CHAPTER 15

Debt and Taxes

Chapter Synopsis

15.1 The Interest Tax Deduction

A C-Corporation pays taxes on profits after interest payments are deducted, but it pays dividends from after-tax net income. Thus, the tax code provides an incentive for the use of debt financing.

An **interest tax shield** is the amount a firm would have paid in taxes if it did not have interest expense. The size of the interest tax shield equals interest expense $\times$ the tax rate.

15.2 Valuing the Interest Tax Shield

The differential taxing of interest and dividends represents a market imperfection not considered in the original MM propositions. Given the availability of an interest tax shield, MM Proposition I can be restated in the presence of corporate taxes such that: The total value of the levered firm exceeds the value of the firm without leverage due to the present value of the tax savings from debt:

$$V^L = V^U + \text{PV(Interest Tax Shield)}$$

If a firm has a permanent, constant amount of debt, *D,* a marginal tax rate of τ_c, and a risk-free debt cost of capital of $r_D = r_f$, then the interest tax shield equals:

$$\text{PV(Interest Tax Shield)} = \frac{\tau_c \times \text{Interest}}{r_f} = \frac{\tau_c \times (r_f \times D)}{r_f} = \frac{\tau_c \times (\cancel{r_f} \times D)}{\cancel{r_f}} = \tau_c \times D$$

The tax deductibility of interest lowers the effective cost of debt financing for the firm. If the interest on debt is tax deductible, then an interest rate *r* is equivalent to an effective after-tax rate of $r \times (1 - \tau_c)$. To account for the benefit of the interest tax shield, the WACC can be restated to account for the after-tax cost of debt:

$$r_{\text{wacc}} = \frac{E}{E+D} r_{\text{E}} + \frac{D}{E+D} r_{\text{D}}(1-\tau_{\text{C}}).$$

15.3 Recapitalizing to Capture the Tax Shield

Consider a firm that has 20 million shares outstanding, a stock price of $15, no debt, and a 35% tax rate. The firm has had consistently stable earnings and management believes that they can borrow as much as $100 million. They are considering a leveraged recapitalization in which they would use the borrowed funds to repurchase $100 million/$15 = 6.67 million shares. They expect that the tax savings from this transaction will boost the stock price and benefit shareholders.

Without leverage, the firm's market value is the value of its unlevered equity. Assuming the current stock price is the fair price for the shares without leverage:

$$V^{\text{U}} = (20 \text{ million shares}) \times (\$15) = \$300 \text{ million}.$$

With $100 million in permanent debt, the present value of the firm's future tax savings is $\tau_{\text{c}} \times D$ = 0.35($100 million) = $35 million and the levered firm value is:

$$V^{\text{L}} = V^{\text{U}} + \text{PV(Interest Tax Shield)} = \$300 \text{ million} + \$35 \text{ million} = \$335 \text{ million}.$$

The equity value, net of the $100 million of debt, is:

$$E = V^{\text{L}} - D = \$335 \text{ million} - \$100 \text{ million} = \$235 \text{ million} \Rightarrow P = \frac{\$235 \text{ million}}{20 - 6.67} = \$17.625.$$

Since the shares were repurchased at $15, the 13.33 million remaining shareholders get all of the $35 million tax shield, which equals $35 million/13.33 million = $2.625 per share.

More realistically, once investors know the recap will occur, the share price will rise immediately to a level that reflects the $35 million value of the interest tax shield that the firm will receive, $235 million/20 million = $16.75 per share. The benefit of the interest tax shield now goes to all 20 million of the original shares outstanding for a total benefit of $1.75/share × 20 million shares = $35 million.

15.4 Personal Taxes

Personal taxes may offset the corporate tax benefits of leverage. Investors are generally taxed on interest income from debt and dividend income from a stock; they are also taxed on capital gains when they sell a stock but may delay incurring those taxes indefinitely.

