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**F9 Study Text
Financial Management**

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Paper F9

Financial management

Welcome to Emile Woolf's study text for
Paper F9 *Financial management* which is:

- Written by tutors
- Comprehensive but concise
- In simple English
- Used around the world by Emile Woolf Colleges including China, Russia and the UK



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Syllabus and study guide

Aim

To develop the knowledge and skills expected of a financial manager, relating to issues affecting investment, financing, and dividend policy decisions.

Main capabilities

After completing this examination paper students should be able to:

- A** Discuss the role and purpose of the financial management function
- B** Assess and discuss the impact of the economic environment on financial management
- C** Discuss and apply working capital management techniques
- D** Carry out effective investment appraisal
- E** Identify and evaluate alternative sources of business finance
- F** Explain and calculate cost of capital and the factors which affect it
- G** Discuss and apply principles of business and asset valuations
- H** Explain and apply risk management techniques in business

Rationale

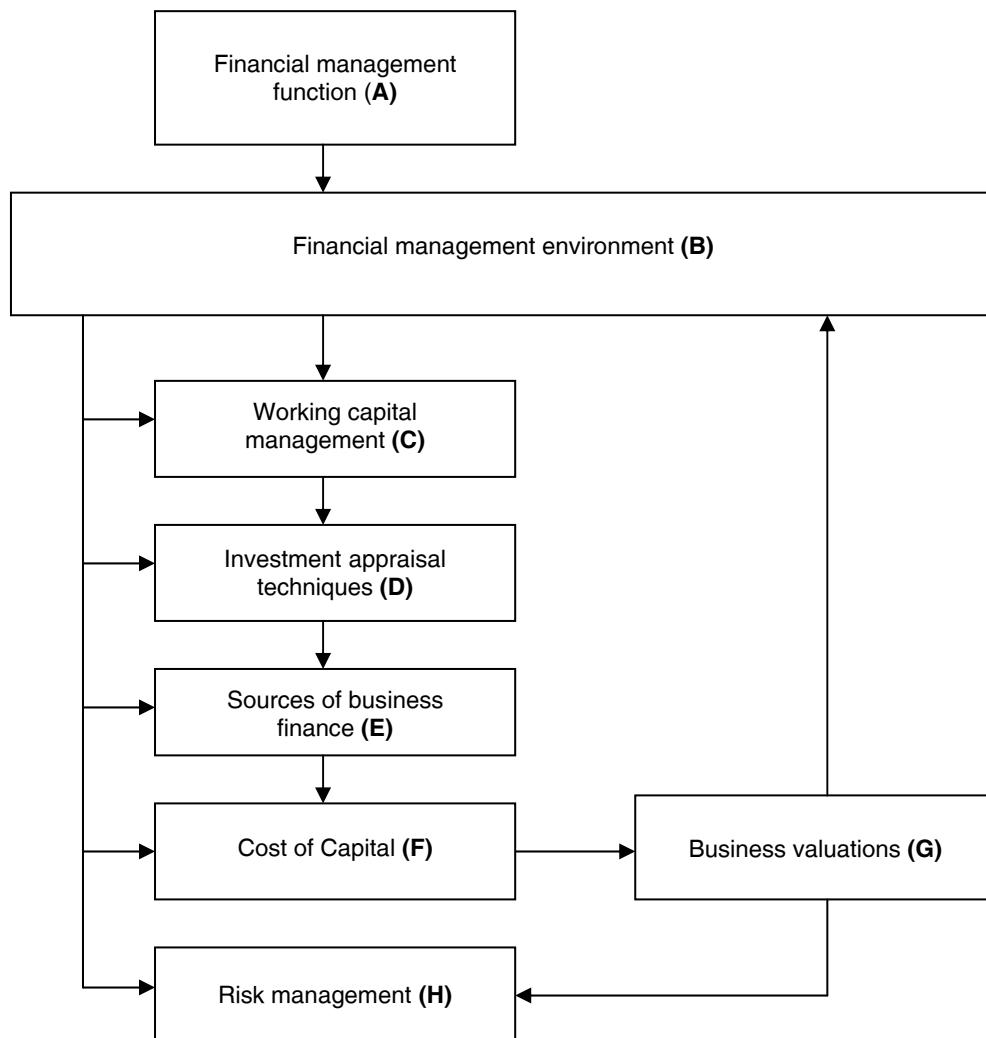
The syllabus for Paper F9, *Financial Management*, is designed to equip candidates with the skills that would be expected from a finance manager responsible for the finance function of a business. The paper, therefore, starts by introducing the role and purpose of the financial management function within a business. Before looking at the three key financial management decisions of investing, financing, and dividend policy, the syllabus explores the economic environment in which such decisions are made.

