

## WHAT IS THE COMPANY'S COST OF CAPITAL?

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## Introduction

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Until this point a cost of capital (required rate of return) has been assumed for, say, a project or a business unit strategy, but we have not gone into much detail about how an appropriate cost of capital is calculated. This vital issue is now addressed.

The objective set for management in a value-based organization is the maximization of long-term shareholder wealth. This means achieving a return on invested money that is greater than shareholders could obtain elsewhere for the same level of risk. Shareholders, and other finance providers, have an opportunity cost associated with putting money into your firm. They could withdraw the money placed with you and invest it in a comparable company's securities. If, for the same risk, the alternative investment offers a higher return than your firm's shares, then as a management team you are destroying shareholder wealth.

**The cost of capital is the rate of return that a company has to offer finance providers to induce them to buy and hold a financial security.**

The cost of capital is the rate of return that a company has to offer finance providers to induce them to buy and hold a financial security. This rate is determined by the returns offered on alternative securities with the same risk.

Using the correct cost of capital as a discount rate is important. If it is too high investment will be constrained, firms will not grow as they should and shareholders will miss out on value-enhancing opportunities. There can be a knock-on effect to the macro-economy and this worries politicians. For example, the one-time President of the Board of Trade, Michael Heseltine, complained:

Businesses are not investing enough because of their excessive expectations of investment returns ... The CBI tells me that the majority of firms continue to require rates of return above 20 per cent. A senior banker last week told me his bank habitually asked for 30 per cent returns on capital.<sup>1</sup>

This chapter focusses on the question of how to measure the returns available on a variety of financial securities at different risk levels. This will be developed into an overall cost of capital for the firm and provide a method for calculating the benchmark rate for the firm, SBUs and projects.

## A word of warning

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Too often, the academics and consultants give the impression of scientific preciseness when calculating a firm's cost of capital. The reality is that behind any final number generated lies an enormous amount of subjective assessment or, worse, opinion. Choices have to be made between competing judgments on a range of issues, including the appropriate risk premium, financial gearing level and risk measure. Good decision-making comes from knowing the limitations of the input variables to the decision. Knowing where informed judgment has been

employed in the cost of capital calculation is required to make value-enhancing decisions and thus assist the art of management. In short, the final number for the required rate of return is less important than knowledge of the factors behind the calculation and the likely size of the margin of error. Precision is less important than knowledge of what is a reasonable range.

## The required rate of return

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The capital provided to large firms comes in many forms. The main forms are equity and debt capital, but there are a number of hybrids, such as convertible bonds. When a finance provider chooses to supply funds in the form of debt finance, there is a deliberate attempt to reduce risk. This can be achieved in a number of ways: by imposing covenants on management which, for example, restrict the gearing (proportion of debt to share capital) level or maintain an interest cover ratio (e.g. annual profit must remain four times greater than annual interest); accept assets as security; by ensuring that the lenders are ahead of other finance providers (particularly ordinary and preference holders) in terms of annual pay-outs and in the event of liquidation.

A lender to a corporation cannot expect to eliminate all risk and so the required rate of return is going to be above that of lending to a reputable State such as the USA or the UK. Placing your savings with the UK government by buying its bonds in return for the promise of regular interest and the payment of a capital sum in a future year is the closest you are going to get to risk-free lending. The rate of return offered on government bonds and Treasury bills (lending that is repaid in a few months) is the bedrock rate that is used to benchmark other interest rates. It is called the risk-free rate of return, or given the symbol  $r_f$ .

A stable well-established company with a relatively low level of borrowing and low risk operations might have to pay a slightly higher rate of return on debt capital than the UK government. Such a company, if it issued a corporate bond with a high credit rating (low risk of default), would pay, say, an extra 100 basis points (i.e. 1%) per year. This is described as the risk premium (RP) on top of the risk-free rate. Then, the cost of debt capital,  $k_D$ , is:

$$k_D = r_f + \text{RP}$$

If the current risk free rate is 6 percent, then  $k_D = 7$  percent.

If the firm already has a high level of debt and wishes to borrow more it may need to offer as much as 800 basis points above the risk-free rate. The credit rating is likely to be below investment grade (below BBB- by Standard and Poor's and Baa3 by Moody's – see Chapter 16 for more details) and therefore will be classified as a high-yield (or junk) bond. So the required return might be 14 percent.

$$k_D = r_f + \text{RP} = 6 + 8 = 14\%$$

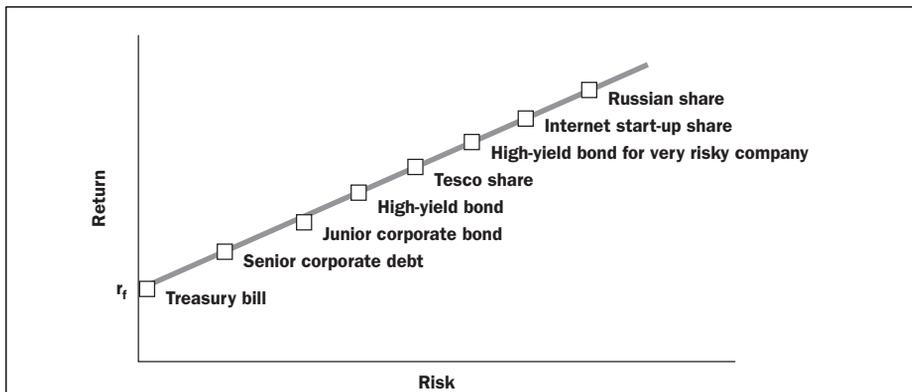
If the form of finance provided is equity capital then the investor is accepting a fairly high probability of receiving no return at all on the investment. The firm has no obligation to pay annual dividends, and other forms of capital have prior claims on annual cash flows. If the firm does less well than expected then it is, generally, ordinary shareholders who suffer the most. If the firm performs well very high returns can be expected. It is the expectation of high returns that causes ordinary shareholders to accept high risk – a large dispersion of returns.

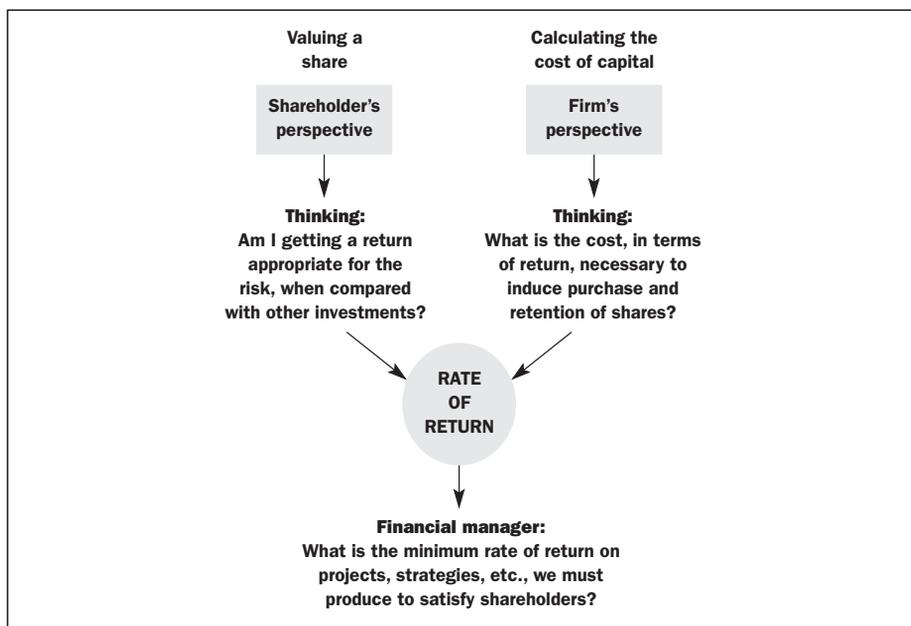
Different equities have different levels of risk, and therefore returns. A shareholder in Tesco is likely to be content with a lower return than a shareholder in, say, an internet start-up, or a company quoted on the Russian Stock Exchange. Thus we have a range of financial securities with a variety of risk and associated return – see Figure 10.1.

## Two sides of the same coin

The issues of the cost of capital for managerial use within the business and the value placed on a share (or other financial security) are two sides of the same coin. They both depend on the level of return. The holders of shares make a valuation on the basis of the returns they estimate they will receive. Likewise, from the firm’s perspective, it estimates the cost of raising money through selling shares as the return that the firm will have to pay to shareholders to induce them to buy and hold the shares. The same considerations apply to bondholders, preference shareholders and so on. If the future cash flowing from the form of finance is anticipated to fall from a previously assumed level then the selling price of the share, bond, etc. goes down until the return is at the level dictated by the returns on financial securities of a similar type and risk. If a company fails to achieve returns that at least compensate finance providers for their opportunity cost it is unlikely to survive for long. Figure 10.2, taking shares as an example, illustrates that valuing a share and the cost of equity capital are two sides of the same coin.

**FIGURE 10.1**  
**Risk-return – hypothetical examples**



**FIGURE 10.2****Two sides of the same coin**

## The weighted average cost of capital (WACC)

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We have established that firms need to offer returns to finance providers commensurate with the risk they are undertaking. The amount of return is determined by what those investors could get elsewhere at that risk level (e.g. by investing in other companies). If we take a firm that is financed entirely by share capital (equity) then the required rate of return to be used in value analysis, e.g. a project or SBU appraisal, is the required return demanded by investors on the company's shares. However, this is only true if the new project (or division) has the same level of risk as the existing set of projects.

The stock market prices shares on the basis of the current riskiness of the firm. This is determined by the activities it undertakes. A company can be seen as merely a bundle of projects from the perspective of ordinary shareholders. If these projects are, on average, of high risk then the required return will be high. If the proposed project (or division) under examination has the same risk as the weighted average of the current set then the required return on the company's equity capital is the rate appropriate for this project (if the company received all its capital from shareholders and none from lenders). If the new project has a lower risk, the company-wide cost of capital needs to be adjusted down for application to this project.

If, however, we are dealing with a company that has some finance in the form of debt and some in the form of equity the situation becomes a little more com-

plicated. Imagine that a corporation is to be established by obtaining one-half of its £1,000m of capital from lenders, who require an 8 percent rate of return for an investment of this risk class, and one-half from shareholders, who require a 12 percent rate of return for the risk they are accepting. Thus we have the following facts:

Cost of debt,		$k_D = 8\%$
Cost of equity,		$k_E = 12\%$
Weight of debt	£500m / £1bn	$W_D = 0.5$
Weight of equity	£500m / £1bn	$W_E = 0.5$

The weighted average cost of capital (WACC) must be established to calculate the minimum return needed on an investment within the firm, that will produce enough to satisfy the lenders and leave just enough to give shareholders their 12 percent return. Anything less than this WACC and the shareholders will receive less than 12 percent. They will recognize that 12 percent is available elsewhere for that level of risk and remove money from the firm.

Weighted Average Cost of Capital,  $WACC = k_E W_E + k_D W_D$

$$WACC = 12 \times 0.5 + 8 \times 0.5 = 10\%$$

### Illustration

Take a firm that produces a 10 percent return on money invested in a project, the same as its WACC. If the firm invested £100,000 in a project that produced a net cash flow per year of £10,000 to infinity (assuming a perpetuity makes the example simple), the first call on that cash flow is from the debt holders, who effectively supplied £50,000 of the funds. They require £4,000 per annum. That leaves £6,000 for equity holders – an annual return of 12 percent on the £50,000 they provided.