Every $1 received after taxes by debt holders from interest payments costs equity holders $1 × (1 – τ^*) on an after tax basis, in which τ^*, the **effective tax advantage of debt**, equals:

$$\tau^* = \frac{(1-\tau_i) - (1-\tau_{\text{c}})(1-\tau_{\text{e}})}{(1-\tau_{\text{i}})} = 1 - \frac{(1-\tau_{\text{c}})(1-\tau_{\text{e}})}{(1-\tau_{\text{i}})}$$

where τ_{e} is the personal tax rate on equity income and τ_{i} is the personal tax rate on interest income. Now, the tax shield in a year is $\tau^* \times$ interest expense, and the value of a levered firm with permanent debt is

$$V^{\text{L}} = V^{\text{U}} + \tau^* \times D.$$

When there are no personal taxes, or when $\tau_e = \tau_i$, then $\tau^* = \tau_c$. However, when $\tau_e < \tau_i$, as it is today, then $\tau^* < \tau_c$ and there is a tax benefits of leverage.

15.5 Optimal Capital Structure with Taxes

In recent years, U.S. firms have shown a clear preference for debt as a source of external financing. In fact, the overall net equity issues has been negative, meaning that the value of shares that firms have bought back is greater than the value of the shares they have issued. Even though firms have not issued new equity, the market value of equity has risen over time such that average firm's debt as a fraction of the firm's value has remained reasonably stable at 35% to 40%. In 2005, debt accounted for about 36% of U.S firms' capital structures; however, the use of debt varied significantly by industry. Firms in growth industries like high technology carry very little debt, whereas airlines, automakers, and utilities, have high leverage ratios.

There is no corporate tax benefit from incurring interest payments that exceed EBIT. In fact, because interest payments constitute a tax disadvantage at the investor level when $\tau_i > \tau_e$, investors will pay higher individual taxes with excess leverage, making them worse off. Thus, it is optimal to borrow until interest equals EBIT to take full advantage of the corporate tax deduction of interest, but avoid the tax disadvantage of excess leverage at the personal level.

Since there are other provisions in the tax laws for deductions and tax credits, such as depreciation, investment tax credits, and operating loss carryforwards, some firms rely less heavily on the interest tax shield. However, even after considering alternate tax shields, firms have far less leverage than theory would predict at this point in the analysis. In the next chapter, factors that may help explain such apparently suboptimal behavior, such as bankruptcy costs, are considered.

Selected Concepts and Key Terms

Interest Tax Shield

The amount that a firm would have paid in taxes if it did not have interest expense. The size of the interest tax shield each period equals interest expense $\times$ the tax rate.

Concept Check Questions and Answers

15.1.1. With corporate income taxes, explain why a firm's value can be higher with leverage even though its earnings are lower.

A firm can be better off even though its earnings are lower because the total amount available to all investors is higher with leverage. The value of a firm is the total amount it can raise from all investors, not just equity holders. So, if the firm can pay out more in total with leverage, it will initially be able to raise more total capital.

15.1.2. What is the interest tax shield?

The interest tax shield is the gain to investors from the tax deductibility of interest payments. It is the additional amount that a firm would have paid in taxes if it did not have leverage.

15.2.1. With corporate taxes as the only market imperfection, how does the value of the firm with leverage differ from its value without leverage?

The total value of the levered firm exceeds the value of the firm without leverage due to the present value of the tax savings from debt.

15.2.2. How does leverage affect a firm's weighted average cost of capital?

Corporate taxes lower the effective cost of debt financing, which translates into a reduction in the weighted average cost of capital. The magnitude of the reduction in the WACC is proportional to the amount of debt financing. The higher the firm's leverage, the more the firm exploits the tax advantage of debt, and so the lower its WACC.

15.3.1. How can shareholders benefit from a leveraged recap when it reduces the total value of equity?

Although a leveraged recap reduces the total value of equity, shareholders capture the benefits of the interest tax shield upfront. The stock price rises at the announcement of the recap.

15.3.2. How does the interest tax shield enter into the market value balance sheet?

The total market value of a firm's securities must equal the total market value of the firm's assets. In the presence of corporate taxes, we must include the interest tax shield as one of the firm's assets on the market value balance sheet.