The next section of the syllabus is the introduction of investing decisions. This is done in two stages – investment in (and the management of) working capital and the appraisal of long-term investments.

The next area introduced is financing decisions. This section of the syllabus starts by examining the various sources of business finance, including dividend policy and how much finance can be raised from within the business. Cost of capital and other factors that influence the choice of the type of capital a business will raise then follows. The principles underlying the valuation of business and financial assets, including the impact of costs of capital on the value of business is covered next.

The syllabus finishes with an introduction to, and examination of, risk and the main techniques employed in the management of such risk.

Relational diagram of main syllabus capabilities



Detailed syllabus

A Financial management function

- 1 The nature and purpose of financial management and the relationship with financial and management accounting.
- 2 Financial objectives and relationship with corporate strategy
- 3 Stakeholders and impact on corporate objectives
- 4 Financial and other objectives in not-for-profit organisations

B Financial management environment

- 1 The economic environment for business
- 2 The nature and role of financial markets and institutions

C Working capital management

- 1 The nature, elements and importance of working capital
- 2 Management of inventories, accounts receivable, accounts payable and cash
- 3 Determining working capital needs and funding strategies

D Investment appraisal

- 1 The nature of investment decisions and the appraisal process
- 2 Non discounted cash flow techniques
- 3 Discounted cash flow (DCF) techniques
- 4 Allowing for inflation and taxation in DCF
- 5 Adjusting for risk and uncertainty in investment appraisal
- 6 Specific investment decisions (lease or buy; asset replacement, capital rationing etc.)

E Business finance

- 1 Sources of, and raising short-term finance
- 2 Sources of, and raising long-term finance
- 3 Internal sources of finance and dividend policy
- 4 Gearing and capital structure considerations
- 5 Finance for Small and Medium-size Entities (SMEs)

F Cost of capital

- 1 Sources of finance and their relative costs
- 2 Estimating the cost of equity
- 3 Estimating the cost of debt and other capital instruments
- 4 Estimating the overall cost of capital
- 5 Capital structure theories and practical considerations
- 6 Impact of cost of capital on investments

G Business valuations

- 1 Nature and purpose of the valuation of business and financial assets
- 2 Models for the valuation of shares
- 3 The valuation of debt and other financial assets
- 4 Efficient market hypothesis (EMH) and practical considerations in the valuation of shares

H Risk management

- 1 The nature and types of risk and approaches to risk management
- 2 Causes of exchange rate differences and interest rate fluctuations
- 3 Hedging techniques for foreign currency risk
- 4 Hedging techniques for interest rate risk

Approach to examining the syllabus

The syllabus for Paper F9 has the aim of developing in students the skills expected from a financial manager who is responsible for the finance function of a business.

The paper also prepares candidates for more advanced and specialist study in Paper P4, Advanced Financial Management.

Examination structure

The examination paper contains four questions, all of which are compulsory. Each question is worth 25 marks and has both computational and discursive elements. The balance between computational and discursive content will continue in line with the pilot paper.

Candidates are provided with a formulae sheet and tables of discount factors and annuity factors.

Study guide

This study guide provides more detailed guidance on the syllabus. You should use this as the basis of your studies.

A Financial management function

1 The nature and purpose of financial management

- (a) Explain the nature and purpose of financial management.
- (b) Explain the relationship between financial management and financial and management accounting.

2 Financial objectives and the relationship with corporate strategy

- (a) Discuss the relationship between financial objectives, corporate objectives and corporate strategy.
- (b) Identify and describe a variety of financial objectives, including:
 - (i) shareholder wealth maximisation
 - (ii) profit maximisation
 - (iii) earnings per share growth

3 Stakeholders and impact on corporate objectives

- (a) Identify the range of stakeholders and their objectives
- (b) Discuss the possible conflict between stakeholder objectives

- (c) Discuss the role of management in meeting stakeholder objectives, including the use of agency theory.
- (d) Describe and apply ways of measuring achievement of corporate objectives including:
 - (i) ratio analysis using appropriate ratios such as return on capital employed, return on equity, earnings per share and dividend per share
 - (ii) changes in dividends and share prices as part of total shareholder return
- (e) Explain ways to encourage the achievement of stakeholder objectives, including:
 - (i) managerial reward schemes such as share options and performance-related pay
 - (ii) regulatory requirements such as corporate governance codes of best practice and stock exchange listing regulations

4 Financial and other objectives in not-for-profit organisations

- (a) Discuss the impact of not-for-profit status on financial and other objectives.
- (b) Discuss the nature and importance of Value for Money as an objective in not-for-profit organisations.
- (c) Discuss ways of measuring the achievement of objectives in not-for-profit organisations.