If things go well and a return of £11,000 (i.e. 11%) is generated then debt holders still receive the contracted amount of £4,000, but the equity holders get a return significantly above the minimum they require at 14 percent return: £7,000 is left to pay out to shareholders on their £50,000 capital input to this project.

### Lowering the WACC and increasing shareholder returns

Examining the WACC formula we see an apparently simple way of reducing the required rate of return, and thus raise the value of a project, division or the entire firm: change the weights in the formula in favor of debt. In other words, alter the capital structure of the firm by having a higher proportion of its capital in the form of cheaper debt.

For example, if the company is expected to produce £100m cash flow per year (to infinity) and its WACC is 10 percent its total corporate value ('enterprise' value that is, the value of the debt and equity) is:

$$£100\text{m} / 0.10 = £1,000\text{m}$$

Let us try to lower the WACC.

Imagine that instead of the firm being established with 50 percent debt in its overall capital, it is set up with 70 percent debt. The proportion of total capital in the form of equity is therefore 30 percent. *If* (a big if) the equity holders remain content with a 12 percent return while the debt holders accept an 8 percent annual return the WACC will fall, and the value of the firm will rise.

$$\text{WACC} = k_E W_E + k_D W_D$$

$$\text{WACC} = 12 \times 0.3 + 8 \times 0.7 = 9.2\%$$

$$\text{Firm value} = £100\text{m} / 0.092 = £1,086.96\text{m}$$

Why don't all management teams increase the proportion of debt in the capital structure and magic-up some shareholder value? The fly in the ointment for many firms is that equity investors are unlikely to be content with 12 percent returns when their shares have become more risky due to the additional financial leverage. The key question is: how much extra return do they demand? The financial economists and Nobel laureates Franco Modigliani and Merton Miller (MM) presented the case that in a perfect capital market (all participants such as shareholders and managers have all relevant information, all can borrow at same interest, etc.) the increase in  $k_E$  would exactly offset the benefit from increasing the debt proportion, to leave the WACC constant so increasing the debt proportion does not add to shareholder value – the only factor that can add value is the improvement in the underlying performance of the business, i.e. its cash flows. According to this view (that there is no optimal capital structure that will maximize shareholder wealth) there is no point in adjusting the debt or equity proportions.

In this stylized world  $k_D$  remains at 8 percent, but  $k_E$  moves to 14.67 percent, leaving WACC, firm value, and shareholder value constant.

$$\text{WACC} = k_E W_E + k_D W_D$$

$$\text{WACC} = 14.67 \times 0.3 + 8 \times 0.7 = 10\%$$

However, there is hope for managers trying to improve shareholder wealth by adjusting the capital structure because in constructing a perfect world Modigliani and Miller left out at least two important factors: tax and financial distress.<sup>2</sup>

## The benefit of tax

First tax. A benefit of financing through debt is that the annual interest can be used to reduce taxable profit thus lowering the cash that flows out to the tax authorities. In contrast, the annual payout on equity (dividends) cannot be used

to reduce the amount of profit that is taxed. The benefits gained from being able to lower the tax burden through financing through debt reduces the effective cost of this form of finance.

To illustrate: Firm A is a company in a country that does not permit interest to be deducted from taxable profit. Firm B is in a country that does permit interest to be deducted. In both companies the interest is 8 percent on £500m. Observe the effect on the amount of profit left for distribution to shareholders:

	Firm A £m	Firm B £m
Profits before interest and tax	100	100
Interest	—	-40
Taxable profit	<u>100</u>	<u>60</u>
Amount taxed @ 30%	-30	-18
Interest	<u>-40</u>	—
Amount available for distribution shareholders	<u>30</u>	<u>42</u>

The extra £12m for Firm B reduces the effective cost of debt from 8 percent to only  $8(1 - T)$ , where  $T =$  the corporation tax rate, 30 percent. The cost of debt capital falls to  $8(1 - 0.3) = 5.6$ , or £28m on £500m of debt. The taxman, by taking £12m less from the company purely because the tax rules allow the deductibility of interest from taxable profit, lowers the effective cost of the debt.

So including the ‘tax shield’ effect we find a reduction in the WACC that leads to an increase in the amount available for shareholders. In our example, if we assume tax on corporate profits at 30 percent then the effective cost of debt falls to 5.6 percent. Resulting in the WACC becoming 8.8 percent.

So, if:

$$k_{\text{DBT}} = \text{cost of debt before tax benefit} = 8\%$$

$$k_{\text{DAT}} = \text{cost of debt after tax benefit} = 8(1 - T) = 8(1 - 0.30) = 5.6\%$$

If we assume a 50:50 capital structure the WACC is:

$$\text{WACC} = k_E W_E + k_{\text{DAT}} W_D$$

$$\text{WACC} = 12 \times 0.5 + 5.6 \times 0.5 = 8.8\%$$

Investment project cash flows discounted at this lower rate will have a higher present value than if discounted at 10 percent. Given that the debt holders receive only their contractual interest and no more this extra value flows to shareholders.

### **But, financial distress constrains gearing**

The introduction of the tax benefit strongly pushes the bias towards very high gearing levels to obtain a lower WACC and higher value. However, such extreme gearing is not observed very often in real world companies. There are a number

of reasons for this, the most important of which is the increasing risk to the finance providers (particularly equity capital holders) of financial distress and, ultimately, liquidation. (See Chapter 18 for more reasons.)

As gearing rises so does the probability of equity investors receiving a poor (no) return. So they demand higher expected returns to compensate. At first, the risk premium rises slowly, but at high gearing levels it rises so fast that it more than offsets the benefit of increasing debt in the capital structure. This is demonstrated in Figure 10.3, in which the WACC at lower levels of debt is primarily influenced by the increasing debt proportion in the capital structure, and at higher levels by the rising cost of equity (and eventually debt).

The conclusion drawn from the capital structure literature is that there is an optimal gearing level that achieves the lowest WACC and highest firm value – discussed in more detail in Chapter 18. When companies are calculating their WACC they should use this target gearing ratio and not a gearing ratio they happen to have at the time of calculation.

So, if in our example case the required return on equity rises from 12 percent to 13 percent when the proportion of the debt in the capital structure rises to 65 percent from 50 percent and the effective rate of return payable on debt is 5.6 percent after the tax shield benefit (i.e. remaining at 8 percent before the tax benefit) then the WACC falls and the value available for shareholders rises.

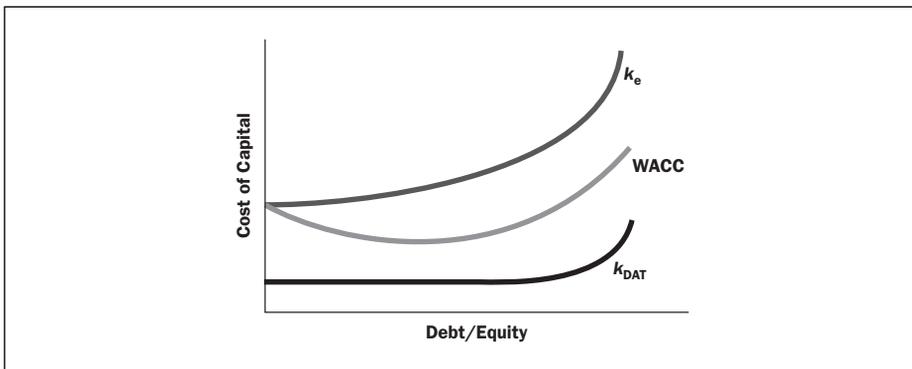
$$\text{WACC} = k_E W_E + k_{\text{DAT}} W_D$$

$$\text{WACC} = 13 \times 0.35 + 5.6 \times 0.65 = 8.19\%$$

### Taking financial gearing too far

For this particular company we will assume that 65 percent gearing is the optimum debt/equity ratio. If we go to 80 percent debt we find this reduces shareholder wealth because the firm's projects (in aggregate) are now discounted at a higher rate of return reducing their present value. The reason the

**FIGURE 10.3**  
Cost of capital with different capital structures



discount rate rises significantly is that the required return on shares rises to, say, 30 percent as investors fear massive potential loss due to the large commitment of the firm to pay out interest whether or not the firm is doing well (for simplicity we assume that the cost of debt remains the same – in reality, at high gearing levels it would rise pushing up the WACC even further).

$$\begin{aligned} \text{WACC} &= k_E W_E + k_{\text{DAT}} W_D \\ \text{WACC} &= 30 \times 0.2 + 5.6 \times 0.8 = 10.48\% \end{aligned}$$

### Worked example 10.1

#### Poise plc

The rate of return offered to debt holders before considering the benefit to shareholders of the tax shield,  $k_{\text{DBT}}$ , is 10%, whereas the required return on equity is 20%. The total amount of capital in use (equity + debt),  $V$ , is £2m. Of that, £1.4m represents the market value of its equity,  $V_E$ , and £600,000 equals the market value of its debt,  $V_D$ . These are the optimum proportions of debt and equity.

Thus:

$$\begin{aligned} k_{\text{DBT}} &= 10\% \\ k_E &= 20\% \\ V &= \text{£}2\text{m} \\ V_E &= \text{£}1.4\text{m} \\ V_D &= \text{£}0.6\text{m} \end{aligned}$$

The weight for equity capital is:

$$W_E = \frac{V_E}{V} = \frac{1.4}{2.0} = 0.7$$

The weight for debt is:

$$W_D = \frac{V_D}{V} = \frac{0.6}{2.0} = 0.3$$

The corporate tax rate is 30% and therefore the after-tax cost of debt is:

$$\begin{aligned} k_{\text{DAT}} &= k_{\text{DBT}} (1 - T) \\ k_{\text{DAT}} &= 10 (1 - 0.30) = 7\% \end{aligned}$$

The weighted average cost of capital for Poise is:

$$\begin{aligned} \text{WACC} &= k_E W_E + k_{\text{DAT}} W_D \\ &= 20\% \times 0.7 + 7\% \times 0.3 \\ &= \mathbf{16.1\%} \end{aligned}$$

This is the rate of return Poise needs to achieve on new business projects if they are of the same risk as the average risk of current set of projects. If the new projects are of higher or lower risk an adjustment needs to be made to the discount rate used – this is discussed later in the chapter.

For example, if Poise is considering a project that requires an investment of £1m at time 0 and then produces after tax annual cash flows before interest payments of £161,000 as a perpetuity (i.e. it achieves a 16.1% rate of return) then the net cost of satisfying the debt holders after the tax shield benefit is £21,000. (The debt holders supplied 30% of the £1m invested, i.e. £300,000; and the cost to the firm of satisfying them is £300,000 × 7% = £21,000.) The remainder of the annual cash flows go to the shareholders; so they receive £140,000 per year which is a 20% return on the £700,000 they supplied.

If the project produces a much lower annual cash flow of £100,000 (a rate of return of 10%) then the debt holders still receive £21,000, leaving only £79,000 for the shareholders. These investors could have achieved a return of 20% by investing in other companies at this level of risk. An annual return of £79,000 represents a mere 11.3% return (£79,000/£700,000). Thus shareholders suffer a loss of wealth relative to the forgone opportunity.

