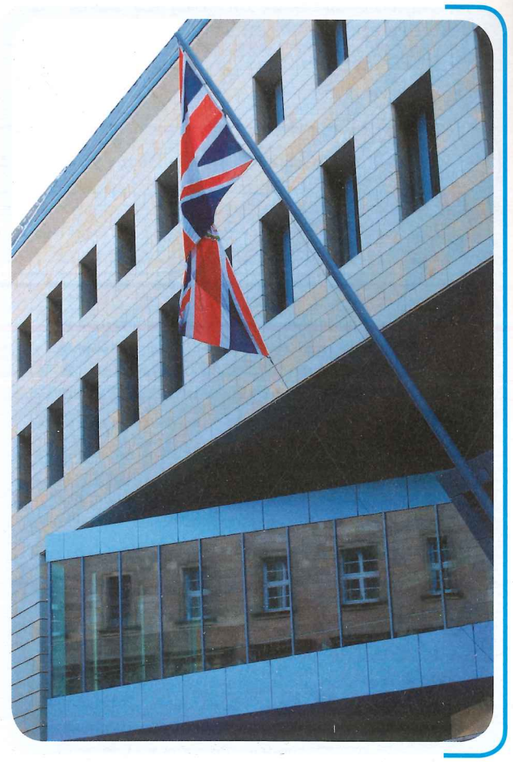
CHAPTER
17

Valuation and Capital Budgeting for the Levered Firm

The Private Finance Initiative (PFI) is a UK scheme that brings together the private and public sector in big social infrastructure projects. Under PFI, a private consortium of firms will design, build, finance and operate an asset or service according to specifications imposed by the public sector. In return, the government will pay the private consortium periodic payments for this collaboration. The rationale underlying PFI is that private organizations are more efficient at running big investment projects and this brings cost savings in addition to improved service and quality.

An example of the PFI is the building of the British Embassy in Berlin in 2000. Under this scheme, Arteos (a subsidiary of Bilfinger Berger, the German construction firm) financed and built the building. In addition, they were contracted to operate it until 2030, after which ownership reverts to the British government. Why did Bilfinger Berger enter into the contract? One of the reasons was the attractive financial package offered to the company by the British government to undertake the collaboration.



KEY NOTATIONS

APV	Adjusted present value
FTE	Flow to equity
NPV	Net present value
NPVF	Net present value of financing
t_C	Corporate tax rate
R_0	Cost of capital for an all-equity firm
R_E	Cost of equity capital
R_D	Cost of debt capital
UCF	Unlevered cash flow
LCF	Levered cash flow
D	Value of debt
E	Value of shares
R_{WACC}	Weighted average cost of capital
β	Beta of systematic risk
R_F	Risk-free rate

Similarly, when a corporation opens a major plant or considers relocation, municipalities or regions often create a package loaded with subsidies, including tax credits, subsidized debt, educational training, road and infrastructure creation, and other incentives.

With subsidized debt, the government or region guarantees the debt, which allows the company to borrow at a much lower interest rate. If the interest rate on the debt is lower than the company's normal cost of debt, how does a company evaluate the financial benefits of this and other such subsidies? In this chapter, we illustrate how to evaluate projects using the adjusted present value and some flow to equity approaches in capital budgeting that allow us to answer this question.

17.1 Adjusted Present Value Approach

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When financing issues are an important part of an investment proposal, a good methodology to use is the adjusted present value method (it is worthwhile reading over **Chapter 7** again to refresh your mind on the more commonly used investment appraisal methods). The approach separates the project cash flows from the financing cash flows and values these separately. If the combined present values are positive, the project should be taken. The **adjusted present value (APV)** method is described by the following formula:

$$APV = NPV + NPVF$$

In words, the value of a project to a levered firm (APV) is equal to the value of the project to an unlevered firm (NPV) plus the net present value of the financing side effects (NPVF). We can generally think of four side effects:

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1 *The tax subsidy to debt*: This was discussed in **Chapter 15**, where we pointed out that for perpetual debt the value of the tax subsidy is $t_C D$. (t_C is the corporate tax rate, and D is the value of the debt.) The material about valuation under corporate taxes in Chapter 15 is actually an application of the APV approach.

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2 *The costs of issuing new securities*: As we will discuss in detail in **Chapter 20**, bankers participate in the public issuance of corporate debt. These bankers must be compensated for their time and effort, a cost that lowers the value of the project.

3 *The costs of financial distress*: The possibility of financial distress, and bankruptcy in particular, arises with debt financing. As stated in the previous chapter, financial distress imposes costs, thereby lowering value.

4 *Subsidies to debt financing*: The interest on debt issued by state and local governments may not be taxable to the investor or the tax may be discounted. Because of this, the yield on government debt can be substantially below the yield on taxable debt. Frequently corporations can obtain financing from a municipality at the tax-exempt rate because the municipality can borrow at that rate as well. As with any subsidy, this subsidy adds value.

Although each of the preceding four side effects is important, the tax deduction to debt almost certainly has the highest value in most actual situations. For this reason, the following example considers the tax subsidy but not the other three side effects. (A later example will deal with these three.)

Consider a project of P.B. Singer plc with the following characteristics:

- Cash inflows: £500,000 per year for the indefinite future.
- Cash costs: 72 per cent of sales.
- Initial investment: £520,000.
- $t_C = 28$ per cent
- $R_A = 20$ per cent, where R_0 is the cost of capital for a project of an all-equity firm.

If both the project and the firm are financed with only equity, the project's cash flows are as follows:

	£
Cash inflows	500,000
Cash costs	−360,000

	£
Profit before tax	140,000
Corporate tax (28% tax rate)	−39,200
Unlevered cash flow (UCF)	100,800

The distinction between present value and net present value is important for this example. The *present value* of a project is determined before the initial investment at date 0 is subtracted. The initial investment is subtracted for the calculation of *net* present value.

Given a discount rate of 20 per cent, the present value of the project is:

$$\frac{£100,800}{0.20} = £504,000$$

The net present value (NPV) of the project – that is, the value of the project to an all-equity firm – is:

$$£504,000 - £520,000 = -£16,000$$

Because the NPV is negative, the project would be rejected by an all-equity firm.

Now imagine that the firm finances the project with exactly £135,483.90 in debt, so that the remaining investment of £384,516.10 (= £520,000 − £135,483.90) is financed with equity. The net present value of the project under leverage, which we call the adjusted present value, or the APV, is:

$$APV = NPV + t_C \times D$$

$$£21,935 = -£16,000 + 0.28 \times £135,483.90$$

That is, the value of the project when financed with some leverage is equal to the value of the project when financed with all equity plus the tax shield from the debt. Because this number is positive, the project should be accepted.

You may be wondering why we chose such a precise amount of debt. Actually, we chose it so that the ratio of debt to the present value of the project under leverage is 0.25.[1]

In this example, debt is a fixed proportion of the present value of the project, not a fixed proportion of the initial investment of £520,000. This is consistent with the goal of a target debt-to-*market*-value ratio, which we find is followed by companies in many countries. For example, banks typically lend to property developers a fixed percentage of the appraised market value of a project, not a fixed percentage of the initial investment.

17.2 Flow to Equity Approach

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The **flow to equity (FTE)** approach is an alternative capital budgeting approach and is similar to the free cash flow to the firm (FCFF) method that was used to value firms in **Chapter 5**. The formula simply calls for discounting the cash flow from the project to the shareholders of the levered firm at the cost of equity capital, R_E. For a perpetuity this becomes:

$$\frac{\text{Cash flow from project to equityholders of the levered firm}}{R_E}$$

There are three steps to the FTE approach.

Step 1: Calculating Levered Cash Flow (LCF)[2]

Assuming an interest rate of 10 per cent, the perpetual cash flow to shareholders in our P.B. Singer plc example is:

	£
Cash inflows	500,000
Cash costs	−360,000
Interest (10% × £135,483.90)	−13,548
Income after interest	126,452
Corporate tax (28% tax rate)	−35,407
Levered cash flow (LCF)	91,045

Alternatively, we can calculate levered cash flow (LCF) directly from unlevered cash flow (UCF). The key here is that the difference between the cash flow that shareholders receive in an unlevered firm and the cash flow that shareholders receive in a levered firm is the after-tax interest payment. (Repayment of principal does not appear in this example because the debt is perpetual.) We write this algebraically as:

$$UCF - LCF = (1 - t_C)R_D BD$$

The term on the right side of this expression is the after-tax interest payment. Thus, because cash flow to the unlevered shareholders (UCF) is £100,800 and the after-tax interest payment is £9,754.84 [= 0.72 × 0.10 × £135,483.90], cash flow to the levered shareholders (LCF) is:

$$£100,800 - £9,755 = £91,045$$

which is exactly the number we calculated earlier.