B Financial management environment

1 The economic environment for business

- (a) Identify and explain the main macroeconomic policy targets.
- (b) Define and discuss the role of fiscal, monetary, interest rate and exchange rate policies in achieving macroeconomic policy targets.
- (c) Explain how government economic policy interacts with planning and decision-making in business.
- (d) Explain the need for and the interaction with planning and decision-making in business of:
 - (i) competition policy
 - (ii) government assistance for business
 - (iii) green policies
 - (iv) corporate governance regulation.

2 The nature and role of financial markets and institutions

- (a) Identify the nature and role of money and capital markets, both national and international, in the UK financial system.
- (b) Explain the role of financial intermediaries.
- (c) Explain the functions of a stock market and a corporate bond market.
- (d) Explain the nature and features of different securities in relation to the risk/return trade-off.

C Working capital management

1 The nature, elements and importance of working capital

- (a) Describe the nature of working capital and identify its elements.
- (b) Identify the objectives of working capital management in terms of liquidity and profitability, and discuss the conflict between them.
- (c) Discuss the central role of working capital management in financial management.

2 Management of inventories, accounts receivable, accounts payable and cash

- (a) Explain the cash operating cycle and the role of accounts payable and receivable.
- (b) Explain and apply relevant accounting ratios, including:
 - (i) current ratio and quick ratio
 - (ii) inventory turnover ratio, average collection period and average payable period
 - (iii) sales revenue/net working capital ratio
- (c) Discuss, apply and evaluate the use of relevant techniques in managing inventory, including the Economic Order Quantity model and Just-in-Time techniques.
- (d) Discuss, apply and evaluate the use of relevant techniques in managing accounts receivable, including:
 - (i) assessing creditworthiness
 - (ii) managing accounts receivable
 - (iii) collecting amounts owing
 - (iv) offering early settlement discounts
 - (v) using factoring and invoice discounting
 - (vi) managing foreign accounts receivable
- (e) Discuss and apply the use of relevant techniques in managing accounts payable, including:
 - (i) using trade credit effectively
 - (ii) evaluating the benefits of discounts for early settlement and bulk purchase
 - (iii) managing foreign accounts payable
- (f) Explain the various reasons for holding cash, and discuss and apply the use of relevant techniques in managing cash, including:
 - (i) preparing cash flow forecasts to determine future cash flows and cash balances
 - (ii) assessing the benefits of centralised treasury management and cash control
 - (iii) cash management models, such as the Baumol model and the Miller-Orr model
 - (iv) investing short-term

3 Determining working capital needs and funding strategies

- (a) Calculate the level of working capital investment in current assets and discuss the key factors determining this level, including:
 - (i) the length of the working capital cycle and terms of trade
 - (ii) an organisation's policy on the level of investment in current assets

- (iii) the industry in which the organisation operates
- (b) Describe and discuss the key factors in determining working capital funding strategies, including:
 - (i) the distinction between permanent and fluctuating current assets
 - (ii) the relative cost and risk of short-term and long-term finance
 - (iii) the matching principle
 - (iv) the relative costs and benefits of aggressive, conservative and matching funding policies
 - (v) management attitudes to risk, previous funding decisions and organisation size

D Investment appraisal

1 The nature of investment decisions and the appraisal process

- (a) Distinguish between capital and revenue expenditure, and between fixed asset and working capital investment.
- (b) Explain the role of investment appraisal in the capital budgeting process.
- (c) Discuss the stages of the capital budgeting process in relation to corporate strategy.

2 Non-discounted cash flow techniques

- (a) Identify and calculate relevant cash flows for investment projects.
- (b) Calculate payback period and discuss the usefulness of payback as an investment appraisal method.
- (c) Calculate return on capital employed (accounting rate of return) and discuss its usefulness as an investment appraisal method.

