PART F

Cost of capital

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The cost of capital

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1 The cost of capital	F1 (a), (b)
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Introduction

In this chapter we examine the concept of the **cost of capital**, which can be used as a **discount rate** in evaluating the investments of an organisation.

We firstly base **cost of equity** calculations on the **dividend valuation model.** We then look at a way of establishing the cost of equity that takes risk into account: the **capital asset pricing model.**

We then calculate the cost of capital for a range of debt instruments and then estimate the **cost of capital.**

Study guide

		Intellectual level
F1	**Sources of finance and their relative costs**	
(a)	Describe the relative risk-return relationship and describe costs of equity and debt.	2
(b)	Describe the creditor hierarchy and its connection with the relative costs of sources of finance.	2
F2	**Estimating the cost of equity**	
(a)	Apply the dividend growth model and discuss its weaknesses.	2
(b)	Describe and explain the assumptions and components of the capital asset pricing model (CAPM).	2
(c)	Explain and discuss the advantages and disadvantages of the CAPM.	2
F3	**Estimating the cost of debt and other capital instruments**	
	Calculate the cost of capital of a range of capital instruments, including:	2
(a)	Irredeemable debt	
(b)	Redeemable debt	
(c)	Convertible debt	
(d)	Preference shares	
(e)	Bank debt	
F4	**Estimating the overall cost of capital**	
(a)	Distinguish between average and marginal cost of capital.	2
(b)	Calculate the weighted average cost of capital (WACC) using book value and market value weightings.	2

Exam guide

In the exam you may be asked to calculate the **weighted average cost of capital** and its component costs, either as a separate sub-question, or as part of a larger question, most likely an investment appraisal. Remember that questions won't just involve calculations; you may be asked to discuss the problems with the methods of calculation you've used or the relevance of the costs of capital to investment decisions.

1 The cost of capital 6/08

FAST FORWARD

The **cost of capital** is the rate of return that the enterprise must pay to satisfy the providers of funds, and it reflects the riskiness of providing funds.

1.1 Aspects of the cost of capital

The cost of capital has two aspects to it.

(a) The **cost of funds** that a company raises and uses, and the return that investors expect to be paid for putting funds into the company.

(b) It is therefore the **minimum return** that a company should make on its own investments, to earn the cash flows out of which investors can be paid their return.

The cost of capital can therefore be measured by studying the returns required by investors, and then used to derive a discount rate for DCF analysis and investment appraisal.

1.2 The cost of capital as an opportunity cost of finance

The cost of capital is an **opportunity cost of finance**, because it is the minimum return that investors require. If they do not get this return, they will transfer some or all of their investment somewhere else. Here are two examples.

(a) If a bank offers to lend money to a company, the interest rate it charges is the **yield** that the bank wants to receive from investing in the company, because it can get just as good a return from lending the money to someone else. In other words, the interest rate is the opportunity cost of lending for the bank.

(b) When shareholders invest in a company, the returns that they can expect must be sufficient to persuade them not to sell some or all of their shares and invest the money somewhere else. The yield on the shares is therefore the **opportunity cost** to the **shareholders of not investing somewhere else**.

1.3 The cost of capital and risk

The cost of capital has three elements.

Risk free rate of return +
Premium for business risk +
Premium for financial risk
COST OF CAPITAL

(a) **Risk-free rate of return**

This is the return which would be required from an investment if it were completely free from risk. Typically, a risk-free yield would be the **yield on government securities**.

(b) **Premium for business risk**

This is an increase in the required rate of return due to the existence of **uncertainty about** the future and about a **firm's business prospects**. The actual returns from an investment may not be as high as they are expected to be. Business risk will be higher for some firms than for others, and some types of project undertaken by a firm may be more risky than other types of project that it undertakes.

(c) **Premium for financial risk**

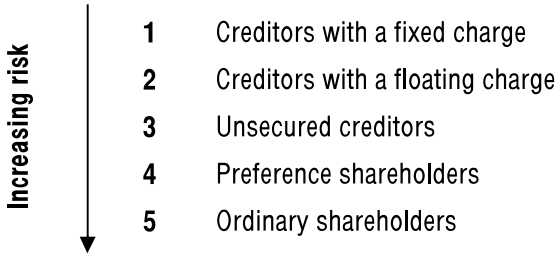
This relates to the danger of high debt levels (high gearing). The higher the gearing of a company's capital structure, the greater will be the financial risk to ordinary shareholders, and this should be reflected in a higher risk premium and therefore a higher cost of capital.

Because different companies are in different types of business (varying business risk) and have different capital structures (varying financial risk) the cost of capital applied to one company may differ radically from the cost of capital of another.

1.4 The relative costs of sources of finance

The cost of debt is likely to be **lower** than the cost of equity, because debt is **less risky** from the debtholders' viewpoint. In the event of liquidation, the **creditor hierarchy** dictates the priority of claims and debt finance is paid off before equity. This makes debt a safer investment than equity and hence debt investors demand a lower rate of return than equity investors. Debt interest is also corporation **tax deductible** (unlike equity dividends) making it even cheaper to a tax paying company. Arrangement costs are usually lower on debt finance than equity finance and once again, unlike equity arrangement costs, they are also tax deductible.

1.5 The creditor hierarchy



This means that the **cheapest type of finance is debt** (especially if secured) and the **most expensive type of finance is equity** (ordinary shares).

2 The dividend growth model 6/08

FAST FORWARD

The **dividend growth model** can be used to estimate a cost of equity, on the assumption that the market value of share is directly related to the expected future dividends from the shares.

2.1 The cost of ordinary share capital

New funds from equity shareholders are obtained either from **new issues of shares** or from **retained earnings**. Both of these sources of funds have a cost.

(a) Shareholders will **not** be prepared to **provide funds** for a **new issue** of **shares** unless the return on their investment is sufficiently attractive.