## The cost of equity capital

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A shareholder has in mind a minimum rate of return determined by the returns available on other shares of the same risk class. Managers, in order to maximize shareholder wealth, must obtain this level of return for shareholders from the firm's activities. If a company does not achieve the rate of return to match the investor's opportunity cost it will find it difficult to attract new funds and will become vulnerable to take-over or liquidation.

With debt finance there is generally a specific rate payable for the use of capital. In contrast, ordinary shareholders are not explicitly offered specific payments. However, an implicit rate of return must be offered to attract investors – it is the expectation of high returns that causes ordinary shareholders to accept high risk.

Investors in shares require a return that provides for two elements. First, they need a return equal to the risk-free rate (usually taken to be that on government securities). Second, there is the risk premium, which rises with the degree of systematic risk (systematic risk is explained below).

Rate of return on shares = Risk-free rate + Risk premium

$$k_E = r_f + RP$$

The risk-free rate gives a return sufficient to compensate for both impatience to consume and inflation (see Chapter 2).<sup>3</sup> To estimate the relevant risk premium on a company's equity there are two steps.

- Step one estimates the average extra return demanded by investors above the risk-free return to induce them to buy a portfolio of average-risk level shares. We look back at the returns shareholders have actually received on average-risk shares above the risk-free return in the past and make the assumption that this is what they also demanded before the event – *ex ante* in the jargon. The average annual risk premium actually obtained by shareholders can only be calculated over an extended period of time (many decades) as short-term returns on shares can be distorted (they are often negative for a year, for example). This is expressed as the difference between the market return,  $r_m$ , and the risk-free return,  $r_f$  that is  $(r_m - r_f)$ .
- Step two adjusts the risk premium for a typical (average-risk level) share to suit the risk level for the particular company's shares under consideration. If the share is more risky than the average then  $(r_m - r_f)$  is multiplied by a systematic risk factor greater than 1. If it is less risky it may be multiplied by a systematic risk factor of, say, 0.8 to reduce the risk premium.

To understand the origin of the most popular method of calculating the cost of equity capital, the capital asset pricing model, it is necessary to first of all deal with the issues of shareholder diversification, the elimination of unsystematic risk and the focus on the variable called beta.

## Diversification

If an investor only has one company's shares in his 'portfolio' then risk is very high. Adding a second reduces risk. The addition of a third and fourth continues to reduce risk but by smaller amounts. This sort of effect is demonstrated in Figure 10.4. The reason for the risk reduction is that security returns generally do not vary with perfect positive correlation. That is, returns do not go up together and down together by the same percentages at the same time. At any one time the good news about one share is offset to some extent by bad news about another.

Generally within a portfolio of shares if one is shooting up, others are stable, going down or rising. Each share movement depends mostly on the particular news emanating from the company. News is generally particular to companies and we should not expect them each to report good (or bad) news on the same day. So, if on a day one share in the portfolio reports the resignation of brilliant chief executive we might expect that share to fall. But, because the portfolio owner is diversified the return on the portfolio will not move dramatically downward. Other companies are reporting marketing coups, big new contracts, or whatever, pushing up their share prices. Others (the majority?) are not reporting any news and their share prices do not move much at all. The point is that by

not having all your eggs in one basket you reduce the chance of the collective value of your investments falling off a cliff. The risk, or volatility, of the value of the portfolio, as measured by standard deviation, is reduced. The greater the extent of diversification, the lower the standard deviation (see Chapter 5 for a discussion of standard deviation).

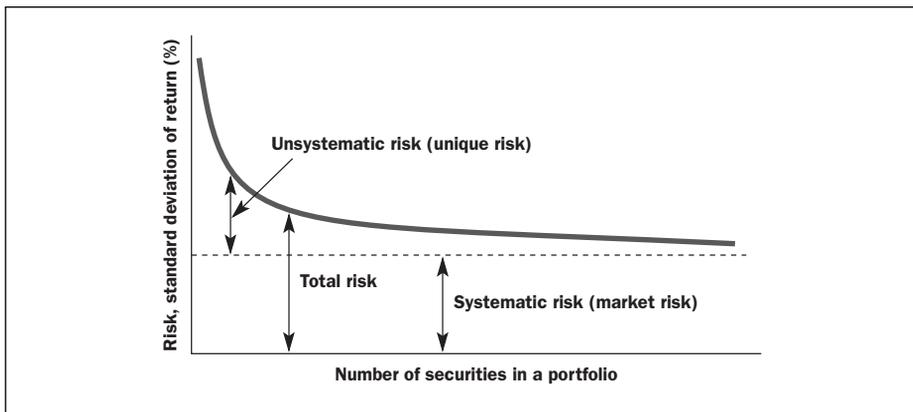
So, despite the fact that returns on individual shares can vary dramatically a portfolio will be relatively stable. The type of risk being reduced through diversification is referred to as unsystematic (unique, or specific) risk. This element of variability in a share's return is due to the specific circumstances of the individual firms. In a portfolio these individual ups and downs tend to cancel out. Another piece of jargon applied to this type of risk is that it is 'diversifiable'. That is, it can be eliminated simply by holding a sufficiently large portfolio.

### Systematic risk

However, no matter how many shares are held there will always be an element of risk that cannot be canceled out by broadening the portfolio. This is called systematic (or market) risk. There are some risk factors common to all firms to a greater or lesser extent. These include macroeconomic movements such as economic growth, inflation and exchange rate changes. No firm is entirely immune from these factors. For example, a deceleration in GDP growth or a rise in tax rates is likely to impact on the returns of all firms within an economy.

Note, however, that while all shares respond to these system-wide risk factors they do not all respond equally. Some shares will exhibit a greater sensitivity to these systematic risk elements than others. The revenues of the luxury goods sectors, for example, are particularly sensitive to the vicissitudes of the economy. Spending on electrical goods and sports cars rises when the economy is in a strong growth phase but falls off significantly in recession. On the other hand,

**FIGURE 10.4**  
Systematic and unsystematic risk



some sectors experience limited variations in demand as the economy booms and shrinks; the food producing and food retailing sectors are prime examples here. People do not cut down significantly on food bought for home consumption despite falling incomes.

It is assumed, quite reasonably, that investors do not like risk. If this is the case then the logical course of action is going to be to eliminate as much unsystematic risk as possible by diversifying. Most of the shares in UK companies are held by highly diversified institutional investors. While it is true that many small investors are not fully diversified it is equally true that the market, and more importantly, market returns are dominated by the actions of fully diversified investors. These investors ensure that the market does not reward investors for bearing some unsystematic risk.

To understand this imagine that by some freak accident a share offered a return of say 50 percent per annum which includes compensation for both unsystematic and systematic risk. There would be a mad scramble to buy these shares, especially by the major diversified funds which don't care about the unsystematic risk on this share – they have other share returns to offset the oscillations of this new one. The buying pressure would result in a rise in the share price. This process would continue until the share offered the same return as other shares with that level of systematic risk (the cash flows, e.g. dividends, expected from the company remain constant but the share price rises therefore returns on the purchase price of the share fall).

Let us assume that the price doubles and therefore the return offered falls to 25 percent. The undiversified investor will be dismayed that he can no longer find any share that will compensate for what he perceives as the relevant risk for him, consisting of both unsystematic and systematic elements.

In the financial markets the risk that matters is the degree to which a particular share tends to move when the market as a whole moves. This is the only issue of concern to the investors that are fully diversified because ups and downs due to specific company events do not affect the return on the portfolio – only market-wide events affect the portfolio's return.

This is leading to a new way of measuring risk. For the diversified investor the relevant measure of risk is no longer standard deviation of returns, it is its systematic risk.

## Beta

The capital asset pricing model (CAPM) defined this systematic risk as beta.<sup>4</sup> Beta,  $\beta$ , measures the covariance between the returns on a particular share with the returns on the market as a whole (usually measured by a market index, FTSE All Share index). That is, the beta value for a share indicates the sensitivity of that share to general market movements. A share with a beta of 1.0 tends to have returns that move broadly in line with the market index. A share with a beta greater than 1.0 tends to exhibit amplified return movements compared to

the index. For example, BT has a beta of 1.62 and, according to the CAPM, when the market index return rises by say 10 percent the returns on BT's shares will tend to rise by 16.2 percent. Conversely if the market falls by 10 percent then BT's shares' returns will tend to fall by 16.2 percent.

Shares with a beta of less than 1.0, such as M&S with a beta of 0.50, will vary less than the market as a whole. So, if the market is rising shares in M&S will not enjoy the same level of upswing. However should the market ever suffer a downward movement for every 10 percent decline in shares generally M&S will give a return decline of only 5 percent, it is therefore less risky than a share in BT according to CAPM. (*Note:* These co-movements are to be taken as statistical expectations rather than precise predictions – thus over a large sample of return movements M&S's returns will move by 5 percent for a 10 percent market movement, if beta is a correct measure of company to market returns. On any single occasion the co-movements may not have this relationship.) Table 10.1 displays the betas for some large UK companies.

**TABLE 10.1**  
**Betas as measured in 2003**

Share	Beta	Share	Beta
BOC Group	0.79	Barclays Bank	1.11
BT	1.62	Marks and Spencer	0.50
Sainsburys (J)	0.80	Great Universal Stores	0.97

Source: Datastream

The basic features of beta are:

- When
- $\beta = 1$  A 1% change in the market index return leads to a 1% change in the return on a specific share
  - $0 < \beta < 1$  A 1% change in the market index return leads to a less than 1% change in the returns on a specific share
  - $\beta > 1$  A 1% change in market index return leads to a greater change than 1% on a specific company's share.

### The security market line (SML)

Risk has been defined for a fully diversified investor in an efficient market as systematic risk because this is the risk that cannot be diversified away and so a higher return is required if an investor is to bear it. In the CAPM the relationship between risk as measured by beta and expected return is shown by the *security market line* as in Figure 10.5. Shares perfectly correlated with the market return ( $r_m$ ) will have a beta of 1.0 and are expected to produce an annual return of 10.4 percent in the circumstances of a risk-free rate of return at 6 percent and the

risk-premium on the market portfolio of shares over safe securities at 4.4 percent (we will examine the origin of this number later). Shares that are twice as risky, with a beta of 2, will have an expected return of 14.8 percent (that is the risk-free return of 6 percent plus two times the risk premium on averagely risky shares of 4.4 percent). Shares that vary half as much as the market index are expected to produce a return of 8.2 percent (which is 6 percent plus one-half of 4.4 percent) *in this particular* hypothetical risk-return line.