Step 2: Calculating R_E

The next step is to calculate the discount rate, R_E. Note that we assumed that the discount rate on unlevered equity, R_A, is 0.20. As we saw in an earlier chapter, the formula for R_E is:

$$R_E = R_A + \frac{D}{E}(1 - t_C)(R_A - R_D)$$

Note that our target debt-to-value ratio of 1/4 implies a target debt-to-equity ratio of 1/3. Applying the preceding formula to this example, we have:

$$R_E = 0.20 + \frac{1}{3}(0.72)(0.20 - 0.10)$$
$$= 0.224$$

Step 3: Valuation

The present value of the project's LCF is:

$$\frac{LCF}{R_E} = \frac{£91,045}{0.224} = £406,451$$

Because the initial investment is £520,000 and £135,483.90 is borrowed, the firm must advance the project £384,516.10 (=£520,000 − £135,483.90) out of its own cash reserves. The *net* present value of the project is simply the difference between the present value of the project's LCF and the investment not borrowed. Thus, the NPV is:

$$£406,451 - £384,516.10 = £21,935$$

which is identical to the result found with the APV approach.

17.3 Weighted Average Cost of Capital Method

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Finally, we can value a project using the **weighted average cost of capital (WACC)** method. Although this method was discussed in earlier chapters (WACC is first discussed in **Chapter 12**, Section 12.5), it is worthwhile to review it here. The WACC approach begins with the insight that projects of levered firms are simultaneously financed with both debt and equity. The cost of capital is a weighted average of the cost of debt and cost of equity. The cost of equity is R_S. Ignoring taxes, the cost of debt is simply the borrowing rate, R_D. However, with corporate taxes, the appropriate cost of debt is $(1 - t_C)\,R_D$, the after-tax cost of debt.

The formula for determining the weighted average cost of capital, R_{WACC}, is:

$$R_{WACC} = \frac{E}{D+E}R_E + \frac{D}{D+E}R_D\,(1 - t_C)$$

The weight for equity, $E/(D + E)$, and the weight for debt, $D/(D + E)$, are target ratios. Target ratios are generally expressed in terms of market values, not accounting values. (Recall that another phrase for accounting value is *book value*.)

The formula calls for discounting the *unlevered* cash flow of the project (UCF) at the weighted average cost of capital, R_{WACC}. The net present value of the project can be written algebraically as:

$$\sum_{t=1}^{\infty} \frac{UCF_t}{(1+R_{WACC})^t} - \text{Initial investment}$$

If the project is a perpetuity, the net present value is:

$$\frac{UCF}{R_{WACC}} - \text{Initial investment}$$

We previously stated that the target debt-to-value ratio of our project is 1/4 and the corporate tax rate is 0.28, implying that the weighted average cost of capital is:

$$R_{WACC} = \frac{3}{4} \times 0.224 + \frac{1}{4} \times 0.10 \times 0.72 = 0.186$$

Note that R_{WACC}, 0.186, is lower than the cost of equity capital for an all-equity firm, 0.20. This must always be the case because debt financing provides a tax subsidy that lowers the average cost of capital.

We previously determined the UCF of the project to be £100,800, implying that the present value of the project is:

$$\frac{£100{,}800}{0.186} = £541{,}935$$

This initial investment is £520,000, so the NPV of the project is:

$$£541{,}935 - £520{,}000 = £21{,}935$$

Note that all three approaches yield the same value.

17.4 A Comparison of the APV, FTE and WACC Approaches

Capital budgeting techniques in the early chapters of this text applied to all-equity firms. Capital budgeting for the levered firm could not be handled earlier in the book because the effects of debt on firm value were deferred until the previous two chapters. We learned there that debt increases firm value through tax benefits but decreases value through bankruptcy and related costs.

In this chapter, we provide three approaches to capital budgeting for the levered firm. The adjusted present value (APV) approach first values the project on an all-equity basis. That is, the project's after-tax cash flows under all-equity financing (called unlevered cash flows, or UCF) are placed in the numerator of the capital budgeting equation. The discount rate, assuming all-equity financing, appears in the denominator. At this point, the calculation is identical to that performed in the early chapters of this book. We then add the net present value of the debt. We point out that the net present value of the debt is likely to be the sum of four parameters: tax effects, flotation costs, bankruptcy costs and interest subsidies.

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The flow to equity (FTE) approach discounts the after-tax cash flow from a project going to the shareholders of a levered firm (LCF). LCF, which stands for levered cash flow, is the residual to shareholders after interest has been deducted. The discount rate is R_E, the cost of capital to the shareholders of a levered firm. For a firm with leverage, R_E must be greater than R_A, the cost of capital for an unlevered firm. This follows from our material in **Chapter 15** showing that leverage raises the risk to the shareholders.

The last approach is the weighted average cost of capital (WACC) method. This technique calculates the project's after-tax cash flows assuming all-equity financing (UCF). The UCF is placed in the numerator of the capital budgeting equation. The denominator, R_{WACC}, is a weighted average of the cost of equity capital and the cost of debt capital. The tax advantage of debt is reflected in the denominator because the cost of debt capital is determined net of corporate tax. The numerator does not reflect debt at all.

Which Method Is Best?

The net present value of our project is exactly the same under each of the three methods. In theory, this should always be the case.[3] However, one method usually provides an easier computation than another, and, in many cases, one or more of the methods are virtually impossible computationally. We first consider when it is best to use the WACC and FTE approaches.

If the risk of a project stays constant throughout its life, it is plausible to assume that R_A remains constant throughout the project's life. This assumption of constant risk appears to be reasonable for most real-world projects. In addition, if the debt-to-value ratio remains constant over the life of the project, both R_E and R_{WACC} will remain constant as well. Under this latter assumption, either the FTE or the WACC approach is easy to apply. However, if the debt-to-value ratio varies from year to year, both R_S and R_{WACC} vary from year to year as well. Using the FTE or the WACC approach when the denominator changes every year is computationally quite complex, and when computations become complex, the error rate rises. Thus, both the FTE and WACC approaches present difficulties when the debt-to-value *ratio* changes over time.

The APV approach is based on the *level* of debt in each future period. Consequently, when the debt level can be specified precisely for future periods, the APV approach is quite easy to use. However, when the debt level is uncertain, the APV approach becomes more problematic. For example, when the debt-to-value ratio is constant, the debt level varies with the value of the project. Because the value of the project in a future year cannot be easily forecast, the level of debt cannot be easily forecast either.

Thus, we suggest the following guideline:

Use WACC or FTE if the firm's target debt-to-value *ratio* applies to the project over its life. Use APV if the project's *level* of debt is known over the life of the project.

There are a number of situations where the APV approach is preferred. For example, in a leveraged buyout (LBO) the firm begins with a large amount of debt but rapidly pays down the debt over a number of years. Because the schedule of debt reduction in the future is known when the LBO is arranged, tax shields in every future year can be easily forecast. Thus, the APV approach is easy to use here. By contrast, the WACC and FTE approaches are virtually impossible to apply here because the debt-to-equity value cannot be expected to be constant over time. In addition, situations involving interest subsidies and flotation costs are much easier to handle with the APV approach. Finally, the APV approach handles the lease-versus-buy decision much more easily than does either the FTE or the WACC approach.

The preceding examples are special cases. Typical capital budgeting situations are more amenable to either the WACC or the FTE approach than to the APV approach. In many countries, financial managers think in terms of target debt-to-value *ratios*. If a project does better than expected, both its value and its debt capacity will likely rise. The manager will increase debt correspondingly here. Conversely, the manager would be likely to reduce debt if the value of the project were to decline unexpectedly. Of course, because financing is a time-consuming task, the ratio cannot be adjusted daily or monthly. Rather, the adjustment can be expected to occur over the long run. As mentioned before, the WACC and FTE approaches are more appropriate than is the APV approach when a firm focuses on a target debt-to-value ratio.

Because of this, we recommend that the WACC and the FTE approaches, rather than the APV approach, be used in most real-world situations. In addition, frequent discussions with business executives have convinced us that the WACC is by far the most widely used method in the real world. Thus, practitioners seem to agree with us that, outside of the special situations mentioned, the APV approach is a less important method of capital budgeting.