(b) Retained earnings also have a cost. This is an **opportunity cost**, the dividend forgone by shareholders.

2.2 The dividend valuation model

If we begin by ignoring share issue costs, the cost of equity, both for new issues and retained earnings, could be estimated by means of a **dividend valuation model**, on the assumption that the market value of shares is directly related to expected future dividends on the shares.

If the future dividend per share is expected to be **constant** in amount, then the **ex dividend** share price will be calculated by the formula:

$$P_0 = \frac{d}{(1+k_e)} + \frac{d}{(1+k_e)^2} + \frac{d}{(1+k_e)^3} + ... = \frac{d}{k_e}, \text{ so } k_e = \frac{d}{P_0}$$

Where k_e is the cost of equity capital

d is the annual dividend per share, starting at year 1 and then continuing annually in perpetuity.

P_0 is the ex-dividend share price (the price of a share where the share's new owner is **not** entitled to the dividend that is soon to be paid).

We shall look at the dividend valuation model again in Chapter 18, in the context of valuation of shares.

2.3 Example: Dividend valuation model

Cygnus has a dividend cover ratio of 4.0 times and expects zero growth in dividends. The company has one million $1 ordinary shares in issue and the market capitalisation (value) of the company is $50 million. After-tax profits for next year are expected to be $20 million.

What is the cost of equity capital?

Solution

Total dividends = 20 million/4 = $5 million.

k_e = 5/50 = 10%.

2.4 The dividend growth model

Shareholders will normally expect dividends to increase year by year and not to remain constant in perpetuity. The **fundamental theory of share values** states that the market price of a share is the present value of the discounted future cash flows of revenues from the share, so the market value given an expected constant annual growth in dividends would be:

$$P_0 = \frac{d_0(1+g)}{(1+k_e)} + \frac{d_0(1+g)^2}{(1+k_e)^2} + ...$$

where P_0 is the current market price (ex div)
d_0 is the current net dividend
k_e is the cost of equity capital
g is the expected annual growth in dividend payments

and both k_e and g are expressed as proportions.

It is often convenient to assume a constant expected dividend growth rate in perpetuity. The formula above then simplifies to:

$$P_0 = \frac{d_0(1+g)}{(k_e - g)} = \frac{d_1}{(k_e - g)}$$

Re-arranging this, we get a formula for the ordinary shareholders' cost of capital.

Exam Formula

Cost of ordinary (equity) share capital, having a current ex div price, P_0, having just paid a dividend, d_0, with the dividend growing in perpetuity by a constant g% per annum:

$$k_e = \frac{d_0(1+g)}{P_0} + g \text{ or } k_e = \frac{d_1}{P_0} + g$$

Question

Cost of equity

A share has a current market value of 96c, and the last dividend was 12c. If the expected annual growth rate of dividends is 4%, calculate the cost of equity capital.

Answer

$$\text{Cost of capital} = \frac{12(1 + 0.04)}{96} + 0.04$$

$$= 0.13 + 0.04$$

$$= 0.17$$

$$= 17\%$$

2.4.1 Estimating the growth rate

There are two methods for estimating the growth rate that you need to be familiar with.

Firstly, the future growth rate can be predicted from an **analysis of the growth in dividends** over the past few years.

Year	*Dividends*	*Earnings*
	$	$
20X1	150,000	400,000
20X2	192,000	510,000
20X3	206,000	550,000
20X4	245,000	650,000
20X5	262,350	700,000

Dividends have risen from $150,000 in 20X1 to $262,350 in 20X5. The increase represents four years growth. (Check that you can see that there are four years growth, and not five years growth, in the table.) The average growth rate, g, may be calculated as follows.

$$\text{Dividend in 20X1} \times (1+g)^4 = \text{Dividend in 20X5}$$

$$(1+g)^4 = \frac{\text{Dividend in 20X5}}{\text{Dividend in 20X1}}$$

$$= \frac{\$262,350}{\$150,000}$$

$$= 1.749$$

$$1+g = \sqrt[4]{1.749} = 1.15$$

$$g = 0.15, \text{ ie } 15\%$$

The growth rate over the last four years is assumed to be expected by shareholders into the indefinite future. If the company is financed entirely by equity and there are 1,000,000 shares in issue, each with a market value of $3.35 ex div, the cost of equity, K_e, is:

$$\frac{d_0(1+g)}{P_0} + g = \frac{0.26235(1.15)}{3.35} + 0.15 = 0.24, \text{ ie } 24\%$$

Alternatively the growth rate can be estimated using **Gordon's growth approximation.** The **rate of growth in dividends** is sometimes expressed, theoretically, as:

Exam formula

$g = br$

where g is the annual growth rate in dividends
b is the proportion of profits that are retained
r is the rate of return on new investments

So, if a company retains 65% of its earnings for capital investment projects it has identified and these projects are expected to have an average return of 8%:

$g = br = 65\% \times 8 = 5.2\%$

2.5 Weaknesses of the dividend growth model 6/08

(a) The model does not incorporate risk.

(b) Dividend do not grow smoothly in reality so g is only an approximation.

(c) The model fails to take capital gains into account, however it is argued that a change of share ownership does not affect the present value of the dividend stream.

(d) No allowance is made for the effects of taxation although the model can be modified to incorporate tax.

(e) It assumes there are no issue costs for new shares.

3 The capital asset pricing model (CAPM) 6/08

FAST FORWARD

The **capital asset pricing model** can be used to calculate a cost of equity and incorporates **risk.**
The CAPM is based on a comparison of the **systematic risk** of **individual investments** with the **risks of all shares** in the **market**.

3.1 Systematic risk and unsystematic risk

FAST FORWARD

The **risk** involved in holding securities (shares) divides into **risk specific** to the company (unsystematic) and risk due to **variations** in **market activity** (systematic).