To find the level of return expected for a given level of beta risk the following equation can be used:

Expected return	=	risk-free rate	+ beta ×	Expected return on the market minus the risk-free rate (the average risk premium for a typical share)
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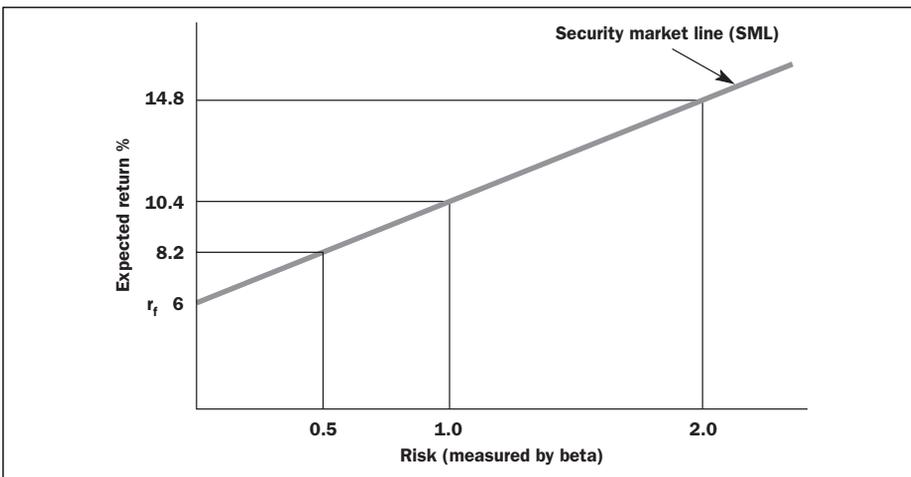
or 
$$k_E = r_f + \beta (r_m - r_f)$$

For a share with a beta of 1.55 when the risk-free return is 6 percent the expected return will be:

$$k_E = 6 + 1.55 (10.4 - 6) = 12.8\%$$

The better way of presenting this is to place the risk premium in the brackets rather than  $r_m$  and  $r_f$  separately because this reminds us that what is important in the risk premium is the required extra return over the risk-free rate as revealed by investors over many years – not the current market returns and risk-

**FIGURE 10.5**  
A hypothetical security market line (SML)



free rate. It is amazing how often financial journalists get this wrong and fixate on recent and current  $r_m$  and  $r_f$  rather than the long-term historical difference between the two. Taking a short period to estimate this would result in wild fluctuations from year to year none of which would reflect the premiums investors demand for holding a risky portfolio of shares compared with a risk-free security.

Thus the better presentation is:

$$k_E = r_f + \beta(RP)$$

$$k_E = 6 + 1.55(4.4) = 12.8\%$$

### Shifting risk-return relationships

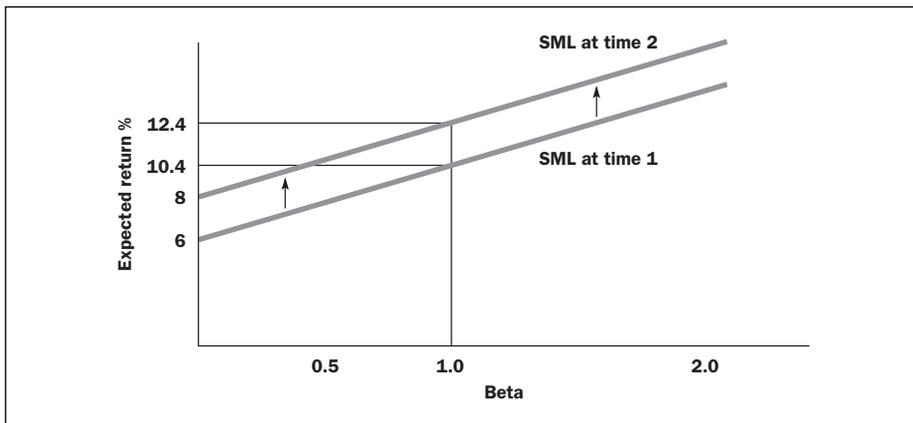
At any one time the position of the SML depends primarily on the risk-free rate of return. If the interest rate on government securities rises by say two percentage points the SML lifts upwards by 2 percent (see Figure 10.6).

### Risk premiums across the world

Table 10.2 shows estimates of the extra annual return received by investors for holding a portfolio of shares compared with government bonds over various time periods. It is clear that the extra return over periods as short as one year can give a distorted picture – we cannot possibly assume that the negative return on shares in 2002 represents the normal ‘additional’ return demand by investors above a risk-free investment. Notice that the risk premium received for holding shares rather than government bonds has generally been in the range of 3 percent to 6 percent for the 16 countries listed. This gives us a strong indication of the likely future risk premium demanded by investors today. Therefore using a risk premium in this range for cost of

**FIGURE 10.6**

**Shifts in the SML – a two percent point rise in the risk-free rate**



equity capital calculation could be defended on these grounds. But note the assumption you would be making: that the returns investors actually received after the event (e.g. over the twentieth century) reflect the return they would have been demanding before the event (e.g. start of the twentieth century) for investing in shares rather than bonds.

## Estimating some expected returns

To calculate the returns investors require from particular shares you need to obtain three numbers using the CAPM: (i) the risk-free rate of return,  $r_f$ , (ii) the

**TABLE 10.2**  
**Equity risk premiums**

	% per annum
<b>UK</b>	
101 years 1900–2000	4.4
51 years 1950–2000	6.8
31 years 1970–2000	3.5
1 year 2002 <sup>1</sup>	–29.2
<b>Other countries</b>	
Australia 101 years 1900–2000	6.3
Belgium 101 years 1900–2000	2.9
Canada 101 years 1900–2000	4.5
Denmark 101 years 1900–2000	2.0
France 101 years 1900–2000	4.9
Germany 99 years 1900–2000 <sup>2</sup>	6.7
Ireland 101 years 1900–2000	3.2
Italy 101 years 1900–2000	5.0
Japan 101 years 1900–2000	6.2
Netherlands 101 years 1900–2000	4.7
South Africa 101 years 1900–2000	5.4
Spain 101 years 1900–2000	2.3
Sweden 101 years 1900–2000	5.2
Switzerland 90 years 1911–2000	2.7
USA 101 years 1900–2000	5.0
World 101 years 1900–2000	4.6

<sup>1</sup> Dimson, Marsh and Staunton, personal communication.

<sup>2</sup> For Germany the years 1922–23 are excluded

Sources: Elroy Dimson, Paul Marsh and Mike Staunton, *Triumph of the Optimists: 101 Years of Global Investment Returns*, Princeton, NJ: Princeton University Press, 2002. The risk premiums presented are relative to government bonds rather than government bills.

risk premium for the market portfolio,  $(r_m - r_f)$ , and (iii) the beta of the share. In 2004 the returns on UK government securities are about 4 to 5 percent. For the purpose of illustration we will take a risk premium of 4.4 percent – the average (post-event) risk premium over 101 years. We have to acknowledge our imprecision at this point (even though some consultants will give a cost of equity capital to a tenth of a percentage point). Looking at the figures in Table 10.2 we could go for a risk premium of, say, 6.9 percent to reflect the fact that shares returned a much higher premium to UK investors in the last 51 years of the twentieth century. On the other hand, we could plump for a much lower figure if we accept the argument that investors were surprised by the size of the premium they actually received; they weren't demanding it *a priori*, it was just that the optimists (share investors) were lucky and got it anyway – see Shiller (2000) and Dimson, Marsh and Staunton (2002) for this view – in future they will get a smaller return above the government bond rate. Table 10.3 calculates the returns required on shares of some leading UK firms using beta as the only risk variable influencing returns.

**TABLE 10.3**  
**Returns expected by investors based on CAPM**

Share	Beta ( $\beta$ )	Expected returns
		$r_f + \beta(r_m - r_f)$
BOC	0.79	$6 + 0.79(4.4) = 9.5$
BT	1.62	$6 + 1.62(4.4) = 13.1$
Sainsburys (J)	0.80	$6 + 0.80(4.4) = 9.5$
GUS	0.97	$6 + 0.97(4.4) = 10.3$
Barclays Bank	1.11	$6 + 1.11(4.4) = 10.9$
Marks and Spencer	0.5	$6 + 0.50(4.4) = 8.2$

### Calculating beta

To make CAPM work for making decisions concerning the future it is necessary to calculate the *future* beta. That is, how more or less volatile a particular share is going to be relative to the market. Investors want extra compensation for relative volatility over the period when they hold the share – i.e. time still to come. Obviously, the future cannot be foreseen, and so it is difficult to obtain an estimate of the likely co-movements of the returns on a share and the market portfolio. One approach is to substitute subjective probability beliefs, but this has obvious drawbacks. The most popular method is to observe the historic relationship between returns and to assume that this co-variance will persist into the future.

Figure 10.7 shows a simplified and idealized version of this sort of analysis. Twelve monthly observations for, say, 2003 are shown (commercially supplied beta calculations are often based on at least 60 monthly observations stretching back over five years). Each plot point in Figure 10.7 expresses the return on the market index portfolio  $r_m$  for a particular month and the return on the specific shares  $r_j$  being examined in that same month.

In such an analysis the market portfolio will be represented by some broad index containing many hundreds of shares. In this highly idealized example the relative returns plot along a straight line referred to as the *characteristic line*. The example shown here is a perfect statistical relationship, there is no statistical ‘noise’ causing the plot points to be placed off the line. The characteristic line has a form described by the following formula

$$r_j = a + \beta_j r_m$$

where:

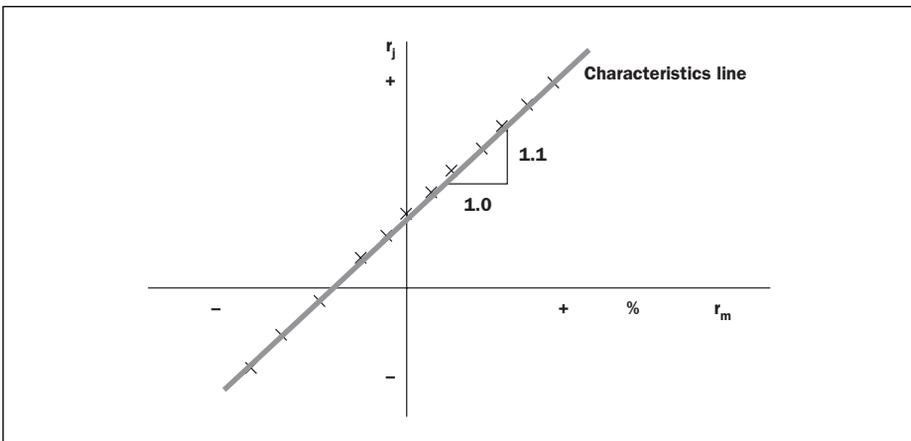
- $r_j$  = rate of return on the  $j$ th share
- $r_m$  = rate of return on the market index portfolio
- $a$  = alpha. The regression line intercept
- $\beta_j$  = the beta of security  $j$ .

The slope of the characteristic line is the beta for share  $j$ . That is:

$$\frac{\text{Change in } r_j}{\text{Change in } r_m} = \beta$$

In this case the slope is 1.1 and therefore  $\beta = 1.1$ .

**FIGURE 10.7**  
**The characteristic line – no unsystematic risk**



A more realistic representation of the relationship between the monthly returns on the market and the returns on a specific share are shown in Figure 10.8. Here very few of the plot points fall on the fitted regression line (the line of best fit). The reason for this scatter of points is because unsystematic risk effects in any one month may cause the returns on a specific share to rise or fall by a larger or smaller amount than it would if the returns on the market were the only influence. The slope of the best fit line is 1.2, therefore beta is 1.2.

