5 \times \$0 + 0.5 \times (\$20,000 - \$11,000) = \$4,500$$

Because shareholders invest just \$1,000, their expected return is 350%.

P13-17. An all-equity company has 100,000 shares outstanding worth \$10 each. The company is considering a project requiring an investment of \$400,000 and has an NPV of \$50,000. The company is also considering financing this project with a new issue of equity.

- a. At what price would the company issue the new shares so that the existing shareholders are indifferent to whether the company takes on the project with this equity financing or does not take on the project?
- b. At what price would the company issue the new shares so that the existing shareholders capture the full benefit associated with the new project?

A13-17. a. For existing shareholders to be indifferent, find the number of shares that will leave share value at its current \$10:

$$\begin{aligned} \text{Old value of company} &= \text{Number of old shares} \times \text{Price per share} \\ &= 100,000 \times \$10 \\ &= \$1,000,000 \end{aligned}$$

$$\begin{aligned} \text{New value of company} &= \text{Old value of company} + \text{New assets} + \text{NPV of project} \\ &= \$1,000,000 + \$400,000 + \$50,000 \\ &= \$1,450,000 \end{aligned}$$

$$\frac{\$1,450,000}{100,000 + X} = \$10$$

where X = the number of shares issued to leave current value at \$10
 $X = 45,000$ shares

\$400,000 needed, divided by 45,000 shares = \$8.89/share

At this price, current shareholders will be indifferent to accepting the new project.

- b. If the old shareholders capture the full benefit of the project, they will have \$50,000/100,000 = \$.50 per share, a total of \$10.50 per share. If the company issues shares at \$10.50 per share, the following will occur:

$$\$400,000 / \$10.50 = 38,095 \text{ new shares needed}$$

$$\text{New value of company} / \text{total number of shares} = \$1,450,000 / 138,095 = \$10.50$$

Just to get a firmer grip on this problem, suppose the company issues new shares at \$10, the market price at the time of the new issue. This means selling 40,000 new shares. Before making the investment, but after raising capital, the company is worth \$1,400,000. Next, the company takes the project and the company value rises to \$1,450,000 and the share price rises to \$10.36. Old shareholders and new shareholders both benefit from this transaction. They both earn a \$0.36 capital gain (\$36,000 of which goes to old shareholders and \$14,000 to new shareholders).

Contrast this with what happens in parts a and b of the problem. When the company sells shares at \$8.89, only the new shareholders benefit, because they buy shares at \$8.89, which are worth \$10 as soon as the company makes its investment. Therefore, the new shareholders earn a gain of \$1.11 per share. Multiply that by 45,000 new shares sold, and you get about \$50,000. So, new shareholders capture the full value of the NPV. When the company sells shares at \$10.50, only the old shareholders benefit. The 10,000 existing shareholders each get a \$0.50 capital gain which equals the full \$50,000 project NPV.

P13-18. You are the manager of a financially distressed company that has \$5 million in loans coming due in 30 days. Your company has \$4 million cash on hand. Suppose that a long-time supplier of materials to your company is planning to exit the business but has offered to sell your company a large supply of material at a bargain price of \$4.5 million – but only if payment is made immediately in cash. If you choose not to acquire this material, the supplier will offer it to a competitor, and your company will have to acquire the materials at market prices totaling \$5 million over the next few months.

- Assuming that you are operating the company in shareholders' best interests, would you accept the project? Why or why not?
- Would you accept this project if the company were unlevered? Why or why not?
- Would you accept the project if the company were organised as a partnership? Why or why not?

- A13-18.**
- If you are operating the company in shareholders' best interests, you will not accept the project. It will be better for the shareholders to default and leave the bondholders with a company that is worth less than the value of their debt. The additional \$.5 million investment made by the shareholders to buy the inventory would be used to pay the bondholders' \$5 million debt. This is an example of the under-investment problem. Shareholders will not invest further in a company if that benefit will accrue to bondholders.
 - If the company were unlevered, it would accept the project. In this case, shareholders will receive the full benefit from the \$.5 million savings, instead of its going to the

bondholders.