Unsystematic or business risk can be diversified away, while **systematic or market risk** cannot. Investors may mix a diversified market portfolio with risk-free assets to achieve a preferred mix of risk and return.

Whenever an investor invests in some shares, or a company invests in a new project, there will be some risk involved. The actual return on the investment might be better or worse than that hoped for. To some extent, risk is unavoidable (unless the investor settles for risk-free securities such as gilts).

Provided that the investor **diversifies** his investments in a suitably wide portfolio, the investments which perform well and those which perform badly should tend to cancel each other out, and much risk can be diversified away. In the same way, a company which invests in a number of projects will find that some do well and some do badly, but taking the whole portfolio of investments, average returns should turn out much as expected.

Risks that can be diversified away are referred to as **unsystematic risk**. But there is another sort of risk too. Some investments are by their very nature more risky than others. This has nothing to do with chance variations up or down in actual returns compared with what an investor should expect. This **inherent risk** – the **systematic risk** or **market risk** – cannot be diversified away.

Key terms

Market or **systematic risk** is risk that cannot be diversified away. **Non-systematic** or **unsystematic risk** applies to a single investment or class of investments, and can be reduced or eliminated by diversification.

In return for accepting systematic risk, a **risk-averse investor** will expect to **earn a return** which is **higher** than the return on a risk-free investment.

The amount of systematic risk in an investment varies between different types of investment.

Exam focus point

Common errors on this topic in exams include:

- Assuming risk-averse investors wish to eliminate risk. Risk-averse investors are prepared to accept risk, in exchange for higher returns
- Failing to link the risks of an investment with its returns
- Mixing up systematic and unsystematic risk

3.2 Systematic risk and unsystematic risk: implications for investments

The implications of systematic risk and unsystematic risk are as follows.

(a) If an investor wants to **avoid risk** altogether, he must **invest entirely** in **risk-free securities**.

(b) If an investor **holds shares in just a few companies**, there will be **some unsystematic risk** as well as systematic risk in his portfolio, because he will not have spread his risk enough to diversify away the unsystematic risk. To eliminate unsystematic risk, he must build up a well diversified portfolio of investments.

(c) If an investor holds a **balanced portfolio** of all the stocks and shares on the stock market, he will incur systematic risk which is exactly equal to the average systematic risk in the stock market as a whole.

(d) **Shares in individual companies** will have **different systematic risk characteristics** to this market average. Some shares will be less risky and some will be more risky than the stock market average. Similarly, some investments will be more risky and some will be less risky than a company's 'average' investments.

3.3 Systematic risk and the CAPM

FAST FORWARD

The **beta factor** measures a share's volatility in terms of market risk.

The capital asset pricing model is mainly concerned with how systematic risk is measured, and how systematic risk affects required returns and share prices. **Systematic risk** is measured using **beta factors**.

Key term

Beta factor is the measure of the systematic risk of a security relative to the market portfolio. If a share price were to rise or fall at double the market rate, it would have a beta factor of 2.0. Conversely, if the share price moved at half the market rate, the beta factor would be 0.5.

CAPM theory includes the following propositions.

(a) Investors in shares require a **return** in **excess of the risk-free rate**, to compensate them for systematic risk.

(b) Investors should **not require** a **premium** for **unsystematic risk**, because this can be diversified away by holding a wide portfolio of investments.

(c) Because systematic risk varies between companies, investors will require a **higher return** from shares in those companies where the systematic risk is bigger.

The same propositions can be applied to capital investments by companies.

(a) Companies will want a **return on a project** to **exceed** the **risk-free rate**, to compensate them for systematic risk.

(b) **Unsystematic risk** can be **diversified away**, and so a premium for unsystematic risk should not be required.

(c) Companies should want a **bigger return** on projects where **systematic risk is greater**.

3.4 Market risk and returns

Market risk (systematic risk) is the average risk of the market as a whole. Taking all the shares on a stock market together, the total expected returns from the market will vary because of systematic risk. The market as a whole might do well or it might do badly.

3.5 Risk and returns from an individual security

In the same way, an individual security may offer prospects of a return of x%, but with some risk (business risk and financial risk) attached. The return (the x%) that investors will require from the individual security will be higher or lower than the market return, depending on whether the security's systematic risk is greater or less than the market average. A major **assumption in CAPM** is that there is a linear relationship between the return obtained from an individual security and the average return from all securities in the market.

3.6 Example: CAPM (1)

The following information is available about the performance of an individual company's shares and the stock market as a whole.

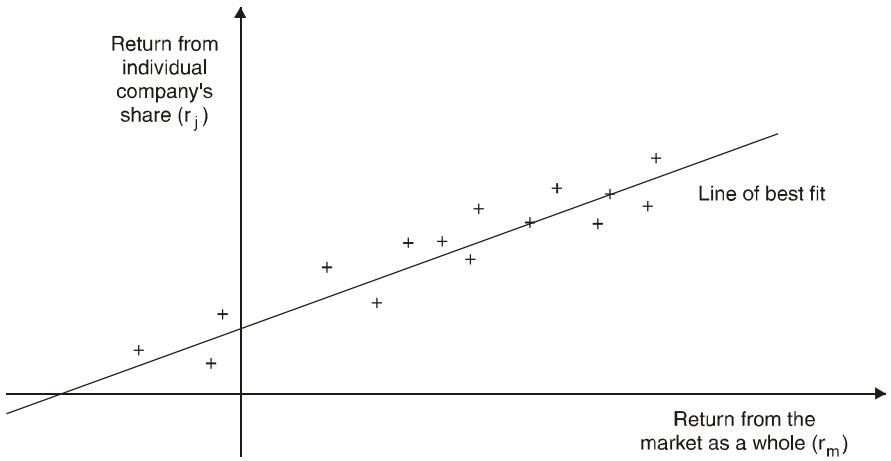
	Individual company	*Stock market as a whole*
Price at start of period	105.0	480.0
Price at end of period	110.0	490.0
Dividend during period	7.6	39.2