### Gordon growth model method for estimating the cost of equity capital

The most influential model for calculating the cost of equity in the early 1960s (and one which is still used today) was created by Gordon and Shapiro (1956), and further developed by Gordon (1962). Suppose a company's shares priced at  $P$  produce earnings of  $E$  per share and pay a dividend of  $d$  per share. The company has a policy of retaining a fraction,  $b$ , of its earnings each year to use for internal investments. If the rate of return (discount or capitalization rate) required on shares of this risk class  $k_E$  then, under certain restrictive conditions, it can be shown that earnings, dividends and reinvestment will all grow continuously, at a rate of  $g = br$ , where  $r$  is the rate of return on the reinvestment of earnings, and we have:

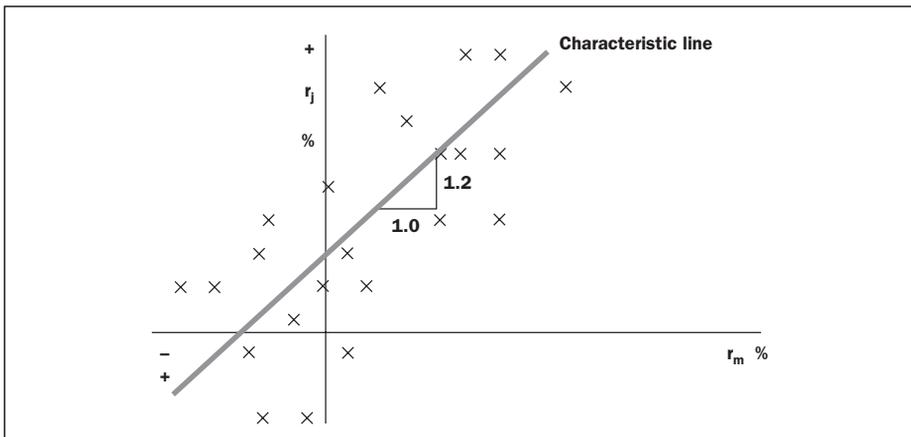
$$P = \frac{d_1}{k_E - g}$$

Solving for  $k_E$  we have:

$$k_E = \frac{d_1}{P} + g$$

where  $d_1$  is the dividend to be received next year.

**FIGURE 10.8**  
The characteristic line – with unsystematic risk



That is, the rate of return investors require on a share is equal to the prospective dividend yield *plus* the rate at which the dividend stream is expected to grow.

Gordon and Shapiro said that there are other approaches to the estimation of future dividends than the extrapolation of the current dividend on the basis of the growth rate explicit in  $b$  and  $r$ , so we can derive  $g$  in other ways and still the  $k_E$  formula remains valid,

A major problem in the practical employment of this model is obtaining a trustworthy estimate of the future growth rate of dividends to an infinite horizon. Gordon and Shapiro (1956) told us to derive this figure from known data in an objective manner, using common sense and with reference to the past rate of growth in a corporation's dividend. In other words, a large dose of judgment is required. The cost of equity capital under this model is very sensitive to the figure put in for  $g$ , and yet there is no reliable method of estimating it for the *future*, all we can do is make reasoned estimates and so the resulting  $k_E$  is based merely on an informed guess. Using past growth rates is one approach, but it means that it is assumed that the future growth of the company's earnings and dividends will be exactly the same as in the past – often an erroneous supposition. Professional analysts' forecasts could be examined, but their record of predicting the future is generally a poor one – especially for more than two years ahead. The rate of growth,  $g$ , is discussed further in Chapter 13, in the context of share valuation.

## The cost of retained earnings

---

The most important source of long-term finance for most corporations is retained earnings. There are many large companies that rarely, if ever, go to their shareholders to raise new money, but rely on previous years' profits. There is a temptation to regard retained earnings as 'costless' because it was not necessary for the management to go out and persuade investors to invest by offering a rate of return.

However, retained earnings should be seen as belonging to the shareholders. They are part of the equity of the firm. Shareholders could make good use of these funds by investing in other firms and obtaining a return. These funds have an opportunity cost. We should regard the cost of retained earnings as equal to the expected returns required by shareholders buying new shares in a firm. There is a slight modification to this principle in practice because new share issues involve costs of issuance and therefore are required to give a marginally higher return to cover the costs of selling the shares.

## The cost of debt capital

---

The cost of debt is generally determined by the following factors:

- the prevailing interest rates

- the risk of default
- the benefit derived from interest being tax deductible.

There are two types of debt capital. The first is debt that is traded, that is, bought and sold in a security market. The second is debt that is not traded.

### Traded debt

In the UK, bonds are normally issued by companies to lenders with a nominal value of £100. Vanilla bonds carry an annual coupon rate until the bonds reach maturity when the nominal or par value of £100 is paid to the lender (see Chapter 16 for more details). The rate of return required by the firm's creditors,  $k_D$ , is represented by the interest rate in the following equation which causes the future discounted cash flows payable to the lenders to equal the current market price of the bond  $P_D$ . We know the current price  $P_D$  of the bond in the market and the annual cash flow that will go to the lenders in the form of interest,  $i$ , and we know the cash to be received,  $R_n$ , when the bond is redeemed at the end of its life. The only number we don't yet have is the rate of return,  $k_D$ . This is found in the same way as the internal rate of return is found. (If IRR is alien to you, re-reading Chapter 2 may be beneficial.)

$$P_D = \sum_{t=1}^n \frac{i}{(1+k_D)^t} + \frac{R_n}{(1+k_D)^n}$$

where:

$i$  = annual nominal interest (coupon payment) receivable from year 1 to year  $n$ ;

$R_n$  = amount payable upon redemption;

$k_D$  = cost of debt capital (pre-tax).

$\sum_{t=1}^n$  means add up the results of all the  $\frac{i}{(1+k_D)^t}$  from next year (year 1) to the  $n$

number of years of the bond's life.

For example, Elm plc issued £100m of bonds six years ago carrying an annual coupon rate of 8 percent. They are due to be redeemed in four years for the nominal value of £100 each. The next coupon is payable in one year and the current market price of a bond is £93. The cost of this redeemable debt can be calculated by obtaining the internal rate of return, imagining that a new identical set of cash flows is being offered to the lenders from a new (four-year) bond being issued today. The lenders would pay £93 for such a bond (in the same risk class) and receive £8 per year for four years plus £100 at the end of the bond's life:

Year	0	1	2	3	4
	+£93	-£8	-£8	-£8	-£108

Thus the rate of return being offered is calculated from:

$$+93 - \frac{8}{1 + k_D} - \frac{8}{(1 + k_D)^2} - \frac{8}{(1 + k_D)^3} - \frac{108}{(1 + k_D)^4} = 0$$

With  $k_D$  at 11 per cent the discounted cash flow = + £2.307.

With  $k_D$  at 10 per cent the discounted cash flow = - £0.66.

Using linear interpretation the IRR can be found:

$$k_D = 10\% + \frac{0.66}{2.307 + 0.66} (11 - 10) = 10.22\%$$

The total market value of the bonds,  $V_D$ , is calculated as follows:

$$V_D = \text{£}100\text{m} \times \frac{\text{£}93}{\text{£}100} = \text{£}93\text{m}$$

We are concerned with finding the cost to a company of the various types of capital it might use to finance its investment projects, strategic plans, etc. It would be wrong to use the coupon rate of 8 percent on the bond. This was the required rate of return six years ago (assuming the bond was sold for £100). A rate of 10.22 percent is appropriate because this is the rate of return bond investors are demanding in the market today. The cost of capital is the best available return elsewhere for the bondholders for the same level of risk. Managers are charged with using the money under their command to produce a return at least equal to the opportunity cost. If the cash flows attributable to these lenders for a project or SBU are discounted at 8 percent then a comparison of the resulting net present value of the investment with the return available by taking the alternative of investing the cash in the capital markets at the same risk is not being made. However, by using 10.22 percent for the bond cost of capital we can compare the alternatives available to the lenders in the financial markets.

### Irredeemable bonds

The rate of return on irredeemable bonds (those that pay interest every year to an indefinite horizon) is easy. They have interest payments which form a perpetuity, therefore:

$$k_D = \frac{i}{P_D}$$

For example, a bond currently trading at £110 offering a £7 annual coupon is giving a rate of return of  $\text{£}7/\text{£}110 = 6.36$  percent.

### Tax effects

As explained earlier in the chapter, a firm is able to offset debt interest against a corporation tax liability. It is the cost of debt after the benefit of the tax shield

that is of interest to firms as this is the effective cost of this form of finance – assuming they have taxable profits which can be reduced by the interest charge.

In the calculation for Elm plc taxation has been ignored and so the above calculation of 10.22 percent should be properly defined as the cost of debt before tax,  $k_{\text{DBT}}$ . An adjustment is necessary to establish the true cost of the bond capital to the firm.

If  $T$  is the rate of corporate tax, 30 percent, then the cost of debt after tax,  $k_{\text{DAT}}$  is:

$$k_{\text{DAT}} = k_{\text{DBT}}(1 - T)$$

$$k_{\text{DAT}} = 10.22(1 - 0.30) = 7.15\%$$

### **A complication to be set aside in an introductory book**

We have calculated the yield to redemption on a very simple bond from first principles, to illustrate the key elements. In reality, most bonds offer coupon payments every six months – this complicates the type of analysis shown above. However, yields to redemption on bonds of different risk classes are available commercially, which avoids effort. The *Financial Times* displays the yields ('bid yield') offered on a range of frequently traded bonds of various risk classes (see 'Global Investment Grade' and 'High Yield and Emerging Market Bonds' tables). A useful website for bond yields is [www.ic-community.co.uk/bonds](http://www.ic-community.co.uk/bonds)

### **Untraded debt**

Most debt capital, such as bank loans, is not traded and repriced regularly on a financial market. We need to find the rate of interest that is the opportunity cost of lenders' funds – the current 'going rate' of interest for the risk class. The easiest way to achieve this is to look at the rate being offered on similar tradable debt securities.

### **Floating-rate debt**

Most companies have variable-rate debt in the form of either bonds or bank loans. Usually the interest payable is set at a margin over a benchmark rate such as bank base rate or LIBOR (see Chapter 15). For practical purposes the current interest payable can be taken as the before-tax rate of return ( $k_{\text{DBT}}$ ) because these rates are the market rates. There is a theoretical argument against this simple approach based on the difference between short- and long-term interest rates. For example, it may be that a firm rolls over a series of short-term loans – in this case the theoretically correct approach is to use the long-term interest rate.

## The cost of preference share capital

---

Preference shares have some characteristics in common with debt capital (e.g. a specified annual payout of higher ranking than ordinary share dividends) and some characteristics in common with equity (dividends may be missed in some circumstances, and the dividend is not tax deductible) – see Chapter 17 for more details. If the holders of preference shares receive a fixed annual dividend and the shares are irredeemable the perpetuity formula may be used to value the security:

$$P_p = \frac{d_1}{k_p}$$

where  $P_p$  is the price of preference shares,  $d_1$  is the annual preference dividend,  $k_p$ , is the investors' required rate of return. Therefore, the cost of this type of preference share is given by:

$$k_p = \frac{d_1}{P_p}$$

## Hybrid securities

---

Hybrid securities can have a wide variety of features – e.g. a convertible bond is a combination of a straight bond offering regular coupons and an option to convert the bond to shares in the company. It is usually necessary to calculate the cost of capital for each of the component elements separately. This can be complex and is beyond the scope of this chapter.