The Three Methods of Capital Budgeting with Leverage

1. Adjusted present value (APV) method:

$$\sum_{t=1}^{\infty} \frac{UCF_t}{(1+R_A)^t} + \text{Additional effects of debt} - \text{Initial investment}$$

where UCF_t is the project's cash flow at date t to the equityholders of an unlevered firm and R_A is the cost of capital for a project in an unlevered firm.

2. Flow to equity (FTE) method:

$$\sum_{t=1}^{\infty} \frac{LCF_t}{(1+R_E)^t} - (\text{Initial investment} - \text{Amount borrowed})$$

where LCF_t is the project's cash flow at date t to the equityholders of a levered firm and R_E is the cost of equity capital with leverage.

3. Weighted average cost of capital (WACC) method:

$$\sum_{t=1}^{\infty} \frac{UCF_t}{(1+R_{WACC})^t} - \text{Initial investment}$$

where R_{WACC} is the weighted average cost of capital.

Notes

1 The middle term in the APV formula implies that the value of a project with leverage is greater than the value of the project without leverage. Because $R_{WACC} < R_A$, the WACC formula implies that the value of a project with leverage is greater than the value of the project without leverage.

2 In the FTE method, cash flow *after interest* (LCF) is used. Initial investment is reduced by *amount borrowed* as well.

Guidelines

1 Use WACC or FTE if the firm's target debt-to-value *ratio* applies to the project over its life.

2 Use APV if the project's *level* of debt is known over the life of the project.

17.5 Capital Budgeting When the Discount Rate Must Be Estimated

The previous sections of this chapter introduced APV, FTE and WACC – the three basic approaches to valuing a levered firm. However, one important detail remains. The example in Sections 17.1 through 17.3 *assumed* a discount rate. We now want to show how this rate is determined for real-world firms with leverage, with an application to the three preceding approaches. The example in this section brings together the work in Chapters 9–12 on the discount rate for unlevered firms with that in Chapter 15 on the effect of leverage on the cost of capital.

Example 17.1

Cost of Capital

World-Wide Enterprises (WWE) is a large conglomerate thinking of entering the widget business, where it plans to finance projects with a debt-to-value ratio of 25 per cent (or, alternatively, a debt-to-equity ratio of 1/3). There is currently one firm in the widget industry, Asian Widgets (AW). This firm is financed with 40 per cent debt and 60 per cent equity. The beta of AW's equity is 1.5. AW has a borrowing rate of 12 per cent, and WWE expects to borrow for its widget venture at 10 per cent. The corporate tax rate for both firms is 0.40, the market risk premium is 8.5 per cent, and the riskless interest rate is 8 per cent. What is the appropriate discount rate for WWE to use for its widget venture?

As shown in Sections 17.1–17.3, a corporation may use one of three capital budgeting approaches: APV, FTE or WACC. The appropriate discount rates for these three approaches are R_A, R_E and R_{WACC}, respectively. Because AW is WWE's only competitor in widgets, we look at AW's cost of capital to calculate R_A, R_E and R_{WACC} for WWE's widget venture. The following four-step procedure will allow us to calculate all three discount rates:

1 *Determining AW's cost of equity capital*: First, we determine AW's cost of equity capital using the security market line (SML):

AW's cost of equity capital

$$\begin{aligned} R_E &= R_F + \beta \times (\overline{R}_M - R_F) \\ &= 8\% + 1.5 \times 8.5\% \\ &= 20.75\% \end{aligned}$$

where $\overline{R}_M$ is the expected return on the market portfolio and R_F is the risk-free rate.

2 *Determining AW's hypothetical all-equity cost of capital*: We must standardize the preceding number in some way because AW and WWE's widget ventures have different target debt-to-value ratios. The easiest approach is to calculate the hypothetical cost of equity capital for AW, assuming all-equity financing. This can be determined from MM's Proposition II under taxes:

AW's cost of capital if all equity

$$\begin{aligned} R_E &= R_A + \frac{D}{E}(1 - t_C)(R_A - R_D) \\ &= R_A + \frac{0.4}{0.6}(0.60)(R_A - 12\%) \\ &= 20.75\% \end{aligned}$$

By solving the equation, we find that $R_A = 0.1825$. Of course, R_A is less than R_A because the cost of equity capital would be less when the firm employs no leverage.

At this point, firms in the real world generally make the assumption that the business risk of their venture is about equal to the business risk of the firms already in the business. Applying this assumption to our problem, we assert that the hypothetical discount rate of WWE's widget venture if all equity financed is also 0.1825.[4] This discount rate would be employed if WWE uses the APV approach because the APV approach calls for R_A, the project's cost of capital in a firm with no leverage.

3 *Determining R_E for WWE's widget venture*: Alternatively, WWE might use the FTE approach, where the discount rate for levered equity is determined like this:

Cost of equity capital for WWE's widget venture

$$\begin{aligned} R_E &= R_A + \frac{D}{E}(1 - t_C)(R_A - R_D) \\ &= 18.25\% + \frac{1}{3}(0.60)(18.25\% - 10\%) \\ &= 19.9\% \end{aligned}$$

Note that the cost of equity capital for WWE's widget venture, 0.199, is less than the cost of equity capital for AW, 0.2075. This occurs because AW has a higher debt-to-equity ratio. (As mentioned, both firms are assumed to have the same business risk.)

4 *Determining R_{WACC} for WWE's widget venture*: Finally, WWE might use the WACC approach. Here is the appropriate calculation:

R_{WACC} for WWE's widget venture

$$\begin{aligned} R_{WACC} &= \frac{D}{D+E}R_D(1 - t_C) + \frac{E}{D+E}R_E \\ &= \frac{1}{4}10\%(0.60) + \frac{3}{4}19.9\% \\ &= 16.425\% \end{aligned}$$

The preceding example shows how the three discount rates, R_A, R_E and R_{WACC}, are determined in the real world. These are the appropriate rates for the APV, FTE and WACC approaches, respectively. Note that R_E for Asian Widgets is determined first because the cost of equity capital can be determined from the beta of the firm's equity. As discussed in an earlier chapter, beta can easily be estimated for any publicly traded firm such as AW.

17.6 APV Example

As mentioned earlier in this chapter, firms generally set a target debt-to-equity ratio, allowing the use of WACC and FTE for capital budgeting. APV does not work as well here. However, as we also mentioned earlier, APV is the preferred approach when there are side benefits and side costs to debt. Because the analysis can be tricky, we now devote an entire section to an example where, in addition to the tax subsidy to debt, both flotation costs and interest subsidies come into play.

Example 17.2

APV

Bicksler Enterprises is considering a £10 million project that will last 5 years. The investment will be depreciated at 25 per cent reducing balance for tax purposes. At the end of the 5 years, the investment will be sold for its residual book value. The cash revenues less cash expenses per year are £3,500,000. The corporate tax bracket is 28 per cent. The risk-free rate is 10 per cent, and the cost of unlevered equity is 20 per cent.

First we will calculate the depreciation in each year.

	C_0	C_1	C_2	C_3	C_4	C_5
Initial outlay	−£10,000,000					
Depreciation		0.25 × (£10,000,000) =£2,500,000	0.25 × (£7,500,000) =£1,875,000	0.25 × (£5,625,000) =£1,406,250	0.25 × (£4,218,750) =£1,054,688	0.25 × (£3,164,063) =£791,016
Residual value		£7,500,000	£5,625,000	£4,218,750	£3,164,063	£2,373,047

The cash flow projections each year are below. Because the investment is sold at its residual value, there are no tax implications for the final cash flow of £2,373,047. If, for example, Bicksler sold the investment for £3,000,000 it would be liable to pay tax on the profit of £626,953 (£3,000,000 − £2,373,047):

	C_0	C_1	C_2	C_3	C_4	C_5	C_6
Initial outlay	−£10,000,000						£2,373,047
Depreciation tax shield		0.28 × £2,500,000 =£700,000	0.28 × £1,875,000 =£525,000	0.28 × £1,406,250 =£393,750	0.28 × £1,054,688 =£295,313	0.28 × £791,016 =£197,754	
Revenue less expenses		(1 − 0.28) × £3,500,000 =£2,520,000	£2,520,000	£2,520,000	£2,520,000	£2,520,000	

We stated before that the APV of a project is the sum of its all-equity value plus the additional effects of debt. We examine each in turn.