The expected return on the company's shares R_i and the expected return on the 'market portfolio' of shares $E(r_m)$ may be calculated as:

$$\frac{\text{Capital gain (or loss)} + \text{dividend}}{\text{Price at start of period}} = \frac{P_1 - P_0 + D_1}{P_0}$$

$$R_i = \frac{(110-105)+7.6}{105} = 12\% \qquad E(r_m) = \frac{(490-480)+39.2}{480} = 10.25\%$$

A statistical analysis of 'historic' returns from a security and from the 'average' market may suggest that a linear relationship can be assumed to exist between them. A series of comparative figures could be prepared of the return from a company's shares and the average return of the market as a whole. The results could be drawn on a scattergraph and a 'line of best fit' drawn (using linear regression techniques) as shown below.



This analysis would show three things.

(a) The **return from** the **security** and the **return from** the **market** as a whole **will tend to rise or fall together**.

(b) The **return from the security** may be **higher or lower** than the **market return**. This is because the systematic risk of the individual security differs from that of the market as a whole.

(c) The scattergraph may **not give a good line of best fit**, unless a large number of data items are plotted, because actual returns are affected by unsystematic risk as well as by systematic risk.

Note that returns can be negative. A share price fall represents a capital loss, which is a negative return.

The conclusion from this analysis is that individual securities will be either more or less risky than the market average in a fairly **predictable** way. The measure of this relationship between market returns and an individual security's returns, reflecting differences in systematic risk characteristics, can be developed into a beta factor for the individual security.

3.7 The equity risk premium

Key term

Market risk premium or **equity risk premium** is the difference between the expected rate of return on a market portfolio and the risk-free rate of return over the same period.

The equity risk premium ($E(r_m - R_f)$) represents the excess of market returns over those associated with investing in risk-free assets.

The CAPM makes use of the principle that **returns on shares** in the **market** as a whole are expected to be higher than the returns on risk-free investments. The difference between market returns and risk-free returns is called an **excess return**. For example, if the return on British Government stocks is 9% and market returns are 13%, the **excess** return on the market's shares as a whole is 4%.

The difference between the risk-free return and the expected return on an individual security can be measured as the **excess return for the market as a whole multiplied** by **the security's beta factor**.

3.8 The CAPM formula 6/08, 12/08

The capital asset pricing model is a statement of the principles explained above. It can be stated as follows.

Exam Formula

$E(r_i) = R_f + \beta_i(E(r_m) - R_f)$

where $E(r_i)$ is the cost of equity capital
R_f is the risk-free rate of return
$E(r_m)$ is the return from the market as a whole
β_i is the beta factor of the individual security

3.9 Example: CAPM (1)

Shares in Louie and Dewie have a beta of 0.9. The expected returns to the market are 10% and the risk-free rate of return is 4%. What is the cost of equity capital for Louie and Dewie?

Solution

$E(r_i) = R_f + \beta_i(E(r_m) - R_f)$

$= 4 + 0.9\ (10 - 4)$

$= 9.4\%$

3.10 Example: CAPM (2)

Investors have an expected rate of return of 8% from ordinary shares in Algol, which have a beta of 1.2. The expected returns to the market are 7%.

What will be the expected rate of return from ordinary shares in Rigel, which have a beta of 1.8?

Solution

Algol: $E(r_i) = R_f + \beta_i(E(r_m) - R_f)$

$8 = R_f + 1.2(7 - R_f)$

$8 = R_f + 8.4 - 1.2\ R_f$

$0.2\ R_f = 0.4$

$R_f = 2$

Rigel: $E(r_i) = 2 + (7 - 2)\ 1.8$

$= 11\%$

Question

Returns

The risk-free rate of return is 7%. The average market return is 11%.

(a) What will be the return expected from a share whose β factor is 0.9?

(b) What would be the share's expected value if it is expected to earn an annual dividend of 5.3c, with no capital growth?

Answer

(a) $7\% + 0.9\ (11\% - 7\%) = 10.6\%$

(b) $\dfrac{5.3c}{10.6\%} = 50c$

3.11 Problems with applying the CAPM in practice 6/08

FAST FORWARD

Problems of CAPM include **unrealistic assumptions** and the **required estimates being difficult to make.**

(a) The need to **determine** the **excess return** ($E(r_m) - R_f$). Expected, rather than historical, returns should be used, although historical returns are often used in practice.

(b) The need to **determine** the **risk-free rate**. A risk-free investment might be a government security. However, interest rates vary with the term of the lending.

(c) **Errors** in the **statistical analysis used** to calculate β values. Betas may also **change over** time.

(d) The CAPM is also **unable to forecast accurately returns** for companies with **low price/earnings** ratios and to take account of seasonal 'month-of-the-year' effects and 'day-of-the-week' effects that appear to influence returns on shares.

Question

Beta factor

(a) What does beta measure, and what do betas of 0.5, 1 and 1.5 mean?

(b) What factors determine the level of beta which a company may have?

Answer

(a) **Beta measures** the systematic risk of a risky investment such as a share in a company. The total risk of the share can be sub-divided into two parts, known as **systematic (or market) risk** and **unsystematic (or unique) risk**. The systematic risk depends on the sensitivity of the return of the share to general economic and market factors such as periods of boom and recession. The capital asset pricing model shows how the return which investors expect from shares should depend only on systematic risk, not on unsystematic risk, which can be eliminated by holding a well-diversified portfolio.

Beta is calibrated such that the average risk of stock market investments has a **beta of 1**. Thus shares with betas of 0.5 or 1.5 would have half or 1½ times the average sensitivity to market variations respectively.