- c. If the company were organised as a partnership, it would accept the project. In this case, the partners do not have the option to default and walk away from the company's debt the way that shareholders of a company can. Because the partners will have to come up with \$1 million, repaying the debts and retaining control of the company, they will rationally take advantage of the opportunity to purchase the materials at a discount.

P13-19. Magnum Enterprises has net operating income of \$5 million; there is \$50 million of debt outstanding with a required rate of return of 6 per cent; the required rate of return on the industry is 12 per cent; and the corporate tax rate is 40 per cent. There are corporate taxes but no personal taxes. Compute the value of Magnum, assuming that the present value of insolvency costs are \$10 million.

A13-19.

	Levered	Unlevered
EBIT	\$5,000,000	\$5,000,000
– Interest paid ($0.06 \times \$50,000,000$)	<u>3,000,000</u>	<u>0</u>
= Taxable income	\$2,000,000	\$5,000,000
– Taxes ($\tau_c = 0.40$)	<u>800,000</u>	<u>2,000,000</u>
= Net income	\$1,200,000	\$3,000,000
+ Interest paid	<u>3,000,000</u>	<u>0</u>
= Total income available to investors	<u>\$4,200,000</u>	<u>\$3,000,000</u>

Present value of tax shield = Debt \times T_c = $\$50,000,000 \times 0.40$ = \$20,000,000

Value of unlevered company = Net income \div Capitalisation rate
 = $\$3,000,000 \div 0.12$
 = \$25,000,000

Value of levered company = Value unlevered company + PV tax shields
 = $\$25,000,000 + \$20,000,000$
 = \$45,000,000

Now, assume the present value of insolvency costs is \$10 million. These are simply subtracted from the total value of the company:

Value of levered company = Value unlevered company + PV tax shields – PV of insolvency costs
 = $\$25,000,000 + \$20,000,000 - \$10,000,000$
 = \$35,000,000

P13-20. Slash and Burn Construction Company currently has no debt and expects to earn \$10 million in net operating income each year for the foreseeable future. The required return on assets for construction companies of this type is 12.5 per cent, and the corporate tax rate is 40 per cent. There are no taxes on dividends or interest at the personal level. Slash and Burn calculates that there is a 10 per cent chance that the company will fall into insolvency in any given year, and if insolvency does occur, it will impose direct and indirect costs totaling \$12 million. If necessary, use the industry required return for discounting insolvency costs.

- Compute the present value of insolvency costs for Slash and Burn.
- Compute the overall value of the company.
- Re-calculate the value of the company, assuming that the company's shareholders face a 25 per cent personal tax rate on equity income.

- A13-20.** a. For any given year, the expected value of insolvency costs will be equal to the probability of insolvency ($p = 0.10$) times the cost to the company if insolvency occurs (\$12,000,000), or \$1,200,000 per year. Since direct insolvency (B/R) costs are usually only incurred by unprofitable companies – that are not currently paying corporate income taxes – and since indirect B/R costs are things such as opportunity costs such as lost sales, loss of reputational capital and loss of key personnel, we will assume that all B/R costs are after-tax costs. The present value of insolvency costs, PV_{BR} , will then be equal to the sum of the stream of discounted expected annual insolvency costs, where the discount rate will be the industry required return ($r = 0.125$). Since this stream is a perpetuity, PV_{BR} will simply be the expected annual B/R costs divided by the discount rate:

$$PV_{BR} = \left[\frac{\$1,200,000}{0.125} \right] = \$9,600,000$$

- b. The overall value of the company is computed using equation 13.7, where V_U is the value of an unlevered company (computed using equation 13.3), V_L is the value of a levered company, and PV_{TS} equals the present value of debt tax shields. Since there are, at present, no debt tax shields, we will simply compute company value, V :