All-equity Value

Assuming the project is financed with all equity, we will discount the revenues and initial outlay cash flows by the cost of unlevered equity. The depreciation tax shield should be discounted at the risk-free rate. The present value of each cash flow is given below:

	C_0	C_1	C_2	C_3	C_4	C_5	C_6
Initial outlay	−£10,000,000						£794,729
Depreciation tax shield		£636,364	£433,884	£295,830	£201,703	£122,790	
Revenue less expenses		£2,100,000	£1,750,000	£1,458,333	£1,215,278	£1,012,731	
Present value	-£10,000,000	£2,736,364	£2,183,884	£1,754,164	£1,416,981	£1,135,521	£794,729

The net present value is thus:

$$-£10{,}000{,}000 + £2{,}736{,}364 + £1{,}754{,}164 + £1{,}416{,}981 + £1{,}135{,}521 + £794{,}729 = £21{,}642$$

This calculation uses the techniques presented in the early chapters of this book. Notice again that the depreciation tax shield is discounted at the riskless rate of 10 per cent. The revenues and expenses are discounted at the higher rate of 20 per cent.

An all-equity firm would accept the project because the NPV is £21,642. However, equity flotation costs and economic volatility (not mentioned yet) would more than likely make the NPV negative. However, debt financing may add enough value to the project to justify acceptance. We consider the effects of debt next.

Additional Effects of Debt

Bicksler Enterprises can obtain a 5-year, non-amortizing loan for £7,500,000 after flotation costs at the risk-free rate of 10 per cent. Flotation costs are fees paid when equity or debt is issued. These fees may go to printers, lawyers and bankers, among others. Bicksler Enterprises is informed that flotation costs will be 1 per cent of the gross proceeds of its loan. The previous chapter indicates that debt financing alters the NPV of a typical project.

Flotation Costs

Given that flotation costs are 1 per cent of the gross proceeds, we have:

$$£7{,}500{,}000 = (1 - 0.01) \times \text{Gross proceeds} = 0.99 \times \text{Gross proceeds}$$

Thus, the gross proceeds are:

$$\frac{£7{,}500{,}000}{1 - 0.01} = \frac{£7{,}500{,}000}{0.99} = £7{,}575{,}758$$

This implies flotation costs of £75,758 (=1% × £7,575,758). To check the calculation, note that net proceeds are £7,500,000 (=£7,575,758 − £75,758). In other words, Bicksler Enterprises receives only £7,500,000. The flotation costs of £75,758 are received by intermediaries such as bankers.

Under International Financial Reporting Standards, flotation costs directly attributable to an investment in a particular asset should be depreciated using the same method as the asset itself. In our case, depreciation would be charged on the flotation costs using 25 per cent reducing balance. The tax shield can then be calculated accordingly. Flotation costs are paid immediately but are deducted from taxes by amortizing on a 25 per cent reducing balance basis over the life of the loan. The depreciation schedule on the flotation costs is presented below:

	C_0	C_1	C_2	C_3	C_4	C_5
Flotation costs	−£75,758					
Depreciation		0.25 × (£75,758) =£18,940	0.25 (£56,818) =£14,205	0.25 × (£42,613) =£10,653	0.25 × (£31,960) =£7,990	0.25 × (£23,970) =£5,993
Residual value		£56,818	£42,613	£31,960	£23,970	£17,977

The cash flows from flotation costs are as follows:

	Date 0	Date 1	Date 2	Date 3	Date 4	Date 5	Date 6
Flotation costs	−£75,758						
Deduction		£18,940	£14,205	£10,653	£7,990	£5,993	£17,977
Tax shield from flotation costs		0.28(£18,940) =£5,303	0.28(£14,205) =£3,977	0.28(£10,653) =£2,983	0.28(£7,990) =£2,237	0.28(£5,993) =£1,678	0.28(£17,977) =£5,034
PV(Costs)	−£75,758	£4,821	£3,287	£2,241	£1,528	£1,042	£2,841

When we discount at 10 per cent, the net cost of flotation is:

$$-£75{,}758 + £4{,}821 + £3{,}287 + £2{,}241 + £1{,}528 + £1{,}042 + £2{,}841 = -£59{,}998$$

The net present value of the project after the flotation costs of debt but before the benefits of debt is:

$$£21{,}642 - £59{,}998 = -£38{,}356$$

Tax Subsidy

Interest must be paid on the gross proceeds of the loan, even though intermediaries receive the flotation costs. Because the gross proceeds of the loan are £7,575,578, annual interest is £757,576 (= £7,575,758 × 0.10).

The interest cost after taxes is £545,455 [=£757,576 × (1 − 0.28)]. Because the loan is non-amortizing, the entire debt of £7,575,758 is repaid at date 5. These terms are indicated here:

	Date 0	Date 1	Date 2	Date 3	Date 4	Date 5
Loan (gross proceeds)	**£7,575,758**					
Interest paid		10% × £7,575,758 = £757,576	£757,576	£757,576	£757,576	£757,576
Interest cost after taxes		(1 − 0.28) × £757,576 = **£545,455**	**£545,455**	**£545,455**	**£545,455**	**£545,455**
Repayment of debt						**£7,575,758**

The relevant cash flows are listed in boldface in the preceding table. They are (1) loan received, (2) annual interest cost after taxes, and (3) repayment of debt. Note that we include the *gross* proceeds of the loan as an inflow because the flotation costs have previously been subtracted.

In Chapter 15 we mentioned that the financing decision can be evaluated in terms of net present value. The net present value of the loan is simply the sum of the net present values of each of the three cash flows. This can be represented as follows:

$$\text{NPV (loan)} = +\text{Amount borrowed} - \begin{matrix}\text{Present value}\\ \text{of after-tax}\\ \text{interest payments}\end{matrix} - \begin{matrix}\text{Present value}\\ \text{of loan}\\ \text{repayments}\end{matrix} \qquad (17.1)$$

The calculations for this example are:

$$£804{,}105 = +£7{,}575{,}758 - \frac{£545{,}455}{0.10} \times \left[1 - \left(\frac{1}{1.10}\right)^{5}\right] - \frac{£7{,}575{,}758}{(1.10)^{5}} \qquad (17.1')$$

The NPV (loan) is positive, reflecting the interest tax shield.[5]

The adjusted present value of the project with this financing is:

$$\text{APV} = \text{All-equity value} - \text{Flotation cost of debt} + \text{NPV (loan)} \qquad (17.2)$$

$$£768{,}749 = £21{,}642 - £59{,}998 + £804{,}105 \qquad (17.2')$$

Though we previously saw that an all-equity firm would probably not accept the project (once equity flotation costs were taken into account), a firm would *accept* the project if a £7,500,000 (net) loan could be obtained.

Because the loan just discussed was at the market rate of 10 per cent, we have considered only two of the three additional effects of debt (flotation costs and tax subsidy) so far. We now examine another loan where the third effect arises.

Non-Market-Rate Financing

A number of companies are fortunate enough to obtain subsidized financing from a governmental authority. Suppose that the project of Bicksler Enterprises is deemed socially beneficial and the British government grants the firm a £7,500,000 loan at 8 per cent interest. In addition, all flotation costs are absorbed by the state. Clearly, the company will choose this loan over the one we previously calculated. Here are the cash flows from the loan:

	Date 0	Date 1	Date 2	Date 3	Date 4	Date 5
Loan received	**£7,500,000**					
Interest paid		8% × £7,500,000 = £600,000	£600,000	£600,000	£600,000	£600,000
After-tax interest		(1 − 0.28) £600,000 = **£432,000**	**£432,000**	**£432,000**	**£432,000**	**£432,000**
Repayment of debt						**£7,500,000**

The relevant cash flows are listed in boldface in the preceding table. Using Equation 17.1, the NPV (loan) is:

$$£1{,}205{,}470 = +£7{,}500{,}000 - \frac{£432{,}000}{0.10} \times \left[1 - \left(\frac{1}{1.10}\right)^{5}\right] - \frac{£7{,}500{,}000}{(1.10)^{5}} \qquad (17.1'')$$

Why do we discount the cash flows in Equation 17.1″ at 10 per cent when the firm is borrowing at 8 per cent? We discount at 10 per cent because that is the fair or market-wide rate. That is, 10 per cent is the rate at which the firm could borrow *without* benefit of subsidization. The net present value of the subsidized loan is larger than the net present value of the earlier loan because the firm is now borrowing at the below-market rate of 8 per cent. Note that the NPV (loan) calculation in Equation 17.1″ captures both the tax effect *and* the non-market-rate effect.

The net present value of the project with subsidized debt financing is:

$$\text{APV} = \text{All-equity value} - \text{Flotation costs of debt} + \text{NPV (loan)} \qquad (17.2)$$

$$£1{,}227{,}112 = £21{,}642 - £0 + £1{,}205{,}470 \qquad (17.2'')$$

The preceding example illustrates the adjusted present value (APV) approach. The approach begins with the present value of a project for the all-equity firm. Next, the effects of debt are added in. The approach has much to recommend it. It is intuitively appealing because individual components are calculated separately and added together in a simple way. And, if the debt from the project can be specified precisely, the present value of the debt can be calculated precisely.