This is reflected by higher volatility of share prices for shares with a beta of 1.5 than for those with a beta of 0.5. For example, a 10% increase in general stock market prices would be expected to be reflected as a 5% increase for a share with a beta of 0.5 and a 15% increase for a share with a beta of 1.5, with a similar effect for price reductions.

(b) The beta of a company will be the **weighted average** of the beta of its shares and the beta of its debt. The beta of debt is very low, but not zero, because corporate debt bears default risk, which in turn is dependent on the volatility of the company's cash flows.

Factors determining the beta of a company's equity shares include:

(i) **Sensitivity** of the company's **cash flows** to economic factors, as stated above. For example sales of new cars are more sensitive than sales of basic foods and necessities.

(ii) The company's **operating gearing**. A high level of fixed costs in the company's cost structure will cause high variations in operating profit compared with variations in sales.

(iii) The company's **financial gearing**. High borrowing and interest costs will cause high variations in equity earnings compared with variations in operating profit, increasing the equity beta as equity returns become more variable in relation to the market as a whole. This effect will be countered by the low beta of debt when computing the weighted average beta of the whole company.

3.12 Dividend growth model and CAPM

The two models will not necessarily give the same cost of equity and you may have to calculate the cost of equity using either, or both, models.

3.12.1 Example : Dividend growth model and CAPM

The following data relates to the ordinary shares of Stilton.

Current market price, 31 December 20X1	250c
Dividend per share, 20X1	3c
Expected growth rate in dividends and earnings	10% pa
Average market return	8%
Risk-free rate of return	5%
Beta factor of Stilton equity shares	1.40

(a) What is the estimated cost of equity using the dividend growth model?
(b) What is the estimated cost of equity using the capital asset pricing model?

Solution

(a) $k_e = \frac{d_0(1+g)}{P_0} + g$

$= \frac{3(1.10)}{250} + 0.10$

$= 0.1132$ or 11.32%

(b) $k_e = 5 + 1.40\ (8 - 5) = 9.2\%$

4 The cost of debt 6/08

FAST FORWARD

The **cost of debt** is the return an enterprise must pay to its lenders.

- For **irredeemable debt**, this is the (post-tax) interest as a percentage of the ex interest market value of the bonds (or preferred shares).
- For **redeemable debt**, the cost is given by the internal rate of return of the cash flows involved.

4.1 The cost of debt capital

The cost of debt capital represents:

(a) The cost of **continuing to use the finance** rather than redeem the securities at their current market price.
(b) The cost of raising **additional fixed interest capital** if we assume that the cost of the additional capital would be equal to the cost of that already issued. If a company has not already issued any fixed interest capital, it may estimate the cost of doing so by making a similar calculation for another company which is judged to be similar as regards risk.

Exam focus point

Remember that different types of debt have different costs. The cost of a bond will not be the same as the cost of a bank loan.

4.2 Irredeemable debt capital

Formula to learn

Cost of irredeemable debt capital, paying interest i in perpetuity, and having a current ex-interest price P_0:

$$k_d = \frac{i}{P_0}$$

4.3 Example: cost of debt capital (1)

Lepus has issued bonds of $100 nominal value with annual interest of 9% per year, based on the nominal value. The current market price of the bonds is $90. What is the cost of the bonds?

Solution

k_d = 9/90 =10%

4.4 Example: cost of debt capital (2)

Henryted has 12% irredeemable bonds in issue with a nominal value of $100. The market price is $95 ex interest. Calculate the cost of capital if interest is paid half-yearly.

Solution

If interest is 12% annually, therefore 6% is payable half-yearly.

$$\text{Cost of loan capital} = \left(1+\frac{6}{95}\right)^2 - 1 = 13.0\%$$

4.5 Redeemable debt capital

If the debt is **redeemable** then in the year of redemption the interest payment will be received by the holder as well as the amount payable on redemption, so:

$$P_0 = \frac{i}{(1+k_{d\,net})} + \frac{i}{(1+k_{d\,net})^2} + \ldots\ldots + \frac{i+p_n}{(1+k_{d\,net})^n}$$

where p_n = the amount payable on redemption in year n.

The above equation cannot be simplified, so 'r' will have to be calculated by trial and error, as an **internal rate of return (IRR)**.

The best trial and error figure to start with in calculating the cost of redeemable debt is to take the cost of debt capital as if it were irredeemable and then add the annualised capital profit that will be made from the present time to the time of redemption.

4.6 Example: cost of debt capital (3)

Owen Allot has in issue 10% bonds of a nominal value of $100. The market price is $90 ex interest. Calculate the cost of this capital if the bond is:

(a) Irredeemable
(b) Redeemable at par after 10 years

Ignore taxation.

Solution

(a) **The cost of irredeemable debt capital** is $\frac{i}{P_0} = \frac{\$10}{\$90} \times 100\% = 11.1\%$

(b) **The cost of redeemable debt capital.** The capital profit that will be made from now to the date of redemption is $10 ($100 – $90). This profit will be made over a period of ten years which gives an annualised profit of $1 which is about 1% of current market value. The best trial and error figure to try first is therefore 12%.