## Calculating the weights

---

Book (accounting) values for debt, equity and hybrid securities should not be used in calculating the weighted average cost of capital. Market values should be used. For example if £100m was raised by selling perpetual bonds (coupons promised without a definite cease date) when interest rates were 5 percent, but these bonds now offer a 10 percent return and, therefore, are selling at half the original value, £50m, then this figure should be used in the weightings. The rationale for using market values is that we need to generate a return for the finance providers on the basis of their current contribution to the capital of the firm and in relation to the current opportunity cost – accounting values have little relevance to this. Investors in bonds right now are facing an opportunity cost of £50m (i.e. they could sell the bonds and release £50m of cash) so this is the figure that managers should see as the amount sacrificed by these finance providers, not the £100m that the bonds once traded at.

With equity capital it is correct to use the market capitalization figure (current share price multiplied by number of shares issued to investors). This is the amount that current investors are sacrificing to invest in this company today – the shares could be sold in the market-place at that value. The balance sheet value for equity shareholders funds is not relevant. It is likely to be very different to the market capitalization. Balance sheets consist of a series of historic accounting entries that bear little relation to the value placed on the shares by investors. Market capitalization figures are available in Monday editions of the *Financial Times* for quoted companies.

## The WACC with three or more types of finance

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The formula becomes longer, but not fundamentally more difficult when there are three (or more) types of finance. For example, if a firm has preference share capital as well as debt and equity the formula becomes:

$$\text{WACC} = k_E W_E + k_{\text{DAT}} W_D + k_p W_p$$

where  $W_p$  is the weight for preference shares.

The weight for each type of capital is proportional to market values – and, of course,  $W_E + W_D + W_p$  totals to 1.0.

## Classic error

---

Managers are sometimes tempted to use the cost of the latest capital raised to discount projects, SBUs etc. This is wrong. Also do not use the cost of the capital you might be about to raise to finance the project.

The latest capital raised by a company might have been equity at, say, 12 percent, or debt at a cost of, say, 8 percent. If the firm is trying to decide whether to go ahead with a project that will produce an IRR of, say, 10.5 percent the project will be rejected if the latest capital-raising exercise was for equity and the discount rate used was 12 percent. On the other hand the project will be accepted if, by chance, the latest funds raised happen to be debt with a cost of 8 percent. The WACC should be used for all projects – at least, for all those of the same risk class as the existing set of projects. The reason is that a firm cannot move too far away from its optimum debt to equity ratio level. If it does its WACC will rise. So, although it may seem attractive for a subsidiary manager to promote a favored project by saying that it can be financed with borrowed funds and therefore it needs only to achieve a rate of return above the interest rate it must be borne in mind that the next capital-raising exercise after that will have to be for equity to maintain an appropriate financial gearing level.

## What about short-term debt?

---

Short-term debt should be included as part of the overall debt of the firm when calculating WACC. The lenders of this money will require a return. However, to the extent that this debt is temporary or is offset by cash and marketable securities held by the firm it may be excluded.

## Applying the WACC to projects and SBUs

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The overall return on the finance provided to a firm is determined by the portfolio of current projects. Likewise the risk (systematic) of the firm is determined by the collection of projects it is currently committed to. If a firm made an additional capital investment that has a much higher degree of risk than the average in the existing set then it is intuitively obvious that a higher return than the normal rate for this company will be required. On the other hand if an extraordinarily low risk activity is contemplated this should require a lower rate of return than usual.

Some multi-divisional firms make the mistake of demanding that all divisions achieve the same rate of return or better. This results in low risk projects being rejected when they should be accepted and high risk projects being accepted when they should be rejected.

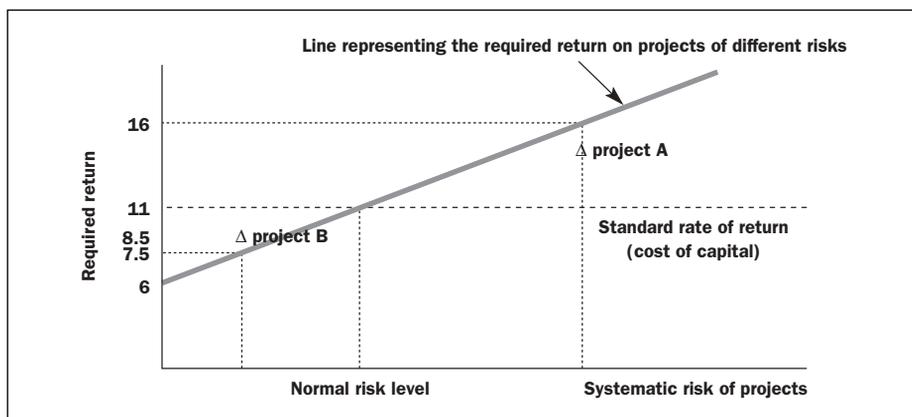
Figure 10.9 is drawn up for an all-equity financed firm, but the principle demonstrated applies to firms financed by a mixture of types of capital. Given the firm's normal risk level the market demands a return of 11 percent. If another project is started with a similar level of risk then it would be reasonable to calculate NPV on the basis of a discount rate of 11 percent. This is the opportunity cost of capital for the shareholders – they could obtain 11 percent by investing their money in shares of other firms in a similar risk class. If however the firm invested in project A with a risk twice the normal level management would be doing their shareholders a disservice if they sought a mere 11 percent rate of return. At this risk level shareholders can get 16 percent on their money elsewhere. This sort of economic decision-making will result in projects being accepted when they should have been rejected. Conversely project B if discounted at the standard rate of 11 percent will be rejected when it should have been accepted. It produces a return of 8.5 percent when all that is required is a return of 7.5 percent for this risk class. It is clear that this firm should accept any project lying on or above the sloping line and reject any project lying below this line.

The rule discussed earlier (that a firm should accept any project that gives a return greater than the opportunity cost of capital) now has to be refined. This rule can only be applied if the marginal project has the same risk level as the existing set of projects. Projects with different risk levels require different levels of return.

Just how high the discount rate has to be is as much a matter for managerial judgment as it is based on the measures of risk and return developed by theo-

FIGURE 10.9

## Rates of return for projects of different systematic risk levels



risks. The CAPM provides a starting point, a framework for thinking about risk premiums, but judging the viability of a project or division is still largely an art which requires experience and perceptive thought, not least because it is very difficult to quantify the likely risk of, say, a SBU developing an internet business. It may be possible to classify projects into broad categories say, high, medium and low, but precise estimation is difficult. What is clear is that the firm should not use a single discount rate for all its activities.

## What do managers actually do?

Academic literature promotes forcefully the use of the WACC. But to what extent have UK firms adopted the recommended methods? In 1983 Richard Pike expressed a poor opinion of the techniques used by businessmen to select the cost of capital: 'the methods commonly applied in setting hurdle rates are a strange mixture of folk-lore, experience, theory and intuition'. In 1976 Westwick and Shohet reported that less than 10 percent of the firms they studied used a WACC. The position has changed significantly over the last two decades. Arnold and Hatzopoulos (2000), in a study of 96 UK firms, found that the majority now calculate a WACC – see Table 10.4.

Despite years of academic expounding on the virtues of WACC and extensive managerial education, a significant minority of firms do not calculate a WACC for use in capital investment appraisal. Furthermore, as Tables 10.5 and 10.6 show, many firms that calculate a WACC do not follow the prescribed methods. Further evidence of a light grasp of textbook procedure was demonstrated in some of the statements made by respondents: 'Above is a minimum [WACC]. A hurdle rate is also used which is the mid-point of the above [WACC] and the lowest rate of return required by venture capitalists.' 'WACC + safety margin'

**TABLE 10.4**

**Replies to the question: How does your company derive the discount rate used in the appraisal of major capital investments? (percentage of respondents)**

Method used	Category of company			
	Small (%)	Medium (%)	Large (%)	Composite (%)
WACC	41	63	61	54
The cost of equity derived from the capital asset pricing model is used	0	8	16	8
Interest payable on debt capital is used	23	8	1	11
An arbitrarily chosen figure	12	4	3	6
Dividend yield on shares plus estimated growth in capital value of share	0	0	3	1
Earnings yield on shares	3	0	0	1
Other	12	8	11	10
Blank	9	8	5	7

Source: Arnold and Hatzopoulos (2000). The 'large' category represents the largest 100 companies in the UK as measured by capital employed. The 'medium-sized' companies are ranked between 250 and 400, and the 'small' firms are ranked 820–1000. The capital employed ranged between £1.3bn and £24bn for the large firms, £207m and £400m for the medium-sized firms and £40m and £60m for the small companies.

'Weighted average cost of capital plus inflation'.

**TABLE 10.5**

**Method of calculating the weighted average cost of capital (percentage of respondents that use WACC)**

Method	Category of company			
	Small (%)	Medium (%)	Large (%)	Composite (%)
Using the CAPM for equity and the market rate of return on debt capital	50	68	79	70
Cost of the equity calculated other than through the CAPM with the cost of debt derived from current market interest rates	50	32	18	29
Other	0	0	3	1

Source: Arnold and Hatzopoulos (2000)

**TABLE 10.6**

**If the weighted average cost of capital is used, then how are the weights defined? (percentage of respondents)**

Method of defining weights	Category of company			
	Small (%)	Medium (%)	Large (%)	Composite (%)
A long-term target debt and equity ratio	19	26	39	30
The present market values of debt and equity	44	47	42	44
Balance sheet ratios of debt and equity	37	26	19	26

Source: Arnold and Hatzopoulos (2000)

Gregory and Rutterford (1999) and Rutterford (2000) carried out a series of in-depth interviews with 18 FTSE-100 company finance directors or heads of corporate finance in 1996. They found that 14 of the companies made use of the capital asset pricing model to estimate the equity cost of capital, five used the dividend yield plus growth method (Gordon's growth model), four used the historic real rate of return on equity and five used more than one method.

### Risk-free rate and betas used

In terms of the risk-free rate most firms (12 out of 14 using the CAPM) used the yield on UK government bonds – they generally chose a bond with a maturity of between seven and 20 years. The remainder used a real (excluding inflation) rate of interest. None used the Treasury bill rate.

Betas were sourced from financial databases, such as that of the London Business School, or from financial advisers – most firms used more than one source. Many interviewees felt that any fine-tuning of the beta estimate would have less impact on the  $k_E$  estimate than would the choice of the equity risk premium.

### Risk premiums used

Two out of the 13 firms which estimated an equity risk premium chose a figure from a mid-1990s Barclays Capital Equity Gilt Study. This was based on a different time period to the study of Dimson, Marsh and Staunton. The Barclays studies published in the mid-1990s tracked returns from 1918 only rather than from January 1900 (the more recent Equity Gilt studies go back to 1900). The figures picked up by companies from these reports, at around 7.5 percent, are much higher than those used earlier in this chapter. The other 11 firms chose a number in a narrow range of 4.5 percent to 6 percent. The firms concerned admitted that

their estimates were a 'gut feel' choice 'that came from our planning manager. He's an MBA and a lot of his MBA work was on the cost of capital. Five percent is a figure he's plucked out of the air based on his experience and knowledge' (Company O: Gregory and Rutterford, 1999, p. 43). Alternatively, managers tended to rely on advice from their bankers that the current equity risk premium was lower than at any time in the past – this had the effect of reducing the WACC estimate by almost two percentage points (compared with using a risk premium of 7.5 percent) in most cases. This intuitive approach has subsequently been borne out by the downward revision of historic risk premiums in empirical studies.