15.4.1. Under current law (in 2009), why is there a personal tax disadvantage of debt?

Just like corporate taxes, personal taxes reduce the cash flows to investors and diminish firm value. Personal taxes thus have the potential to offset some of the corporate tax benefits of leverage. Currently, in the United States and many other countries, interest income is taxed more heavily than capital gains from equity.

15.4.2. How does the personal tax disadvantage of debt change the value of leverage for the firm?

Personal taxes offset some of the corporate tax benefits of leverage and thus reduce the value of leverage for the firm.

15.5.1. How does the growth rate of a firm affect the optimal fraction of debt in the capital structure?

The optimal fraction of debt, as a proportion of a firm's capital structure, declines with the growth rate of the firm.

15.5.2. Do firms choose capital structures that fully exploit the tax advantages of debt?

The empirical results of international leverage indicate that firms do not fully exploit the tax advantages of debt because the interest expense of the average firm is well below its taxable income

Examples with Step-by-Step Solutions

Solving Problems

Problems using this chapter's ideas often involve calculating the after-tax cost of debt, the after-tax weighted-average cost of capital, the interest tax shield, and finding the present value of the interest tax shield and the value of a levered firm. Applications include considering the consequences on shareholder value of a leveraged recapitalization, which

involves issuing debt which is then used to repurchase shares. Problems may also involve considering the effects of personal taxes.

Examples

1. **You are trying to decide whether your firm should use debt financing under different assumptions regarding the amount of debt in its capital structure. The firm's assets will generate an expected EBIT of $800,000 per year (beginning one year from today) in perpetuity. The firm will make no new capital or working capital investments and all assets are fully depreciated. The assets have a beta of 1.5, the risk-free rate is 5%, and the market risk premium is 10%. You can issue bonds at par paying an annual coupon at a 5% annual rate. The corporate tax rate is 50%, and the firm has 100,000 shares outstanding.**
   [A] What is the value of the firm with no debt? What is the stock value per share?
   [B] What is the value of the firm if it issues $1.5 million of debt and uses the proceeds to repurchase 75,000 shares for $20 (75,000 × $20 = $1.5 million)? What is the stock value per share? Should the firm issue the debt?

Step 1. Determine the unlevered equity cost of capital.

The equity cost of capital is $E[R_i] = r_f + \beta_i^{Mkt}(E[R_{Mkt}] - r_f) = 5\% + 1.5(10\%) = 20\%$.

Step 2. Determine the free cash flows of the unlevered firm.

Since the firm will make no new investments and has no depreciation, FCF = NI each year.

EBIT	$800,000
− Tax @ 50%	400,000
Net income	400,000

Step 3. Determine the value of the unlevered firm.

Since the cash flows are a perpetuity, $PV = \frac{FCF}{r} = \frac{\$400,000}{0.20} = \$2$ million

Step 4. Determine the value per share.

$$\text{Value per share} = \frac{V^U}{\text{Shares Outstanding}} = \frac{\$2,000,000}{100,000} = \$20$$

Step 5. Determine the value of the levered firm.

$$V^L = V^U + \text{PV(Tax shield)} = \$2,000,000 + \frac{D(r_D)(\tau_C)}{r_D}$$

$$= \$2,000,000 + \frac{\$1,500,000(0.05)(0.50)}{0.05} = \$2,750,000$$

Step 6. Determine the equity value per share.

The total equity value is $V^L - D$ = $2,750,000 – $1,500,000, and the number of shares repurchased is $1,500,000/$20=75,000, so:

$$\text{Value per share} = \frac{2,750,000 - 1,500,000}{100,000 - 75,000} = \$50.$$

Thus, the firm should issue the debt based on these assumptions because it leads to an increase in the share price of $\frac{\$50-\$20}{\$20}=150\%$.

2. Wrigley Inc. had $1 billion in EBITDA in 2006. The firm is unlevered and has a market value of equity of $12 billion and a tax rate of 40%. Consider the effect on the value of the firm of the following debt issuances. Assume that all proceeds will be used to buy back stock.