17.7 Beta and Leverage

A previous chapter provides the formula for the relationship between the beta of the equity and leverage of the firm in a world without taxes. We reproduce this formula here:

The no-tax case

$$\beta_{\text{Equity}} = \beta_{\text{Asset}}\left(1 + \frac{\text{Debt}}{\text{Equity}}\right) \qquad (17.3)$$

As pointed out earlier, this relationship holds under the assumption that the beta of debt is zero.

Because firms must pay corporate taxes in practice, it is worthwhile to provide the relationship in a world with corporate taxes. It can be shown that the relationship between the beta of the unlevered firm and the beta of the levered equity is this:[6]

The corporate tax case

$$\beta_{\text{Equity}} = \left[1 + \frac{(1 - t_c)\text{Debt}}{\text{Equity}}\right]\beta_{\text{Unlevered firm}} \qquad (17.4)$$

when (1) the corporation is taxed at the rate of t_c, and (2) the debt has a zero beta.

Because [1 + (1 − t_c) Debt/Equity] must be more than 1 for a levered firm, it follows that $\beta_{\text{Unlevered firm}} < \beta_{\text{Equity}}$. The corporate tax case of Equation 17.4 is quite similar to the no-tax case of Equation 17.3 because the beta of levered equity must be greater than the beta of the unlevered firm in either case. The intuition that leverage increases the risk of equity applies in both cases.

However, notice that the two equations are not equal. It can be shown that leverage increases the equity beta less rapidly under corporate taxes. This occurs because, under taxes, leverage creates a *riskless* tax shield, thereby lowering the risk of the entire firm.

Example 17.3

Unlevered Betas

Barajas SA is considering a scale-enhancing project. The market value of the firm's debt is €100 million, and the market value of the firm's equity is €200 million. The debt is considered riskless. The corporate tax rate is 28 per cent. Regression analysis indicates that the beta of the firm's equity is 2. The risk-free rate is 10 per cent, and the expected market premium is 8.5 per cent. What would the project's discount rate be in the hypothetical case that Barajas SA is all-equity?

We can answer this question in two steps.

1 *Determining beta of hypothetical all-equity firm*: Rearranging Equation 17.4, we have this:

Unlevered beta

$$\frac{\text{Equity}}{\text{Equity} + (1 - t_C) \times \text{Debt}} \times \beta_{\text{Equity}} = \beta_{\text{Unlevered firm}}$$

$$\frac{€200 \text{ million}}{€200 \text{ million} + (1 - 0.28) \times €100 \text{ million}} \times 2 = 1.47 \qquad (17.5)$$

2 *Determining discount rate*: We calculate the discount rate from the security market line (SML) as follows:

Discount rate

$$\begin{aligned} R_E &= R_F + \beta \times (R_M - R_F) \\ &= 10\% + 1.47 \times 8.5\% \\ &= 22.5\% \end{aligned}$$

The Project Is Not Scale Enhancing

Because the previous example assumed that the project is scale enhancing, we began with the beta of the firm's equity. If the project is not scale enhancing, we could begin with the equity betas of firms in the industry of the project. For each firm, we could calculate the hypothetical beta of the unlevered equity by Equation 17.5. The SML could then be used to determine the project's discount rate from the average of these betas.

Example 17.4

More Unlevered Betas

The Irish firm, J. Lowes plc, which currently manufactures staples, is considering a €1 million investment in a project in the aircraft adhesives industry. The corporation estimates unlevered after-tax cash flows (UCF) of €300,000 per year into perpetuity from the project. The firm will finance the project with a debt-to-value ratio of 0.5 (or, equivalently, a debt-to-equity ratio of 1:1).

The three competitors in this new industry are currently unlevered, with betas of 1.2, 1.3 and 1.4. Assuming a risk-free rate of 5 per cent, a market risk premium of 9 per cent and a corporate tax rate of 12.5 per cent, what is the net present value of the project?

We can answer this question in five steps.

1 *Calculating the average unlevered beta in the industry*: The average unlevered beta across all three existing competitors in the aircraft adhesives industry is:

$$\frac{1.2 + 1.3 + 1.4}{3} = 1.3$$

2 *Calculating the levered beta for J. Lowes's new project*: Assuming the same unlevered beta for this new project as for the existing competitors, we have, from Equation 17.4:

Levered beta

$$\begin{aligned} \beta_{\text{Equity}} &= \left[1 + \frac{(1 - t_C)\text{Debt}}{\text{Equity}}\right] \beta_{\text{Unlevered firm}} \\ &= \left(1 + \frac{0.875 \times 1}{1}\right) \times 1.3 \\ &= 2.4375 \end{aligned}$$

3 *Calculating the cost of levered equity for the new project*: We calculate the discount rate from the security market line (SML) as follows:

Discount rate

$$\begin{aligned} R_E &= R_F + \beta \times (R_M - R_F) \\ &= 0.05 + 2.4375 \times 0.09 \\ &= 0.269 \end{aligned}$$

4 *Calculating the WACC for the new project*: The formula for determining the weighted average cost of capital, R_{WACC}, is:

$$\begin{aligned} R_{\text{WACC}} &= \frac{D}{D+E} R_D (1 - t_C) + \frac{E}{D+E} R_E \\ &= \frac{1}{2} \times 0.05 \times 0.875 + \frac{1}{2} \times 0.269 \\ &= 0.156 \end{aligned}$$

5 *Determining the project's value*: Because the cash flows are perpetual, the NPV of the project is:

$$\frac{\text{Unlevered cash flows } (UCF)}{R_{\text{WACC}}} - \text{Initial investment}$$

$$\frac{€300{,}000}{0.156} - £1 \text{ million} = £923{,}077$$

Real World Insight 17.1

Investing in Student Apartments

A major growth area for investment in the UK is student accommodation. With more universities charging premium fees for their programmes, incoming students are becoming increasingly more choosy about the indirect impact of moving to a new city to study. Affordable but pleasant accommodation is a key input in deciding which university to attend and this has attracted a wave of entrepreneurs who seek to leverage the excess demand for student apartments.

One such entrepreneur, Russian billionaire Mikhail Fridman, has invested millions in UK student accommodation. His first investment was a £61 million purchase of apartments from McLaren Property, which doubled as a ballet school. At the same time, Fridman spent £83 million to buy more apartments in other parts of the UK. Finally, in 2015, he acquired Pure Student Living (five London-based luxury student tower blocks) for £535 million.

Summary and Conclusions

Earlier chapters of this text showed how to calculate net present value for projects of all-equity firms. We pointed out in the last two chapters that the introduction of taxes and bankruptcy costs changes a firm's financing decisions. Rational corporations should employ some debt in a world of this type. Because of the benefits and costs associated with debt, the capital budgeting decision is different for levered firms than for unlevered firms. The present chapter has discussed three methods for capital budgeting by levered firms: the adjusted present value (APV), flows to equity (FTE), and weighted average cost of capital (WACC) approaches.

1 The APV formula can be written as:

$$\sum_{t=1}^{\infty} \frac{UCF_t}{(1 + R_A)^t} + \text{Additional effects of debt} - \text{Initial investment}$$

There are four additional effects of debt:

(a) Tax shield from debt financing
(b) Flotation costs
(c) Bankruptcy costs
(d) Benefit of non-market-rate financing.

2 The FTE formula can be written as:

$$\sum_{t=1}^{\infty} \frac{LCF_t}{(1+R_E)^t} - (\text{Initial investment} - \text{Amount borrowed})$$

3 The WACC formula can be written as:

$$\sum_{t=1}^{\infty} \frac{UCF_t}{(1+R_{WACC})^t} - \text{Initial investment}$$

4 Corporations frequently follow this guideline:

(a) Use WACC or FTE if the firm's target debt-to-value *ratio* applies to the project over its life.

(b) Use APV if the project's *level* of debt is known over the life of the project.

5 The APV method is used frequently for special situations like interest subsidies, LBOs and leases. The WACC and FTE methods are commonly used for more typical capital budgeting situations. The APV approach is a rather unimportant method for typical capital budgeting situations.

6 The beta of the equity of the firm is positively related to the leverage of the firm.

Questions and Problems

connect

CONCEPT

1 Adjusted Present Value How is the APV of a project calculated? What about the FTE? What is the main difference between the APV, FTE and WACC?