$$V_L = V = V_U + PV_{TS} - PV_{BR} \quad (\text{Eq 13.7})$$

$$V_U = \left[\frac{EBIT(1 - T_c)}{r} \right] = \frac{\$10,000,000 (0.60)}{0.125} = \frac{\$6,000,000}{0.125} = \$48,000,000$$

$$V = V_U - PV_{BR} = \$48,000,000 - \$9,600,000 = \$38,400,000$$

- c. Incorporating a personal tax rate on equity income into the valuation model of an unlevered company presented in equation 13.3 yields:

$$V_U = \left[\frac{EBIT(1 - T_c)(1 - T_{PS})}{r} \right] = \frac{\$10,000,000 (0.60) (0.75)}{0.125} = \frac{\$4,500,000}{0.125} = \$36,000,000$$

And the new value of the company, V , taking account of insolvency costs as well, becomes:

$$V = V_U - PV_{BR} = \$36,000,000 - \$9,600,000 = \$26,400,000$$

- P13-21.** Worldwide Contractors currently has no debt and expects to earn \$10 million in net operating income each year, for the foreseeable future. The required return on assets for construction companies of this type is 12.5 per cent, and the corporate tax rate is 40 per cent. There are no taxes on dividends or interest at the personal level. Worldwide calculates that there is a 10 per cent chance that the company will fall into insolvency in any given year. If insolvency does occur, it will impose direct and indirect costs totaling \$12 million. If necessary, use the industry required return for discounting insolvency costs. Assume that the managers of this company are weighing two capital structure alteration proposals.

Proposal 1: involves borrowing \$20 million, at an interest rate of 6 per cent, and using the proceeds to repurchase an equal amount of outstanding shares. With this level of debt, the likelihood that Worldwide Contractors will fall into insolvency in any given year increases to 15 per cent. If insolvency occurs, it will impose direct and indirect costs, totaling \$12 million.

Proposal 2: involves borrowing \$30 million, at an interest rate of 8 per cent, and also using the proceeds to repurchase an equal amount of outstanding shares. With this level of debt, the likelihood of Worldwide Contractors falling into insolvency in any given year rises to 25 per cent. The associated direct and indirect costs of insolvency, if it occurs, increase to \$20 million.

For each proposal, calculate both the present value of the interest tax shields and the overall value of the company, assuming that there are no personal taxes on debt or equity income.

- A13-21.** If Worldwide Contractors takes on debt, the company can be valued as a levered company using equation 13.7. As in problem 13-22, the value of Worldwide Contractors as an unlevered company computed using equation 13.3 will be \$48,000,000 $[EBIT(1-T_C) \div r]$ and the value of the company with B/R costs will be V_U minus PV_{BR} . A new present value of insolvency costs will need to be computed for each option, given the increased probability of encountering B/R under options 1 and 2 ($p_1 = 0.15$ and $p_2 = 0.25$) and the increased cost of B/R (\$20,000,000) under option 2. The present value of the tax shields, PV_{TS} , will be given for each option by equation 13.4:

$$PV_{TS} = \left[\frac{T_C \times r_d D}{r_d} \right] \quad (\text{Eq 13.4})$$

Option 1:

$$PV_{TS} = \left[\frac{T_C \times r_d D}{r_d} \right] = \left[\frac{0.40 \times 0.06 \times \$20,000,000}{0.06} \right] = \$8,000,000$$

$$PV_{BR} = \left[\frac{0.15 \times \$12,000,000}{0.125} \right] = \left[\frac{\$1,800,000}{0.125} \right] = \$14,400,000$$

$$V_L = V_U + PV_{TS} - PV_{BR}$$

$$V = \$48,000,000 + \$8,000,000 - \$14,400,000 = \$41,600,000$$

Option 2:

$$PV_{TS} = \left[\frac{T_C \times r_d D}{r_d} \right] = \left[\frac{0.40 \times 0.08 \times \$30,000,000}{0.08} \right] = \$12,000,000$$