[A] Issuing $6 billion of 8% coupon rate 5-year bonds which repay the principal in 5 years.

[B] Issuing $6 billion of 8% coupon rate permanent bonds.

[C] Issuing $6 billion of 8% coupon rate bonds, with amount of bonds increasing by 5% every year forever.

Step 1. Determine the value of the levered firm for the 5-year bonds.

Since annual interest is 0.08($6 billion) = $480 million, the annual tax shield is $480 million × 0.40 = $192 million for five years.

$$V^L = V^U + \text{PV(Interest Tax Shield)} = \$12 \text{ billion} + \$192 \text{ million}\left(\frac{1}{.08}\right)\left[1-\frac{1}{.08(1.08)^5}\right]$$
$$= \$12 \text{ billion} + \$0.8 \text{ billion} = \$12.8 \text{ billion}$$

Step 2. Determine the value of the levered firm for the permanent bonds.

Now, the $192 million tax shield is a perpetuity.

$$V^L = V^U + \text{PV(Interest Tax Shield)} = \$12 \text{ billion} + \left[\frac{\$192 \text{ million}}{.08}\right]$$
$$= \$12 \text{ billion} + 2.4 \text{ billion} = \$14.4 \text{ billion}$$

Step 3. Determine the value of the levered firm for the bonds that increase by 5% every year forever.

Now, the $14 million tax shield is the first cash flow in a growing perpetuity.

$$V^L = V^U + \text{PV(Interest Tax Shield)} = \$12 \text{ billion} + \left[\frac{\$192 \text{ million}}{.08-.05}\right]$$
$$= \$12 \text{ billion} + 6.4 \text{ billion} = \$18.5 \text{ billion}$$

3. Best Buy is equally likely to have EBIT this coming year of $1 billion, $1.5 billion, or $2 billion. Its corporate tax rate is 35%, and investors pay a 15% tax rate on income from equity and a 30% tax rate on interest income.

[A] What is the effective interest tax shield (considering both personal taxes and corporate taxes) if interest expense is $500 million this year?

[B] At what level of interest expense does the effective tax advantage of debt disappear?

Step 1. Determine the effective tax rate if all of the interest will be used to shield taxes.

$$\tau^* = 1-\frac{(1-\tau_C)(1-\tau_e)}{1-\tau_i} = 1-\frac{(1-0.35)(1-0.15)}{1-0.30} = 21.1\%$$

Step 2. Determine the effective tax shield if interest expense is $500,000.

Tax shield = τ^* × Interest expense = 0.211 × $500,000 = $105,357

Step 3. Determine when the effective tax rate is negative by considering different levels of interest expense.

Interest expense	Probability of NI > 0	$E[\tau_C]$	τ^*
\$500,000,000	1.0	0.350	0.21
\$1,000,000,000	1.0	0.350	0.21
\$1,500,000,000	$2/3$	0.233	0.07
\$2,000,000,000	$1/3$	0.117	-0.07

So for an interest expense up to \$1.5 billion, there is a tax advantage. For interest expense over \$1.5 billion, there is an expected effective tax disadvantage for debt financing.

Questions and Problems

1. A firm expects free cash flow of \$10 million each year. Its corporate tax rate is 35%, and its unlevered cost of capital is 10%. The firm also has outstanding debt of \$35 million, and it expects to maintain this level of debt permanently.
   [A] What is the firm's value without leverage?
   [B] What is the firm's value with the \$35 million of debt?

2. A firm is considering permanently adding \$100 million of debt to its capital structure. The corporate tax rate is 35%.
   [A] Absent personal taxes, what is the value of the interest tax shield from the new debt?
   [B] If investors pay a tax rate of 40% on interest income, and a tax rate of 20% on income from dividends and capital gains, what is the value of the interest tax shield from the new debt?