Year		Cash flow	Discount factor	PV	Discount factor	PV
		$	12%	$	11%	$
0	Market value	(90)	1.000	(90.00)	1.000	(90.00)
1–10	Interest	10	5.650	56.50	5.889	58.89
10	Capital repayment	100	0.322	32.20	0.352	35.20
				(1.30)		+4.09

The approximate cost of redeemable debt capital is, therefore:

$$(11 + \frac{4.09}{(4.09 - -1.30)} \times 1) = 11.76\%$$

4.7 Debt capital and taxation

The interest on debt capital is likely to be an allowable deduction for purposes of taxation and so the cost of debt capital and the cost of share capital are not properly comparable costs. This tax relief on interest ought to be recognised in computations. The after-tax cost of irredeemable debt capital is:

$$k_{d\,net} = \frac{i(1-T)}{P_0}$$

where $k_{d\,net}$ is the cost of debt capital

i is the annual interest payment

P_0 is the current market price of the debt capital ex interest (that is, after payment of the current interest)

T is the rate of corporation tax

Formula to learn

Cost of irredeemable debt capital, paying annual net interest $i(1 - T)$, and having a current ex-interest price P_0:

$$k_{d\,net} = \frac{i(1-T)}{P_0}$$

Therefore if a company pays $10,000 a year interest on irredeemable bonds with a nominal value of $100,000 and a market price of $80,000, and the rate of tax is 30%, the cost of the debt would be:

$$\frac{10,000}{80,000}\ (1 - 0.30) = 0.0875 = 8.75\%$$

The higher the rate of tax is, the greater the tax benefits in having debt finance will be compared with equity finance. In the example above, if the rate of tax had been 50%, the cost of debt would have been, after tax:

$$\frac{10,000}{80,000}\ (1 - 0.50) = 0.0625 = 6.25\%$$

Exam focus point

Students often don't remember that debt attracts tax relief in most jurisdictions.

In the case of **redeemable debt**, the capital repayment is not allowable for tax. To calculate the cost of the debt capital to include in the weighted average cost of capital, it is necessary to calculate an internal rate of return which takes account of tax relief on the interest.

4.8 Example: cost of debt capital (4)

(a) A company has outstanding $660,000 of 8% bonds on which the interest is payable annually on 31 December. The debt is due for redemption at par on 1 January 20X6. The market price of the bonds at 28 December 20X2 was $95. Ignoring any question of personal taxation, what do you estimate to be the current cost of debt?

(b) If a new expectation emerged that the cost of debt would rise to 12% during 20X3 and 20X4 what effect might this have in theory on the market price at 28 December 20X2?

(c) If the effective rate of tax was 30% what would be the after-tax cost of debt of the bonds in (a) above? Tax is paid each 31 December on profits earned in that year.

Solution

(a) The current cost of debt is found by calculating the pre-tax internal rate of return of the cash flows shown in the table below. A discount rate of 10% is chosen for a trial-and-error start to the calculation.

Item and date		*Year*	*Cash flow*	*Discount factor*	*Present value*
			$	10%	$
Market value	28.12.X2	0	(95)	1.000	(95.0)
Interest	31.12.X3	1	8	0.909	7.3
Interest	31.12.X4	2	8	0.826	6.6
Interest	31.12.X5	3	8	0.751	6.0
Redemption	1.1.X6	3	100	0.751	75.1
NPV					0.0

By coincidence, the cost of debt is 10% since the NPV of the cash flows above is zero.

(b) If the cost of debt is expected to rise in 20X3 and 20X4 it is probable that the market price in December 20X2 will fall to reflect the new rates obtainable. The probable market price would be the discounted value of all future cash flows up to 20X6, at a discount rate of 12%.

Item and date		*Year*	*Cash flow*	*Discount factor*	*Present value*
			$	12%	$
Interest	31.12.X2	0	8	1.000	8.0
Interest	31.12.X3	1	8	0.893	7.1
Interest	31.12.X4	2	8	0.797	6.4
Interest	31.12.X5	3	8	0.712	5.7
Redemption	1.1.X6	3	100	0.712	71.2
NPV					98.4

The estimated market price would be $98.40.

(c)

Item and date		*Year*	*Cash flow ex int*	*PV 5%*	*PV 10%*
			$	$	$
Market value		0	(95.0)	(95.0)	(95.0)
Interest (8 × (1 – 0.3))	31.12.X3	1	5.6	5.3	5.1
Interest	31.12.X4	2	5.6	5.1	4.6
Interest	31.12.X5	3	5.6	4.8	4.3
Redemption	1. 1.X6	3	100.0	86.4	75.1
NPV				6.6	(5.9)

The estimated after-tax cost of debt is: $5\% + \left(\frac{6.6}{(6.6+5.9)} \times 5\%\right) = 7.6\%$

Exam focus point

Make sure that you know the difference in methods for calculating the cost of irredeemable **and** redeemable debt, as this is often a weakness in exams.

4.9 The cost of floating rate debt

If a firm has variable or **'floating rate' debt**, then the cost of an equivalent fixed interest debt should be substituted. 'Equivalent' usually means fixed interest debt with a similar term to maturity in a firm of similar standing, although if the cost of capital is to be used for project appraisal purposes, there is an argument for using debt of the same duration as the project under consideration.

4.10 The cost of bank debt

The cost of short-term funds such as bank loans and overdrafts is the current interest being charged on such funds. Alternatively, the cost of debt of ordinary or straight bonds could be used.

4.11 The cost of convertible debt

The cost of capital of convertible to debt is harder to determine. The calculation will depend on whether or not conversion is likely to happen.

(a) If conversion is **not** expected, the conversion value is ignored and the bond is treated as **redeemable debt**, using the IRR method described in section 4.6.

(b) If conversion **is** expected, the IRR method for calculating the cost of redeemable debt is used, but the number of years to redemption is replaced by the **number of years to conversion** and the redemption value is replaced by the **conversion value** ie the market value of the shares into which the debt is to be converted.

Formula to learn

Conversion value = $P_0 (1 + g)^n R$

where P_0 is the current ex-dividend ordinary share price
g is the expected annual growth of the ordinary share price
n is the number of years to conversion
R is the number of shares received on conversion

4.12 Example: Cost of convertible debt

A company has issued 8% convertible bonds which are due to be redeemed in five years' time. They are currently quoted at $82 per $100 nominal. The bonds can be converted into 25 shares in five years' time. The share price is currently $3.50 and is expected to grow at a rate of 3% pa. Assume a 30% rate of tax.

Calculate the cost of the convertible debt.