### Cost of debt

All 11 firms that explicitly consider the cost of debt allowed for the corporate tax rate to reduce the effective cost. All the companies used the cost of long-term debt rather than the Treasury (three-month lending) rate advocated in some textbooks. The majority chose to base the cost of debt on the cost of government debt and either take this as the cost of debt or add a credit risk premium. Three companies took the yield on their own outstanding bonds and the remainder chose a long-term bond yield 'based on experience'. 'We do not put in our real cost of debt. There are certain, for example tax driven, vehicles which give us actually quite a low cost of debt . . . So we tend to ignore those. That does build up a nice margin of safety within the target (cost of capital) of course' (Company C: Gregory and Rutterford, 1999, p. 46).

### Debt/equity ratios

Ten out of 15 firms that calculated the WACC used a long-run target debt/equity ratio, five used the actual debt/equity ratio and one used both. For firms using a target ratio, this was taken as 20 percent, 25 percent or 30 percent, and was at least as high as the current actual debt/equity ratio, in some cases substantially higher – one firm with a cash surplus nevertheless chose a ratio of 20 percent.

Ten companies chose to estimate a nominal (including inflation) WACC (average value of 11.67 percent). Five used a real (excluding inflation) WACC (average value of 8.79 percent) and three used both a nominal and a real WACC. Rutterford (2000) comments: 'differences in data inputs for the equity risk premium (from 4 percent to 7.5 percent) and the choice of debt/equity ratio (from 0 percent to 50 percent) meant that the final WACC estimate was a fairly subjective estimate for each firm'.

### Hurdle rates

Corporations seem to make a distinction between WACC and the hurdle rate. Gregory and Rutterford found that the average *base* hurdle rate was 0.93 percent higher than the average WACC. The base hurdle rate is defined as the rate

for standard projects, before any adjustments for divisional differences in operating risk, financial risk or currency risk. Most of the firms had a range of hurdle rates, depending on project or the risk factors.

However, there was no consensus among the firms on how to adjust the differential project risk. Fourteen out of 18 made some adjustment for different levels of risk, with nine of those 14 making some adjustment for country risk or foreign exchange risk as well as for systematic risk. Note however that in 17 out of 18 cases the adjustment was made to the base hurdle rate and not to the more theoretically appropriate WACC. There was a general impression of sophistication in attaining the WACC in the first place, followed by a rule-of-thumb-type approach when making risk adjustments: 'The comment I make in terms of the hurdle rates for investment purposes is that we do it relatively simply in terms of low risk, high risk, country-specific risk' (Company P: Gregory and Rutterford, 1999, p. 53).

Methods range from adding two percentage point increments, to having two possible hurdle rates, say, 15 percent and 20 percent. Fifteen firms had premiums of 0 percent to 8 percent over the base hurdle rate, while three firms added more than ten percentage points for the highest-risk projects.

### **Some way to go yet**

Even when the textbook model is accepted a range of WACCs can be estimated for the same firm: 'for example, altering the choice of target debt/equity ratio or equity risk premium can have an impact of 2 percent or more on the resulting WACC figure. Furthermore, little work has yet been done to extend the complex analysis for the firm's WACC to the divisional level' (Rutterford, 2000, p. 149). This lack of sophistication was confirmed in another study, carried out by Francis and Minchington (2000) that discovered 24 percent of firms (of varied sizes) used a divisional cost of capital that reflects the cost of debt capital only significantly underestimating the cost of capital. Furthermore, 69 percent did not use a different rate for different divisions to reflect levels of risk.

## **Implementation issues**

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### **How large is the equity risk premium?**

To understand the controversy over the equity risk premium we need to appreciate that it can only ever be a subjective estimate. The reason for this is that we are trying to figure out how much additional annual return investors in an averagely risky share require above the risk-free rate today. Investors when deciding this are looking at the future, not the past. Each investor is likely to have a different assessment of the appropriate extra return compared with the risk-free investment. We need to assess the weighted average of investors' attitudes.

Using historical returns to see the size of the premium actually received may be a good starting point, but we must be aware that we are making a leap of faith to then assume that the past equity risk premium is relevant for today's analysis with its future focus. In using historic data we are making at least two implicit assumptions:

- there has been no systematic change in the risk aversion of investors over time,
- the index being used as a benchmark has had an average riskiness that has not altered in a systematic way over time.

### **Differing views**

Some City analysts believe that things have changed so radically in terms of the riskiness of ordinary shares for a fully diversified investor that the risk premium is now very small – some plump for 2 percent while extremists say that over the long run shares are no more risky than gilts, so say that the premium is zero. To justify their beliefs they point to the conquest of inflation, the lengthening of economic cycles, the long bull market (an argument weakened recently) and the increasing supply of risk capital as ageing industrial societies start to save more for retirement.

Even Barclays Capital dramatically revised the equity risk premium from over seven percentage points greater than gilts to around 4 percent. The Competition Commission tends to take a range of between 3.5 and 5 percent. OFWAT (the UK water industry regulator) prefers not to use historic premiums as they 'all significantly overstate the current expectations of actual equity investors'; OFWAT uses a range of between 3 and 4 percent. OFGEM (the UK gas and electricity regulator) states that a range of between 3 and 4.2 percent 'appears appropriate' (based on forward-looking averages of market predictions and average of past trends). Note that in their negotiating stance the regulators are likely to take a range that is as low as possible.<sup>5</sup>

### **An opinion**

In my view, equities have not become as safe as gilts. For equities the last two decades of the twentieth century were a charmed period. If long-term history is a guide shareholders will eventually learn the hard way that one can lose a great deal of money in stock markets. It is possible for returns to be negative for an entire decade or more. Turbulence and volatility will be as present in the twenty-first century as in the last. I believe the prudent investor needs to examine a long period of time, in which rare, but extreme, events have disrupted the financial system (wars, depressions, manias and panics) to gain an impression of the riskiness of shares.

What is clear is that obtaining the risk premium is not as scientific as some would pretend. The range of plausible estimates is wide and the effect of

choosing 2 percent rather than 4.4 percent, or even 7.5 percent can have a significant effect on the acceptance or rejection of capital investment projects within the firm, or the calculation of value performance metrics. One of the respondents to the Arnold and Hatzopoulos survey expressed the frustration of practitioners by pointing out that precision in the WACC method is less important than to have reliable basic data: 'The real issue is one of risk premium on equity. Is it 2% or 8%?!'

## Which risk-free rate?

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The risk-free rate is a completely certain return. For complete certainty two conditions are needed:

- the risk of default is zero,
- when intermediate cash flows are earned on a multi-year investment there is no uncertainty about reinvestment rates.

The return available on a zero coupon government bond<sup>6</sup> which has a time horizon equal to the cash flow (of a project, an SBU, etc.) being analyzed is the closest we are going to get to the theoretically correct risk-free rate of return.

Business projects usually involve cash flows arising at intervals, rather than all at the end of an investment. Theoretically, each of these separate cash flows should be discounted using different risk-free rates. So, for the cash flows arising after one year on a multi-year project, the rate on a one-year zero-coupon government bond should be used as part of the calculation of the cost of capital. The cash flows arising in year five should be discounted on the basis of a cost of capital calculated using the five-year zero-coupon rate and so on. However, this approach is cumbersome, and there is a practical alternative that gives a reasonable approximation to the theoretical optimum. It is considered acceptable to use a long-term government rate on all the cash flows of a project that has a long-term horizon. Furthermore, the return on a government bond with coupons, rather than a zero coupon bond, is generally taken to be acceptable. The rule of thumb seems to be to use the return available on a reputable government security having the same time horizon as the project under consideration – so for a short-term project one should use the discount rate which incorporates the short-term government security rate, for a 20-year project use the 20-year government bond yield-to-maturity.<sup>7</sup>

## How reliable is CAPM's beta?

There are many problems with the use of the CAPM's beta in the cost of equity capital calculation. We will consider two of them here:

### The use of historic betas for future analysis

The mathematics involved in obtaining an historic beta is straightforward enough; however it is not clear whether using weekly data is more appropriate than monthly, or whether the historical data on the returns on the market and the return on a particular share should be recorded over a one-, three-, five- or ten-year period. Each is likely to provide a different estimate of beta. Even if this is resolved the difficulty of using an historic measure for estimating a future relationship is very doubtful. Betas tend to be unstable over time. This was discovered as long ago as the early 1970s. Both Blume and Levy carried out extensive testing and discovered that the beta for a share tends to change significantly from one period to another. If the apparent risk on a share changes then the return that managers are required to obtain fluctuates unreasonably. If the requirement is to compensate investors for the risk class of the share they hold surely we need a measure of risk that is not volatile, otherwise managers will be rejecting projects in one year that they accept in another purely because of the different time period over which beta was measured (and whether weekly or monthly data are used). Table 10.7 gives an impression of the variability of the betas for some UK firms – some have been stable, while others have changed significantly.

**TABLE 10.7**

**Betas as measured for the five years to 1997, 2000 and 2004**

	1997	2000	2004
BOC	0.65	0.585	0.79
Barclays Bank	1.22	1.55	1.11
BT	0.91	0.94	1.62
GUS	0.59	0.39	0.97
Marks and Spencer	0.95	0.44	0.50
J. Sainsbury	0.60	0.19	0.80

Source: Datastream

One potential explanation for the shifting betas is that the risk of the security changes – firms change the way they operate and the markets they serve. A company that was relatively insensitive to general market change two years ago may now be highly responsive – but have the companies in Table 10.7 really changed the nature (riskiness) of their businesses that much over these periods? I doubt it. Alternatively, the explanation may lie in measurement error – large random errors cause problems in producing comparable betas from one period to another. To add to this problem we have a wide variety of market indices (such as FTSE-100, FTSE All Share) to choose from when calculating the historical co-variability of a share with the market (its beta).

### The breakdown in the relationship between beta and return

The fundamental point about the CAPM is that investors demand higher returns on shares that are more volatile relative to the market index. Investors require that a share with a beta of 1.5 should provide a higher return than a share with a beta of 1. When the model was first developed in the 1960s this was nothing more than an assertion based on theorizing. In the 1970s and 1980s tests were performed to see if, in practice, portfolios of shares having shown a high beta produce higher returns in future than portfolios of shares with a low beta. In theory, the returns on share portfolios with different betas would lie along the security market line (SML). So, if you purchased a portfolio made up of shares with a beta of 2.0 (historically these shares have been twice as volatile as the market) you would expect it to produce much higher returns over the next five years than a portfolio made up of shares that have shown a low beta in their historic relationship with market returns, say, a beta of 0.5. If beta is the only risk that investors care about (the nub of the CAPM) then this is the only factor for raising the equity cost of capital. If the historical evidence shows that investors have not received this extra return then one has to doubt whether beta risk is the only form of risk that investors require compensation for. And, if they don't require compensation for taking on this extra risk why should managers try to achieve higher returns for higher beta activities? So, are investors really bothered about beta risk?