3. An unlevered firm has 50 million shares outstanding and a stock price of \$20. The firm plans to unexpectedly announce that it will issue \$500 million in 10% coupon rate debt financing and use the proceeds to repurchase shares. The debt level is expected to remain at this level. The tax rate is 35%.
   [A] What is the firm's market value before the announcement?
   [B] What is the market value of the firm after the repurchase?
   [C] What is the share value after the repurchase assuming that the shares can be repurchased at \$20 per share?

4. Suppose the corporate tax rate is 35%, and investors pay a tax rate of 15% on income from dividends or capital gains and a tax rate of 28% on interest income. Your firm plans to issue \$1 billion in perpetual 10% coupon bonds. The firm has historically paid all net income out as dividends; however, in order to pay this interest expense, the firm will cut its dividend.
   [A] How much will bondholders receive after paying taxes on the interest they earn?
   [B] By how much will the firm need to cut its dividend each year to pay this interest expense?
   [C] By how much will this cut in the dividend reduce equity holders' annual after-tax income?
   [D] How much less will the government receive in total tax revenues each year?
   [E] What is the effective tax advantage of debt with this amount of leverage?

5. Your unlevered firm will have a certain EBIT every year of \$80 million. Every year it will spend \$10 million on capital expenditures, invest \$10 million in net working capital, and have \$28 million in depreciation. The corporate tax rate is 35%, and the firm's cost of capital is 11%.
   [A] If the firm's free cash flow is expected to grow by 5% per year, what is the value of its equity today?

[B] If the debt cost of capital is 10%, what amount of borrowing would maximize the value of the firm? What would the value of the firm be then?

Solutions to Questions and Problems

1. [A] $V^U = \frac{10}{0.10} = \$100 \text{ million}$

   [B] $V^L = V^U + \tau_c D = 100 + 0.35 \times 30 = \$110.5 \text{ million}$

2. [A] PV(Interest Tax Shield) = $\tau_c D$ = 35% × 100 = \$35 million.

   [B] $\tau^* = 1 - \frac{(1-0.35)(1-0.20)}{1-0.40} = 13.33\%$

   PV(Interest Tax Shield) = $\tau_c D$ = 13.33% × 100 = \$13.33 million

3. [A] V^U = \$20 × 50 million = \$1 billion

   [B] $V^L = V^U$ + PV(Tax Shield) = \$1 billion + $\frac{\$500 \text{ million}(0.10)(0.35)}{0.10}$ = \$175 million

   = \$1.175 billion.

   [C] E = V^L – D = \$1.175 billion – \$500 million = \$675 million

   They will repurchase $\$\frac{500 \text{ million}}{\$20} = 25 \text{ million shares.}$

   The share price is thus $= \frac{\$1.175 \text{ billion} - 500 \text{ million}}{50 \text{ million} - 25 \text{ million}}$ = \$27.

4. [A] \$100 million × (1 – .28) = \$72 million each year

   [B] An interest expense of \$100 million per year reduces net income by 100(1 – .35) = \$65 million after corporate taxes. So, dividends will be \$65 million less.

   [C] \$65 million dividend cut ⇒ \$65 × (1 – .15) = \$55.25 million per year.

   [D] Interest taxes = .28 × 100 million = \$28 million
   Less corporate taxes = .35 × 100 million= \$35 million
   Less dividend taxes = .15 × 65 million = \$9.75 million
   ⇒ Government tax revenues change by 28 – 35 – 9.75 = –\$16.75 million

   [E] $\tau^* = 1 - \frac{(1-0.35)(1-0.15)}{1-0.28} = 23.3\%$

5. [A] $\text{FCF} = \text{EBIT} \times (1-\tau) + \text{Dep} - \text{Capex} - \Delta\text{NWC} = 80 \times (1-0.35) + 28 - 10 - 10 = \$60$

   $V^U = E = \frac{60}{0.11 - 0.05} = \$1 \text{ billion}$

   [B] The firm can pay \$80 million in interest, so it can borrow:

   $\frac{\$80 \text{ million}}{0.10} = \$800 \text{ million at 10\%.}$

   $V^L = \$1 \text{ billion} + \frac{\$800 \text{ million}(0.10)(0.35)}{0.10} = \$1.28 \text{ billion}$