2 Capital Budgeting Assumptions What assumptions are commonly made in a capital budgeting analysis?

3 Weighted Average Cost of Capital Is WACC consistent with a target debt–equity ratio? Explain.

4 APV, FTE and WACC Compare and contrast the three methods of capital budgeting. What are their strengths and weaknesses? When and why should you use each method instead of the other two? Are the three methods consistent when a firm does not have a target debt-to-equity ratio? Explain.

5 Discount Rate in Capital Budgeting Review the steps required in calculating the correct discount rate for capital budgeting when a firm has a high level of debt in its capital structure.

6 Beta and Leverage What are the two types of risk that are measured by a levered beta?

REGULAR

7 Capital Budgeting You are determining whether your company should undertake a new project and have calculated the NPV of the project using the WACC method when the CFO, a former accountant, notices that you did not use the interest payments in calculating the cash flows of the project. What should you tell him? If he insists that you include the interest payments in calculating the cash flows, what method can you use? The former accountant also tells you to assume the opportunity cost of the company's idle asset is zero. Is he correct? Why / why not?

8 NPV and APV Zoso is a rental car company that is considering whether to add 25 cars to its fleet. The company depreciates all its rental cars using 20 per cent reducing balance, and at the end of 5 years assumes that the cars will be sold at residual value. The new cars are expected to generate £120,000 per year in earnings before taxes and depreciation for 5 years. The company is financed entirely by equity and has a 28 per cent tax rate. The required return on the company's unlevered equity is 10 per cent, and the new fleet will not change the risk of the company.

(a) What is the maximum price that the company should be willing to pay for the new fleet of cars if it remains an all-equity company?

(b) Suppose the company can purchase the fleet of cars for £375,000. Additionally, assume the company can issue £250,000 of 5-year, 8 per cent debt to finance the project. All principal will be repaid in one balloon payment at the end of the fifth year. What is the adjusted present value (APV) of the project?

9 NPV Capital Budgeting Bose plc has developed a design for a new iPod docking station, and is considering whether it is viable to produce the product as a replacement for its existing product, whose popularity has decreased in the last year. The company publishes its financial accounts at 31 December 2014, and today is 1 January 2015. As the financial manager of the business you have been provided with the following information:

- The machinery required to produce the station will cost £100 million today. The project is likely to become obsolete after 5 years, at which time the machinery will have an expected resale value of £30 million.
- The company has already spent £20 million on market research and development of the prototype for the product.
- Production will take place on premises currently owned but rented out by the company for 35 million per annum.
- The annual sales volume over the life of the project is expected to be 100,000; 100,000; 200,000; 300,000; and 200,000 in years 1–5, respectively. The selling price per unit will be £300 throughout the life of the project.
- The variable costs per unit produced are expected to be as follows:

Materials	£90 per machine
Wages	£30 per machine
Others	£30 per machine

- The firm's fixed costs are currently £50 million, and are expected to increase to £55 million as a direct result of this project.
- The project's working capital requirements for the project are as follows:

Raw materials	one-tenth of annual material requirements
Finished goods	one-tenth of annual total costs of production
Debtors	one-fifth of annual sales
Creditors	one-fifth of annual material requirements.

- Tax depreciation on the purchase of the machine is allowed at 25 per cent on a reducing balance basis.
- The company pays corporation tax at 35 per cent, which is payable one year in arrears.
- The opportunity cost of capital for the project is 10 per cent.

Produce a working capital schedule and tax depreciation schedule for the project. Also prepare a change in income statement and show the change in cash flows. Calculate the project's NPV. Should the project be accepted?

10 APV Gemini plc, an all-equity firm, is considering a €2.4 million investment that will be depreciated according to 25 per cent reducing balances. At the end of its 4-year life, the investment will be sold for its residual value. The project is expected to generate earnings before taxes and depreciation of €850,000 per year for 4 years. The investment will not change the risk level of the firm. The company can obtain a 4-year, 9.5 per cent loan to finance the project from a local bank. All principal will be repaid in one balloon payment at the end of the fourth year. The bank will charge the firm €24,000 in flotation fees, which will be amortized over the 4-year life of the loan. If the company financed the project entirely with equity, the firm's cost of capital would be 13 per cent. The corporate tax rate is 12.5 per cent. Using the adjusted present value method, determine whether the company should undertake the project.

11 Flow to Equity Milano Pizza owns three identical restaurants popular for their specialty pizzas. Each restaurant has a debt–equity ratio of 40 per cent and makes interest payments of €29,500 at the end of each year. The cost of the firm's levered equity is 19 per cent. Each store estimates that annual sales will be €1 million; annual cost of goods sold will be €450,000; and annual general and administrative costs will be €325,000. These cash flows are expected to remain the same forever. The corporate tax rate is 37.2 per cent.

(a) Use the flow to equity approach to determine the value of the company's equity.

(b) What is the total value of the company?

12 WACC Cryo NV is an all-equity firm involved in property and casualty insurance. However, Cryo is about to issue a 10-year bond issued at par with a coupon of 8 per cent. Prior to the bond issue, the firm has a beta of 0.8 but recognizes that this will change once the firm moves to its new target debt–equity ratio of 0.25. The expected return on the Euro Stoxx 50 index is 13 per cent and Treasury bills currently yield 3.4 per cent. What

will be Cryo NV's cost of debt, cost of equity and WACC once the bond is issued? The corporate tax rate is 23 per cent.

13 WACC If Wild Widgets were an all-equity company, it would have a beta of 1.1. The company has a target debt–equity ratio of 0.40. The expected return on the market portfolio is 13 per cent, and Treasury bills currently yield 7 per cent. The company has one bond issue outstanding that matures in 20 years and has a 9 per cent coupon rate. The bond currently sells for £97.50. The corporate tax rate is 28 per cent.

(a) What is the company's cost of debt?

(b) What is the company's cost of equity?

(c) What is the company's weighted average cost of capital?

14 Beta and Leverage Maersk A/S and Lundberg A/S would have identical equity betas of 0.9 if both were all equity financed. The market value information for each company is shown here:

	Maersk A/S (DKr)	Lundberg A/S (DKr)
Debt	11,400,000	25,600,000
Equity	25,600,000	11,400,000

The expected return on the market portfolio is 9 per cent, and the risk-free rate is 2.3 per cent. Both companies are subject to a corporate tax rate of 25 per cent. Assume the beta of debt is zero.

(a) What is the equity beta of each of the two companies?

(b) What is the required rate of return on each of the two companies' equity?

15 NPV of Loans Daniel Kaffe, CFO of Kendrick Enterprises, is evaluating a 6-year, 13 per cent loan with gross proceeds of €9,000,000. The interest payments on the loan will be made annually. Flotation costs are estimated to be 1 per cent of gross proceeds and will be amortized using a 25 per cent reducing balance method over the 6-year life of the loan. The company has a tax rate of 35 per cent, and the loan will not increase the risk of financial distress for the company.

(a) Calculate the net present value of the loan excluding flotation costs.

(b) Calculate the net present value of the loan including flotation costs.

16 NPV Station GmbH is a German all-equity firm which is about to issue a new 10-year, 17 per cent bond with interest paid annually. The debt issue of €10 million is to fund an expansion of the firm's activities into Switzerland. Flotation costs are 0.8 per cent of gross proceeds, amortized over the life of the bond using 20 per cent reducing balances. Station's tax rate is 33 per cent and the bond will not increase the risk of financial distress. You believe that the company may be better off issuing the bond in Switzerland (rather than Germany) to raise visibility of the company among its new customer base. You estimate that a Swiss bond issue will increase cash flows by €200,000 per annum over 10 years from additional Swiss revenues. However, flotation costs are 1.2 per cent in Switzerland. What is the net present value of the loan if it is made in Germany? Is a Swiss bond issue a better decision? Explain.

17 NPV for an All-equity Company Shattered Glass plc is an all-equity firm. The cost of the company's equity is currently 22 per cent, and the risk-free rate is 3 per cent. The company is currently considering a project that will cost £8 million and last 5 years. The project will generate revenues minus expenses each year (excluding depreciation) in the amount of £2.3 million. If the company has a tax rate of 23 per cent, should it accept the project? The initial investment is depreciated using 20 per cent reducing balance and will have zero salvage value at the end of its life.

18 WACC XYZ plc is considering purchasing new equipment that would cost £40 million. The expected unlevered cash flows from this investment are £13 million per annum for the next 5 years. The company's stock returns have a covariance with the market portfolio of 0.048. The standard deviation of the returns on the market portfolio is 20 per cent, and the expected market risk premium is 7.5 per cent. XYZ currently have bonds outstanding with a market value of £30 million and a yield to maturity of 8 per cent. The company also has 5 million shares of ordinary shares outstanding, currently selling at £20 per share. The company's CEO considers the current debt–equity ratio as optimal. Government debt is currently selling at a yield of 6 per cent, and the company pays a corporation tax rate of 21 per cent.