$$PV_{BR} = \left[\frac{0.25 \times \$20,000,000}{0.125} \right] = \left[\frac{\$5,000,000}{0.125} \right] = \$40,000,000$$

$$V_L = V_U + PV_{TS} - PV_{BR}$$

$$V = \$48,000,000 + \$12,000,000 - \$40,000,000 = \$20,000,000$$

- P13-22.** Go to Yahoo! and download recent balance sheets for Microsoft, BHP Billiton, Archer Daniels Midland, and Woolworths. Calculate several debt ratios for each company and comment on the differences that you observe in the use of leverage. What factors do you think account for these differences?

- A13-22.** Internet exercise – answers will vary.

Answer to MiniCase

Capital Structure

A few years after being appointed financial manager at Sedona Fabricators, Inc., you are asked by your boss to prepare for your first presentation to the Board of Directors. This presentation will pertain to issues associated with capital structure. It is intended to ensure that some of the newly appointed, independent board members understand certain terminology and issues. As a guideline for your presentation, you are provided with the following outline of questions.

Assignment

1. What is capital structure?
2. What is financial leverage?
3. How does financial leverage relate to company risk and expected returns?
4. Modigliani and Miller demonstrated that capital structure policy is irrelevant. What is the basis for their argument? What are their Propositions I and II?
5. How does the introduction of corporate taxes affect the M&M model?
6. How do the costs of insolvency and financial distress affect the M&M model?
7. What are agency costs? How can the use of debt reduce agency costs associated with equity?

Answers

1. Capital structure is the structure of the long-term (capital) sources of financing, or in other words, the structure of the long-term portion of liabilities and shareholders' equity on the balance sheet.
2. Financial leverage refers to the use of long-term debt as opposed to equity as a means of raising funds.
3. The relationship financial leverage has with company risk and expected returns is highlighted in the Chapter through 'The fundamental principle of financial leverage'. This principle states that substituting long-term debt for equity in a profitable company's capital structure increases both the level of expected returns to shareholders, measured by earnings per share, and the risk (dispersion) of those expected returns.
4. Franco Modigliani and Merton Miller showed that a company's value is based solely on the level and risk of the operating profits generated by that company's assets. Simply splitting the stream of profits produced by these assets between shareholders and bondholders can neither increase nor reduce the company's overall market value. They also showed that if the cost of capital is constant, regardless of the fraction of debt in a company's capital structure, then the cost of equity must increase systematically as leverage increases. Modigliani and Miller's famous Proposition I, referred to as the 'irrelevance proposition,' asserts that the market value of any company is independent of its capital structure and is given by capitalising its expected net operating income (EBIT) at the required rate of return on assets (r). Modigliani and Miller's Proposition II asserts that if we hold the required return on assets (r) and the required return on debt (r_d) constant, the required return on levered equity (r_l) rises linearly as the debt-to-equity ratio rises.
5. The presence of corporate taxes creates valuable interest tax shield as interest on debt is a tax deductible expense while dividends are not. This interest tax shield is embodied into the M&M Model as an annuitised or the present value of all future interest tax shields.
In equation form, the present value of interest tax shield = $(T_c \times r_d \times D) / r_d$
6. That costs of insolvency and financial distress affect the M&M Model can be demonstrated by referring to Figure 13.7. This figure demonstrates that at some point the present value of expected insolvency and agency costs start to overwhelm the present value of benefits derived from interest tax shields of debt.
7. Agency costs associated with equity refer to those costs incurred by managers for their personal benefit (perquisites) that reduce the value of the company. Jensen and Meckling show how using debt financing can help overcome the agency costs of external equity in two ways. First, using debt, by definition, means that less external equity will have to be sold to raise a given dollar amount of external financing. The second, and more important effect of employing outside debt rather than equity financing is that doing so reduces the amount and value of perquisites that managers can consume. The burden of having to make regular debt-service payments serves as a very effective tool for disciplining corporate managers.