Solution

Conversion value $= P_0(1+g)^n R$

$= 3.50 \times (1+0.03)^5 \times 25$

$= \$101.44$

As the redemption value is $100, investors would **choose to convert** the bonds so the **conversion value** is used in the IRR calculation.

Year	*Cash flow*		*Discount factor 8%*	*PV*	*Discount factor 12%*	*PV*
		$		$		$
0	Market value	(82.00)	1.000	(82.00)	1.000	(82.00)
1 – 5	Interest (8 × (1 – 0.3)	5.60	3.993	22.36	3.605	20.19
5	Conversion value	101.44	0.681	69.08	0.567	57.52
				9.44		(4.29)

Cost of debt = $8\% + \dfrac{9.44}{9.44 + 4.29}(12\% - 8\%) = 10.75\%$

4.13 The cost of preference shares

For preference shares the future cash flows are the dividend payments in perpetuity so that:

$$P_0 = \frac{d}{(1+k_{pref})} + \frac{d}{(1+k_{pref})^2} + \frac{d}{(1+k_{pref})^3} + \ldots.$$

where P_0 is the current market price of preference share capital after payment of the current dividend
d is the dividend received
k_{pref} is the cost of preference share capital

$$\frac{d}{(1+k_{pref})} + \frac{d}{(1+k_{pref})^2} + \frac{d}{(1+k_{pref})^3} \ldots..$$

simplifies to $\frac{d}{k_{pref}}$

Formula to learn

The cost of preference shares can be calculated as $k_{pref} = \frac{d}{P_0}$.

Exam focus point

Don't forget however that tax relief is not given for preference share dividends.

When calculating the weighted average cost of capital (see section 5), the cost of preference shares is a separate component and should **not** be combined with the cost of debt or the cost of equity.

5 The weighted average cost of capital 12/07, 6/08, 12/08

FAST FORWARD

The **weighted average cost of** capital is calculated by weighting the costs of the individual sources of finance according to their **relative** importance as sources of finance.

5.1 Computing a discount rate

We have looked at the costs of individual sources of capital for a company. But how does this help us to work out the cost of capital as a whole, or the discount rate to apply in DCF investment appraisals?

In many cases it will be difficult to associate a particular project with a particular form of finance. A company's funds may be viewed as a **pool of resources**. Money is withdrawn from this pool of funds to invest in new projects and added to the pool as new finance is raised or profits are retained. Under these circumstances it might seem appropriate to use an average cost of capital as the discount rate.

The correct cost of capital to use in investment appraisal is the **marginal cost of the funds** raised (or earnings retained) to finance the investment. The weighted average cost of capital (WACC) might be considered the most **reliable guide** to the **marginal cost of capital**, but only on the assumption that the company continues to invest in the future, in projects of a standard level of business risk, by raising funds in the same proportions as its existing capital structure.

Key term

Weighted average cost of capital is the average cost of the company's finance (equity, bonds, bank loans) weighted according to the proportion each element bears to the total pool of capital.

5.2 General formula for the WACC

A general formula for the weighted average cost of capital (WACC) k_0 is as follows.

Exam formula

$$WACC = \left[\frac{V_e}{V_e + V_d}\right] k_e + \left[\frac{V_d}{V_e + V_d}\right] k_d (1 - T)$$

where k_e is the cost of equity
k_d is the cost of debt
V_e is the market value of equity in the firm
V_d is the market value of debt in the firm
T is the rate of company tax

5.3 Example: weighted average cost of capital

An entity has the following information in its statement of financial position.

	$'000
Ordinary shares of 50¢	2,500
12% unsecured bonds	1,000

The ordinary shares are currently quoted at 130¢ each and the bonds are trading at $72 per $100 nominal. The ordinary dividend of 15¢ has just been paid with an expected growth rate of 10%. Corporation tax is currently 30%.

Calculate the weighted average cost of capital for this entity.

Solution

Market values:

		$'000
Equity (V_e):	$\frac{2,500}{0.5} \times 1.30$	6,500
Bonds (V_d):	$1,000 \times 0.72$	720
		7,220

Cost of equity:

$$k_e = \frac{d_o(1+g)}{P_o} + g = \frac{0.15(1+0.1)}{1.3} + 0.1 = 0.2269 = 22.69\%$$

Cost of debt:

$$k_d = \frac{i}{P_o} = \frac{0.12}{0.72} = 0.1667 = 16.67\%$$

Weighted average cost of capital:

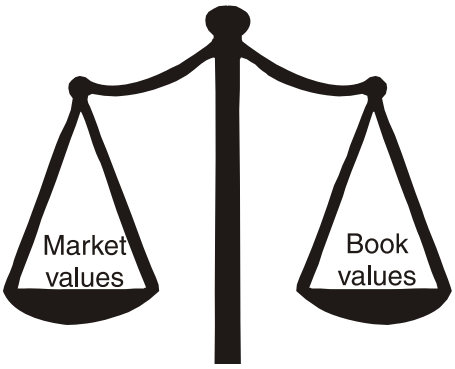
$$WACC = \left[\frac{V_e}{V_e + V_d}\right] k_e + \left[\frac{V_d}{V_e + V_d}\right] k_d (1 - T)$$

$V_E + V_D = 7,220$

$$WACC = \left[\left(\frac{6,500}{7,220}\right) \times 22.69\%\right] + \left[\left(\frac{720}{7,220}\right) \times 16.67\% \times 0.7\right] = 20.43\% + 1.16\% = 21.59\%$$

5.4 Weighting

Two methods of weighting could be used.



Market values should always be used if data is available. Although book values are often easier to obtain, they are based on historical costs and their use will seriously **understate** the impact of the cost of equity finance on the average cost of capital. If the WACC is underestimated, unprofitable projects will be accepted.

5.5 Marginal cost of capital approach

The **marginal cost of capital** approach involves calculating a marginal cut-off rate for acceptable investment projects by:

(a) **Establishing rates of return** for each component of capital structure, except retained earnings, based on its value if it were to be raised under current market conditions.