The results of early studies generally showed a positive relationship between beta and subsequent returns. Investors got a higher return for bearing beta risk – it seems reasonable to presume that this is because they *demand*ed this premium. This demand was transmitted via the buying and selling of shares on the stock market. By influencing share prices investors influence returns – for shares with the same level of projected cash flows the high beta ones are bid down because investors are more reluctant to hold them.

However, the evidence of the early studies was not perfectly in support of the CAPM. The extent to which returns rose with beta was significantly less than the theoreticians expected. Low-risk shares tended to show rates of return higher than the theory would suggest, and high beta shares show lower returns than the CAPM predicts.

The debate moved in the late 1980s and 1990s to whether the CAPM and beta were any use at all. The question 'Is beta dead?' has caused heated debate in the academic world just at the time, ironically, of its greatest adoption by practitioners. Fischer Black (1993) discovered that while returns on US shares did vary in relation to beta in the period 1931–91, there appeared to be no relationship at all in the period 1966–91. His Portfolio 1 (consisting of those shares with the top 10 percent of betas, average beta of 1.50) showed the same return as portfolio 10 (average beta of 0.51).

The publication of Eugene Fama and Kenneth French's (1992) empirical study of US share returns over the period 1963–90 was a further blow to the

CAPM. They found ‘no reliable relation between  $\beta$  and average return’.<sup>8</sup> They continue: ‘The Sharpe-Lintner-Black model [CAPM] has long shaped the way academics and practitioners think about average return and risk ... In short, our tests do not support the most basic prediction of the SLB model, that average stock returns are positively related to market  $\beta$ s ... Our bottom-line results are: (a)  $\beta$  does not seem to help explain the cross-section of average stock returns, and (b) the combination of size and book-to-market equity [do].’ In other words, beta has not been able to explain returns whereas two other factors have. A firm’s total market value has had some effect on returns – the larger the firm the lower the return. Also the ratio of the firm’s book (balance sheet) value to its market value (total value of all shares issued) has had some explanatory power – if book value is high *vis-à-vis* market value then returns tend to be higher. This particular onslaught on CAPM has caused great consternation and reaction in the academic world.

Louis Chan and Josef Lakonishok (1993) breathed a little life into the now dying beta. They looked at share returns over the period 1926–91 and found a faint pulse of a relationship between beta and returns but were unable to show statistical significance because of the ‘noisy’ data. More vibrant life can be witnessed if the share return data after 1982 is excluded – but, then, shouldn’t it work in all periods? They also argued that beta may be a more valid determinant of return in extreme market circumstances, such as a stock market crash and therefore should not be written off as being totally ‘dead’.

Beta has been brought to its knees by the punches delivered by American researchers, it was kicked again while it was down by the damaging evidence drawn from the European share markets. For example Albert Corhay and co-researchers Gabriel Hawawini and Pierre Michel (1987) found that investors in stocks (shares) trading in the USA, the UK and Belgium were not compensated with higher average returns for bearing higher levels of risk (as measured by beta) over the 13-year sample period. Investors in stocks trading on the Paris Stock Exchange were actually penalized rather than rewarded – they received below average rates of return for holding stocks with above-average levels of risk. Strong and Xu (1997) show that for UK shares during the period 1973–92 displayed a *negative* relationship between average returns and beta!

It is plain that even if the CAPM is not dead, it has been severely wounded. Beta may or may not have some explanatory power for returns. That debate will rage for many years yet. What we can conclude from the evidence presented is that there appears to be more to risk than beta.

## Fundamental beta

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Instead of using historical betas calculated through a regression of the firm’s returns against a proxy for the market portfolio (eg. FTSE 100) some analysts calculate a ‘fundamental beta’. This is based on the intuitive underpinning of the

risk-return relationship: if the firm (or project) cash flows are subject to more (systematic) variability then the required return should be higher. What causes greater systematic variability? Three factors have been advanced:

- **The type of business that the company (SBU or project) is engaged in** Some businesses are more sensitive to market conditions than others. The turnover and profits of cyclical industries change a great deal with macro-economic fluctuations. So, for example, the sale of yachts, cars or designer clothes rises in a boom and crashes in decline. On the other hand, non-cyclical industries, such as food retailing or tobacco, experience less variability with the economic cycle. Thus, in a fundamental beta framework cyclical businesses would be allocated a higher beta than non-cyclical businesses. If the purchase of the product can be delayed for months, years or even indefinitely (i.e. it is discretionary) then it is more likely to be vulnerable to an economic downturn.
- **Degree of operating gearing** If the firm has high fixed costs compared with variable costs of production its profits are highly sensitive to output levels. A small percentage fall in output and revenue can result in a large percentage change in profits. The higher variability in profit means that a higher beta should be allocated.
- **Degree of financial gearing** If the company has high borrowings, with a concomitant requirement to pay interest regularly, then profits attributable to shareholders are likely to be more vulnerable to shocks. So the beta will rise if the company has higher financial gearing (or leverage). The obligation to meet interest payments increases the variability of after-interest profits. In a recession profits can more easily turn into losses. Financial gearing exacerbates the underlying business risk.

The obvious problem with using the fundamental beta approach is the difficulty of deriving the exact extent to which beta should be adjusted up or down depending on the strength of the three factors.

## Some thoughts on the cost of capital

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### Progress

There have been a number of significant advances in theory and in practice over the last 40 years. No longer do most firms simply use the current interest rate, or adjust for risk in an entirely arbitrary manner. There is now a theoretical base to build on, both to determine a cost of capital for a firm, and to understand the limitations (or qualities) of the input data and modeling.

It is generally accepted that a weighted average of the costs of all the sources of finance is to be used. It is also accepted that the weights are to be based on market values (rather than book values), as market values relate more closely to

the opportunity cost of the finance providers. Furthermore, it is possible that the WACC may be lowered and shareholder value raised by shifting the debt/equity ratio.

Even before the development of modern finance it was obvious that projects (or collections of projects, as firms are) that had a risk higher than that of investing in government securities require a higher rate of return. A risk premium must be added to the risk-free rate to determine the required return. However, modern portfolio theory (MPT) has refined the definition of risk, so the analyst need only consider compensation (additional return) for systematic risk.

### **Outstanding issues**

Despite the progress, considerable difficulties remain. Practitioners need to be aware of both the triumphs of modern financial theory as well as its gaps. The area of greatest controversy is the calculation of the cost of equity capital. In determining the cost of equity capital we start with the following facts.

- The current risk-free rate is the bedrock. It is acceptable to use the rate on a government bond with the same maturity as the project, SBU, etc.
- The return should be increased to allow for the risk of a share with average systematic risk. (Add a risk premium to the risk-free rate return.) As a guide, investors have received a risk premium of around 4 to 5 percent for accepting the risk level equivalent to that on the average ordinary share over the past 100 years.
- A particular company's shares do not carry average equity risk, therefore the risk premium should be increased or decreased depending on the company's systematic risk level.

So, if the project or SBU under examination has a systematic risk which is lower than that on the average share it would seem sensible that the returns attributable to shareholders on this project should be somewhere between the risk-free rate and the risk-free rate plus, say, 4.4 percent. If the project has a systematic risk greater than that exhibited by shares generally then the returns required for shareholders will be more than the risk-free rate plus, say, 4.4 percent.

The main difficulty is in calculating the systematic risk level. In the heyday of the CAPM this was simple: beta was all you needed. Today we have to allow for the possibility that investors want compensation for a multiplicity of systematic risk factors. Not unnaturally many business people are unwilling to adopt such a burdensome approach and fall back on their 'judgment' to adjust for the risk of a project. In practice it is extremely difficult to state precisely the riskiness of a project – we are dealing with future uncertainties about cash flows from day-to-day business operations subject to sudden and unforeseen shocks. The pragmatic approach is to avoid precision and simply place each proposed project into one of three risk categories: low, medium or high. This neatly bypasses the

complexities laid out by the theorists and also accurately reflects the fact that decisions made in the real world are made with less than complete knowledge. Mechanical decision-making within the firm based on over-simplistic academic models is often a poor substitute for judgment that recognizes the imperfections of reality.

One thing is certain: if anyone ever tells you that they can unequivocally state a firm's cost of capital to within a tenth of a percentage point, you know you are talking to someone who has not quite grasped the complexity of the issue.

## Conclusion

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A firm that asks an unreasonably high rate of return will be denying its shareholders wealth-enhancing opportunities and ceding valuable markets to competitors. One that employs an irrationally low cost of capital will be wasting resources, setting managers targets that are unduly easy to reach and destroying wealth.

This chapter has described the academic foundations (much of it Nobel prize winning) for calculating a company's cost of capital. It has also pointed out the practical difficulties of calculating real world discount rates. The difficulties are severe, but please don't throw your hands up and conclude that the economists and finance theorist have taken us on a long arduous road back to where we started. We are not at square one. We have a set of rules to provide a key management number. We now know that judgment is required at many stages in the process and where those particular points are. This allows us to view any number produced by our own calculations or those of the finance team, with the required amount of reasoned skepticism. And, when making decisions on whether to invest in that new factory or close down a division we have some grasp of the degree to which there is room for error in the value calculation. This part of the book reinforces that in this uncertain world we should think in terms of a range of possible outcomes, with all too imprecise subjective probabilities, not in terms of cut-and-dried pin-point precision. The arguments in this chapter should, I hope, allow you to estimate the boundaries for the range values you feel comfortable with. Returns falling below the acceptable range can be easily rejected, those with a good margin above are simple decisions. Management at these extremes is survivable even for the humdrum executive. Those projects that give returns lying in the middle require insightful judgment: that is the art of management and call for the leaders.

## Notes

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- 1 Quoted in Philip Coggan and Paul Cheeseright, *Financial Times*, 8 November 1994.
- 2 Modigliani and Miller did not ignore tax and financial distress in their work, but did down play them in the formulation of their early model.

- 3 This is assuming that future inflation is included in the projected cash flows. That is, we are using nominal cash flows and a nominal interest rate. An alternative method is to use real cash flows and a real discount rate (i.e. with inflation removed).
- 4 Other models of risk and return define systematic in other ways.
- 5 An excellent discussion of the calculation of the cost of capital by regulators is to be found in Lockett, M. (2001) Calculating the cost of capital for the regulated electricity distribution companies, Aston University MBA Project Dissertation and in a later paper: Lockett, M. (2002), Calculating the cost of capital for the regulated electricity distribution companies. *Power Engineering Journal*, October, pp. 251–63.
- 6 A zero-coupon bond is one that promises the owner a capital sum at the end of its life, say ten years down the line, but does not offer any income between now and then. These sell for much less than the amount promised at the end. So a ‘zero’ with ten years to run offering £100 on redemption might currently be selling for £40. As a holder you have no income, but you do receive a large capital gain.
- 7 Lockett (2002) describes the increasing popular approach of using the rate of return offered on a UK government index-linked gilt in a WACC calculation that is based on real rates of return and real cash flows. That is, with inflation removed from both. This would appear to be a method used by regulators such as OFGEM, OFWAT and the Competition Commission. This generally provides a figure of around 2.25–3.0 percent as the required return in the absence of inflation or risk. If you are conducting an analysis with actual projected cash flows (i.e. with inflation built into the assumptions) then you need to add an estimated inflation rate, which will take you back (approximately) to the rate on the conventional government bond of the same time to maturity.
- 8 There is some controversy over their interpretation of the data, but nevertheless this is a very serious challenge to the CAPM.