3 Discounted cash flow (DCF) techniques

- (a) Explain and apply concepts relating to interest and discounting, including:
 - (i) the relationship between interest rates and inflation, and between real and nominal interest rates
 - (ii) the calculation of future values and the application of the annuity formula
 - (iii) the calculation of present values, including the present value of an annuity and a perpetuity, and the use of discount and annuity tables
 - (iv) the time value of money and the role of cost of capital in appraising investments
- (b) Calculate net present value and discuss its usefulness as an investment appraisal method.
- (c) Calculate internal rate of return and discuss its usefulness as an investment appraisal method.
- (d) Discuss the superiority of DCF methods over non-DCF methods.
- (e) Discuss the relative merits of NPV and IRR.

4 Allowing for inflation and taxation in DCF

- (a) Apply and discuss the real-terms and nominal-terms approaches to investment appraisal.
- (b) Calculate the taxation effects of relevant cash flows, including the tax benefits of capital allowances and the tax liabilities of taxable profit.
- (c) Calculate and apply before- and after-tax discount rates.

5 Adjusting for risk and uncertainty in investment appraisal

- (a) Describe and discuss the difference between risk and uncertainty in relation to probabilities and increasing project life.
- (b) Apply sensitivity analysis to investment projects and discuss the usefulness of sensitivity analysis in assisting investment decisions.
- (c) Apply probability analysis to investment projects and discuss the usefulness of probability analysis in assisting investment decisions.
- (d) Apply and discuss other techniques of adjusting for risk and uncertainty in investment appraisal, including:
 - (i) simulation
 - (ii) adjusted payback
 - (iii) risk-adjusted discount rates

6 Specific investment decisions (Lease or buy; asset replacement; capital rationing, etc.)

- (a) Evaluate leasing and borrowing to buy using the before-and after-tax costs of debt.
- (b) Evaluate asset replacement decisions using equivalent annual cost.
- (c) Evaluate investment decisions under single-period capital rationing, including:
 - (i) the calculation of profitability indexes for divisible investment projects
 - (ii) the calculation of the NPV of combinations of non-divisible investment projects
 - (iii) a discussion of the reasons for capital rationing

E Business finance

1 Sources of and raising short-term finance

- (a) Identify and discuss the range of short-term sources of finance available to businesses, including:
 - (i) overdraft
 - (ii) short-term loan
 - (iii) trade credit
 - (iv) lease finance

2 Sources of, and raising, long-term finance

- (a) Identify and discuss the range of long-term sources of finance available to businesses, including:
 - (i) equity finance
 - (ii) debt finance

- (iii) lease finance
- (iv) venture finance
- (b) Identify and discuss methods of raising equity finance, including:
 - (i) rights issue
 - (ii) placing
 - (iii) public offer
 - (iv) stock exchange listing

3 Internal sources of finance and dividend policy

- (a) Identify and discuss internal sources of finance, including:
 - (i) retained earnings
 - (ii) increasing working capital management efficiency
- (b) Discuss the relationship between the dividend decision and the financing decision
- (c) Discuss practical influences on the dividend decision, including:
 - (i) legal constraints
 - (ii) liquidity
 - (iii) shareholder expectations
 - (iv) alternatives to cash dividends

4 Gearing and capital structure considerations

- (a) Identify and discuss the problem of high levels of gearing
- (b) Assess the impact of sources of finance on financial position and financial risk using appropriate measures, including:
 - (i) ratio analysis using balance sheet gearing, operational and financial gearing, interest coverage ratio and other relevant ratios
 - (ii) cash flow forecasting
 - (iii) effect on shareholder wealth

5 Finance for small and medium sized entities (SMEs)

- (a) Describe the financing needs of small businesses.
- (b) Describe the nature of the financing problem for small businesses in terms of the funding gap, the maturity gap and inadequate security.
- (c) Explain measures that may be taken to ease the financing problems of SMEs, including the responses of government departments and financial institutions.
- (d) Identify appropriate sources of finance for SMEs and evaluate the financial impact of different sources of finance on SMEs.

F Cost of capital

1 Sources of finance and their relative costs

- (a) Describe the relative risk-return relationship and the relative costs of equity and debt.
- (b) Describe the creditor hierarchy and its connection with the relative costs of sources of finance.

2 Estimating the cost of equity

- (a) Apply the dividend growth model and discuss its weaknesses.
- (b) Describe and explain the assumptions and components of the capital asset pricing model (CAPM).
- (c) Apply the CAPM to valuing shares.
- (d) Explain and discuss the advantages and disadvantages of the CAPM.