(a) Use the WACC approach to determine whether XYZ plc should purchase the equipment.

(b) If the company decides to buy the equipment financed solely with debt, what is the cost of capital for the project?

19 WACC Bolero plc has compiled the following information on its financing costs:

Type of financing	Book value (£)	Market value (£)	Cost (%)
Long-term debt	2,000,000	2,000,000	3.5
Short-term debt	9,000,000	8,000,000	6.8
Ordinary shares	6,000,000	22,000,000	14.5
Total	17,000,000	32,000,000	

The company is in the 28 per cent tax bracket and has a target debt–equity ratio of 60 per cent. The target short-term debt/long-term debt ratio is 20 per cent.

(a) What is the company's weighted average cost of capital using book value weights?

(b) What is the company's weighted average cost of capital using market value weights?

(c) What is the company's weighted average cost of capital using target capital structure weights?

(d) What is the difference between WACCs? Which is the correct WACC to use for project evaluation?

20 APV Letlago plc has established a joint venture with Wannako Ltd to build a new gold mine in Kenya. The initial investment in paving equipment is £12 million. The equipment will be depreciated using the 20 per cent reducing balance method over its economic life of 5 years, at the end of which it will be sold for its residual value. Earnings before interest, taxes and depreciation collected from the gold mine are projected to be £0.8 million per annum for 20 years starting from the end of the first year. The corporate tax rate is 23 per cent. The required rate of return for the project under all-equity financing is 19 per cent. The pre-tax cost of debt for the joint partnership is 8.5 per cent. To encourage investment in the country's infrastructure, the Kenyan government will subsidize the project with a £10 million, 15-year loan at an interest rate of 7 per cent per year. All principal will be repaid in one balloon payment at the end of year 15. What is the adjusted present value of this project?

21 APV For the company in the previous problem, what is the value of being able to issue subsidized debt instead of having to issue debt at the terms it would normally receive? Assume the face amount and maturity of the debt issue are the same.

22 APV MVP GmbH has produced football supplies for over 20 years. The company currently has a debt–equity ratio of 50 per cent and is in the 29.8 per cent tax bracket. The required return on the firm's levered equity is 16 per cent. MVP is planning to expand its production capacity. The equipment to be purchased is expected to generate the following unlevered cash flows:

Year	Cash flow (€)
0	−24,000,000
1	8,000,000
2	13,000,000
3	10,000,000

The company has arranged a €12 million debt issue to partially finance the expansion. Under the loan, the company would pay interest of 9 per cent at the end of each year on the outstanding balance at the beginning of the year. The company would also make year-end principal payments of €4 million per year, completely retiring the issue by the end of the third year. Using the adjusted present value method, should the company proceed with the expansion?

23 WACC Neon Corporation's share price returns have a covariance with the market portfolio of 0.048. The standard deviation of the returns on the market portfolio is 20 per cent, and the expected market risk premium is 7.5 per cent. The company has bonds outstanding with a total market value of £30 million and a yield to maturity of 8 per cent. The company also has 5 million ordinary shares outstanding, each selling for £20. The company's CEO considers the firm's current debt–equity ratio optimal. The corporate tax rate is 28 per cent, and Treasury bills currently yield 6 per cent. The company is considering the purchase of additional equipment that would cost £40 million. The expected unlevered cash flows from the equipment are £13 million per year for 5 years. Purchasing the equipment will not change the risk level of the firm.

(a) Use the weighted average cost of capital approach to determine whether Neon should purchase the equipment.

(b) Suppose the company decides to fund the purchase of the equipment entirely with debt. What is the cost of capital for the project now? Explain.

CHALLENGE

24 APV, FTE and WACC Seger plc is an unlevered firm with expected annual earnings before taxes of £35 million in perpetuity. The current required return on the firm's equity is 20 per cent, and the firm distributes all of its earnings as dividends at the end of each year. The company has 1.5 million ordinary shares outstanding and is subject to a corporate tax rate of 28 per cent. The firm is planning a recapitalization under which it will issue £40 million of perpetual 9 per cent debt and use the proceeds to buy back shares.

(a) Calculate the value of the company before the recapitalization plan is announced. What is the value of equity before the announcement? What is the price per share?

(b) Use the APV method to calculate the company value after the recapitalization plan is announced. What is the value of equity after the announcement? What is the price per share?

(c) How many shares will be repurchased? What is the value of equity after the repurchase has been completed? What is the price per share?

(d) Use the flow to equity method to calculate the value of the company's equity after the recapitalization.

25 APV, FTE and WACC Mojito Mint Company has a debt–equity ratio of 0.45. The required return on the company's unlevered equity is 17 per cent, and the pre-tax cost of the firm's debt is 9 per cent. Sales revenue for the company is expected to remain stable indefinitely at last year's level of £23,500,000. Variable costs amount to 60 per cent of sales. The tax rate is 28 per cent, and the company distributes all its earnings as dividends at the end of each year.

(a) If the company were financed entirely by equity, how much would it be worth?

(b) What is the required return on the firm's levered equity?

(c) Use the weighted average cost of capital method to calculate the value of the company. What is the value of the company's equity? What is the value of the company's debt?

(d) Use the flow to equity method to calculate the value of the company's equity.

26 APV, FTE and WACC Lone Star Industries has just issued £160,000 of perpetual 10 per cent debt and used the proceeds to repurchase equity. The company expects to generate £75,000 of earnings before interest and taxes in perpetuity. The company distributes all its earnings as dividends at the end of each year. The firm's unlevered cost of capital is 18 per cent, and the corporate tax rate is 28 per cent.

(a) What is the value of the company as an unlevered firm?

(b) Use the adjusted present value method to calculate the value of the company with leverage.

(c) What is the required return on the firm's levered equity?

(d) Use the flow to equity method to calculate the value of the company's equity.

27 Projects that Are Not Scale Enhancing Blue Angel Ltd, a private firm in the holiday gift industry, is considering a new project. The company currently has a target debt–equity ratio of 0.40, but the industry target debt–equity ratio is 0.35. The industry average beta is 1.2. The market risk premium is 8 per cent, and the risk-free rate is 7 per cent. Assume all companies in this industry can issue debt at the risk-free rate. The corporate tax rate is 28 per cent. The project requires an initial outlay of £450,000 and is expected to result in a £75,000 cash inflow at the end of the first year. The project will be financed at Blue Angel's target debt–equity ratio. Annual cash flows from the project will grow at a constant rate of 5 per cent until the end of the fifth year and remain constant forever thereafter. Should Blue Angel invest in the project?

28 Equivalence of WACC and APV Read the paper by M. Massari, F. Roncaglio and L. Zanetti, 'On the Equivalence between the APV and the WACC Approach in a Growing Leveraged Firm', *European Financial Management*, Vol. 14, No. 1, 2008, pp. 152–162. Provide an overview of the main findings and discuss the implications of the research for investment evaluation.

29 Equivalence of WACC and APV Select a range of empirical studies on capital budgeting and discuss their findings. What, in your opinion, are the most interesting findings?

30 NPV After graduating from university you get a job for a non-dividend paying company which has recently listed on the stock exchange. Your manager tells you that the company does not favour the NPV approach to capital budgeting. Do you think this is a good decision by the company's management?

Exam Question (45 minutes)

Electrolar AB is planning to set up new operations in northern Sweden. Having established that the investment has a positive net present value, they now have to consider their financing decision. The underwriters to the company state that the total funding required amounts to SKr0.5 billion and that this can be raised through a debt issue or an equity issue.

1 Their first option concerns the use of debt financing. The underwriters suggest that a 10-year bond issue with a 7 per cent coupon may be a sensible route to raising these funds. If interest payments are tax deductible and the tax rate is 26.33 per cent, estimate the required rate of return for debt financing to the nearest half per cent. (25 marks)

2 The second option relates to equity financing. The underwriters believe that if the company were to issue shares to fund the proposed project, they would have to be sold at a discount of 20 per cent. Issue expenses will be 1 per cent of the funding requirement. Estimate the return required by investors when investing in Electrolar plc's new share issue. (25 marks)

3 Review the ways in which positive net present value opportunities may arise when a company wishes to raise funds in the financial markets. Use an example to illustrate your answer. (25 marks)

4 Compare and contrast the strengths and weaknesses of the adjusted present value, weighted average cost of capital, and flow to equity approaches to investment appraisal. Which method, in your opinion, is the best? Explain. (25 marks)

Mini Case

The Leveraged Buyout of Cheek Products Ltd

Cheek Products Ltd was founded 53 years ago by Joe Cheek and originally sold snack foods such as crisps and biscuits. Through acquisitions, the company has grown into a conglomerate with major divisions in the snack food industry, home security systems, cosmetics and plastics. Additionally, the company has several smaller divisions. In recent years the company has been underperforming, but the company's management does not seem to be aggressively pursuing opportunities to improve operations (and the share price).