(b) **Relating dividends or interest** to these values to obtain a marginal cost for each component.

(c) **Applying the marginal cost** to each component depending on its proportionate weight within the capital structure and adding the resultant costs to give a weighted average.

It can be argued that the current weighted average cost of capital should be used to evaluate projects. Where a company's capital structure changes only very **slowly** over time, the marginal cost of new capital should be roughly **equal** to the weighted average cost of current capital.

Where gearing levels fluctuate significantly, or the finance for new project carries a significantly different level of risks to that of the existing company, there is good reason to seek an alternative marginal cost of capital.

5.6 Example: Marginal cost of capital

Georgebear has the following capital structure:

	After tax cost	*Market value*	After tax cost x Market value
Source	%	$m	
Equity	12	10	1.2
Preference	10	2	0.2
Bonds	7.5	8	0.6
		20	2.0

$$\text{Weighted average cost of capital} = \frac{2 \times 100\%}{20}$$

$$= 10\%$$

Georgebear's directors have decided to embark on major capital expenditure, which will be financed by a major issue of funds. The estimated project cost is $3,000,000, 1/3 of which will be financed by equity, 2/3 of which will be financed by bonds. As a result of undertaking the project, the cost of equity (existing and new shares) will rise from 12% to 14%. The cost of preference shares and the cost of existing bonds will remain the same, while the after tax cost of the new bonds will be 9%.

Required

Calculate the company's new weighted average cost of capital, and its marginal cost of capital.

Solution

New weighted average cost of capital

	After tax cost	*Market value*	*After tax cost x Market value*
Source	%	$m	
Equity	14	11	1.54
Preference	10	2	0.20
Existing bonds	7.5	8	0.60
New bonds	9	2	0.18
		23	2.52

$$\text{WACC} = \frac{2.52 \times 100\%}{23}$$

$$= 11.0\%$$

$$\text{Marginal cost of capital} = \frac{(2.52 - 2.0) \times 100\%}{23 - 20}$$

$$= 17.3\%$$

Chapter Roundup

- The **cost of capital** is the rate of return that the enterprise must pay to satisfy the providers of funds, and it reflects the riskiness of providing funds.
- The **dividend growth model** can be used to estimate a cost of equity, on the assumption that the market value of share is directly related to the expected future dividends from the shares.
- The **capital asset pricing model** can be used to calculate a cost of equity and incorporates **risk.**

  The CAPM is based on a comparison of the **systematic risk** of **individual investments** with the **risks of all shares** in the **market**.
- The **risk** involved in holding securities (shares) divides into **risk specific** to the company (unsystematic) and risk due to **variations** in **market activity** (systematic).

  Unsystematic or business risk can be diversified away, while **systematic or market risk** cannot. Investors may mix a diversified market portfolio with risk-free assets to achieve a preferred mix of risk and return.
- The **beta factor** measures a share's volatility in terms of market risk.
- Problems of CAPM include **unrealistic assumptions** and the **required estimates being difficult to make.**
- The **cost of debt** is the return an enterprise must pay to its lenders.
  - For **irredeemable debt**, this is the (post-tax) interest as a percentage of the ex interest market value of the bonds (or preferred shares).
  - For **redeemable debt**, the cost is given by the internal rate of return of the cash flows involved.
- The **weighted average cost of** capital is calculated by weighting the costs of the individual sources of finance according to their **relative** importance as sources of finance.

Quick Quiz

1 **Fill in the blanks**

Cost of capital = (1) ..... + (2) premium for ..... risk + (3) premium for ..... risk.

2 A share has a current market value of 120c and the last dividend was 10c. If the expected annual growth rate of dividends is 5%, calculate the cost of equity capital.

3 What type of risk arises from the existing operations of a business and cannot be diversified away?

4 Which of the following risks can be eliminated by diversification?

A Inherent risk
B Systematic risk
C Market risk
D Unsystematic risk

5 Unsystematic risk is measured by beta factors.

True ☐
False ☐

6 A portfolio consisting entirely of risk-free securities will have a beta factor of (tick one box):

–1 ☐
0 ☐
1 ☐

7 The risk free rate of return is 8%. Average market return is 14%. A share's beta factor is 0.5. What will be its expected return?

8 Identify the variables k_e, k_d, V_e and V_d in the following weighted average cost of capital formula.

$$WACC = \left[\frac{V_e}{V_e + V_d}\right] k_e + \left[\frac{V_d}{V_e + V_d}\right] k_d (1 - T)$$

9 When calculating the weighted average cost of capital, which of the following is the preferred method of weighting?

A Book values of debt and equity
B Average levels of the market values of debt and equity (ignoring reserves) over five years
C Current market values of debt and equity (ignoring reserves)
D Current market values of debt and equity (plus reserves)

10 What is the cost of $1 irredeemable debt capital paying an annual rate of interest of 7%, and having a current market price of $1.50?

Answers to Quick Quiz

1 (1) Risk-free rate of return
(2) Business
(3) Financial

2 $\frac{10(1+0.05)}{120} + 0.05 = 13.75\%$

3 Systematic or market risk

4 D Unsystematic risk is risk that is specific to sectors, companies or projects. Systematic risk (also known as inherent risk or market risk) affects the whole market and therefore cannot be reduced by diversification.

5 False. Beta factors measure systematic risk.

6 Zero

7 Expected return = 8 + 0.5 (14 – 8) = 11%

8 k_e is the cost of equity
k_d is the cost of debt
V_e is the market value of equity in the firm
V_d is the market value of debt in the firm

9 C Current market values of debt and equity (ignoring reserves)

10 Cost of debt = $\frac{0.07}{1.50} = 4.67\%$

Now try the question below from the Exam Question Bank

Number	Level	Marks	Time
Q23	Introductory	N/A	35 mins