Meg Whalen is a financial analyst specializing in identifying potential buyout targets. She believes that two major changes are needed at Cheek Products. First, she thinks that the company would be better off if it sold several divisions and concentrated on its core competencies in snack foods and home security systems. Second, the company is financed entirely with equity. Because the cash flows of the company are relatively steady, Meg thinks the company's debt–equity ratio should be at least 0.25. She believes these changes would significantly enhance shareholder wealth, but she also believes that the existing board and company management are unlikely to take the necessary actions. As a result, Meg thinks the company is a good candidate for a leveraged buyout.

A leveraged buyout (LBO) is the acquisition by a small group of equity investors of a public or private company. Generally, an LBO is financed primarily with debt. The new shareholders service the heavy interest and principal payments with cash from operations and/or asset sales. Shareholders generally hope to reverse the LBO within 3 to 7 years by way of a public offering or sale of the company to another firm. A buyout is therefore likely to be successful only if the firm generates enough cash to serve the debt in the early years and if the company is attractive to other buyers a few years down the road.

Meg has suggested the potential LBO to her partners, Ben Feller and Brenton Flynn. Ben and Brenton have asked Meg to provide projections of the cash flows for the company. Meg has provided the following estimates (in millions):

	2011 (£)	2012 (£)	2013 (£)	2014 (£)	2015 (£)
Sales	1,627	1,824	1,965	2,012	2,106
Costs	432	568	597	645	680
Depreciation	287	305	318	334	340

	2011 (£)	2012 (£)	2013 (£)	2014 (£)	2015 (£)
EBT	908	951	1,050	1,033	1,086
Capital expenditures	165	143	180	182	195
Change in NWC	(72)	(110)	60	56	64
Asset sales	840	610			

At the end of 5 years, Meg estimates that the growth rate in cash flows will be 3.5 per cent per year. The capital expenditures are for new projects and the replacement of equipment that wears out. Additionally, the company would realize cash flow from the sale of several divisions. Even though the company will sell these divisions, overall sales should increase because of a more concentrated effort on the remaining divisions.

After ploughing through the company's financials and various pro forma scenarios, Ben and Brenton feel that in 5 years they will be able to sell the company to another party or take it public again. They are also aware that they will have to borrow a considerable amount of the purchase price. The interest payments on the debt for each of the next 5 years if the LBO is undertaken will be these (in millions):

	2011	2012	2013	2014	2015
Interest payments (£)	1,140	1,100	1,180	1,150	1,190

The company currently has a required return on assets of 14 per cent. Because of the high debt level, the debt will carry a yield to maturity of 12.5 per cent for the next 5 years. When the debt is refinanced in 5 years, they believe the new yield to maturity will be 8 per cent.

Check Products Ltd currently has 104 million shares of equity outstanding that sell for £53 per share. The corporate tax rate is 28 per cent. If Meg, Ben and Brenton decide to undertake the LBO, what is the most they should offer per share?

Practical Case Study

We now return to our Cement example in Chapters 7 and 8. So far, we have gone with a consensus discount rate and assumed away any complications from leverage. The cement company for which you are carrying out consultancy has no debt funding. However, it wishes to borrow from a multinational bank in Tanzania the total amount required for the loan. If it does this, its debt–equity ratio will increase to 50 per cent. Assuming that the surveyed discount rates (see Chapter 7 case study) are for the firm prior to any debt increase, how would you now alter the analysis to take into account the increased debt? Use all information available to you, including the financial statements of other relevant companies.

Reference

Inselbag, I. and Kaufold, H. (1997) 'Two Approaches for Valuing Companies under Alternative Financial Strategies (and How to Choose between Them)', *Journal of Applied Corporate Finance*, Vol. 10, No. 1, 114–122.

Additional Reading

For recent developments, see:

1 Booth, L. (2002) 'Finding Value Where None Exists: Pitfalls in Using Adjusted Present Value', *Journal of Applied Corporate Finance*, Vol. 15, No. 1, 8–17.

2 Booth, L. (2007) 'Capital Cash Flows, APV and Valuation', *European Financial Management*, Vol. 13, No. 1, 29–48.

3 Dempsey, M. (2013) 'Consistent Cash Flow Valuation with Tax-Deductible Debt: A Clarification', *European Financial Management*, Vol. 19, No. 4, 830–836.

4 Massari, M., F. Roncaglio and L. Zanetti (2008) 'On the Equivalence between the APV and WACC Approach in a Growing Leveraged Firm', *European Financial Management*, Vol. 14, No. 1, 152–162.

Endnotes

1 That is, the present value of the project after the initial investment has been made is £541,935.49 (= £21,935.49 + £520,000). Thus, the debt-to-value ratio of the project is 0.25 (£135,483.90/£541,935.49).

This level of debt can be calculated directly. Note that:

Present value of levered project = Present value of unlevered project + $t_C \times D$

$$V_{\text{With debt}} = £504{,}000 + 0.28 \times 0.25 \times V_{\text{With debt}}$$

Rearranging the last line, we have:

$$V_{\text{With debt}} \times (1 - 0.28 \times 0.25) = £504{,}000$$

$$V_{\text{With debt}} = £541{,}935.50$$

Debt is 0.25 of value: £135,483.90 (= 0.25 × £541,935.50).

2 We use the term *levered cash flow* (LCF) for simplicity. A more complete term would be *cash flow from the project to the shareholders of a levered firm.* Similarly, a more complete term for *unlevered cash flow* (UCF) would be *cash flow from the project to the shareholders of an unlevered firm.*

3 See Inselbag and Kaufold (1997).

4 Alternatively, a firm might assume that its venture would be somewhat riskier because it is a new entrant. Thus, the firm might select a discount rate slightly higher than 0.1825. Of course, no exact formula exists for adjusting the discount rate upward.

5 The NPV (loan) must be zero in a no-tax world because interest provides no tax shield there. To check this intuition, we calculate:

$$\text{No-tax case: } 0 = +£7{,}575{,}758 - \frac{£757{,}576}{0.10} \times \left[1 - \left(\frac{1}{1.10}\right)^5\right] - \frac{£7{,}575{,}758}{(1.10)^5}$$

6 This result holds only if the beta of debt equals zero. To see this, note that:

$$V_U + t_C D = V_L = D + E \qquad \textbf{(a)}$$

where: V_U is the value of unlevered firm; V_L is the value of levered firm; D is the market value of debt in a levered firm; and E is the market value of equity in a levered firm.

As we stated in the text, the beta of the levered firm is a weighted average of the debt beta and the equity beta:

$$\frac{D}{D+E} \times \beta_D + \frac{E}{D+E} \times \beta_E$$

where β_D and β_E are the betas of the debt and the equity of the levered firm, respectively. Because $V_L = D + E$, we have:

$$\frac{D}{V_L} \times \beta_D + \frac{E}{V_L} \times \beta_E \qquad \textbf{(b)}$$

The beta of the levered firm can *also* be expressed as a weighted average of the beta of the unlevered firm and the beta of the tax shield:

$$\frac{V_U}{V_U + t_C D} \times \beta_U + \frac{t_C D}{V_U + t_C D} \times \beta_D$$

where β_U is the beta of the unlevered firm. This follows from Equation (a). Because $V_L = V_U + t_C D$, we have:

$$\frac{V_U}{V_L} \times \beta_U + \frac{t_C D}{V_L} \times \beta_D \qquad \textbf{(c)}$$

We can equate (b) and (c) because both represent the beta of a levered firm. Equation (a) tells us that $V_U = S + (1 - t_C) \times D$. Under the assumption that $\beta_D = 0$, equating (b) and (c) and using Equation (a) yields Equation 17.4.

The generalized formula for the levered beta (where β_D is not zero) is:

$$\beta_E = \beta_U + (1 - t_C)(\beta_U - \beta_D)\frac{D}{E}$$

and

$$\beta_U = \frac{E}{D(1 - t_C) + E}\beta_E + \frac{D(1 - t_C)}{D(1 - t_C) + E}\beta_D$$