3 Estimating the cost of debt and other capital instruments

- (a) Calculate the cost of capital of a range of capital instruments, including:
 - (i) irredeemable debt
 - (ii) redeemable debt
 - (iii) convertible debt
 - (iv) preference shares
 - (v) bank debt

4 Estimating the overall cost of capital

- (a) Distinguish between average and marginal cost of capital.
- (b) Calculate the weighted average cost of capital (WACC) using book value and market value weightings.

5 Capital structure theories and practical considerations

- (a) Describe the traditional view of capital structure and its assumptions.
- (b) Describe the views of Miller and Modigliani on capital structure, both without and with corporate taxation, and their assumptions.
- (c) Identify a range of capital market imperfections and describe their impact on the views of Miller and Modigliani on capital structure.
- (d) Explain the relevance of pecking order theory to the selection of sources of finance.

6 Impact of cost of capital on investments

- (a) Explain the relationship between company value and cost of capital.
- (b) Discuss the circumstances under which WACC can be used in investment appraisal.
- (c) Discuss the advantages of the CAPM over WACC in determining a project-specific cost of capital.
- (d) Apply the CAPM in calculating a project-specific discount rate.

G Business valuations

1 Nature and purpose of the valuation of business and financial assets

- (a) Identify and discuss reasons for valuing businesses and financial assets.
- (b) Identify information requirements for valuation and discuss the limitations of different types of information.

2 Models for the valuation of shares

- (a) Dividend valuation model, including the dividend growth model.
- (b) Market capitalisation.
- (c) Asset-based valuation models, including:
 - (i) net asset value (balance sheet basis)
 - (ii) net asset value (net realisable value basis)
 - (iii) net asset value (replacement cost basis)
- (d) Income-based valuation models, including:
 - (i) price/earnings ratio method
 - (ii) earnings yield method
 - (iii) discounted cash flow basis

3 The valuation of debt and other financial assets

- (a) Apply appropriate valuation methods to:
 - (i) irredeemable debt
 - (ii) redeemable debt
 - (iii) convertible debt
 - (iv) preference shares

4 Efficient market hypothesis (EMH) and practical considerations in the valuation of shares

- (a) Distinguish between and discuss weak form efficiency, semi-strong form efficiency and strong form efficiency
- (b) Discuss practical considerations in the valuation of shares, including:
 - (i) marketability and liquidity of shares
 - (ii) availability and sources of information
 - (iii) market imperfections and pricing anomalies
- (c) Describe the significance of investor speculation and the explanations of investor decisions offered by behavioural finance

H Risk Management**1 The nature and types of risk and approaches to risk management**

- (a) Describe and discuss different types of foreign currency risk:
 - (i) translation risk
 - (ii) transaction risk
 - (iii) economic risk
- (b) Describe and discuss different types of interest rate risk:
 - (i) gap exposure
 - (ii) basis risk

2 Causes of exchange rate differences and interest rate fluctuations

- (a) Describe the causes of exchange rate fluctuations, including:
 - (i) balance of payments
 - (ii) purchasing power parity theory
 - (iii) interest rate parity theory
 - (iv) four-way equivalence
- (b) Forecast exchange rates using:
 - (i) purchasing power parity

- (ii) interest rate parity
- (c) Describe the causes of interest rate fluctuations, including:
 - (i) structure of interest rates and yield curves
 - (ii) expectations theory
 - (iii) liquidity preference theory
 - (iv) market segmentation

3 Hedging techniques for foreign currency risk

- (a) Discuss and apply traditional methods of foreign currency risk management, including:
 - (i) currency of invoice
 - (ii) netting and matching
 - (iii) leading and lagging
 - (iv) forward exchange contracts
 - (v) money market hedging
 - (vi) asset and liability management
- (b) Compare and evaluate traditional methods of foreign currency risk management.
- (c) Identify the main types of foreign currency derivatives used to hedge foreign currency risk and explain how they are used in hedging.

4 Hedging techniques for interest rate risk

- (a) Discuss and apply traditional methods of interest rate risk management, including:
 - (i) matching and smoothing
 - (ii) asset and liability management
 - (ii) forward rate agreements
- (b) Identify the main types of interest rate derivatives used to hedge interest rate risk and explain how they are used in hedging.

New terminology and presentation of financial statements

A revised version of IAS1 Presentation of Financial Statements was issued by the IASB in September 2007.

The revision affects the use of terminology in financial statements and also some aspects of presentation. The main changes are relevant to all International papers but in particular F3, F7, F8, P2 and P7. The main changes are as follows:

- (1) The 'balance sheet' is re-named as the 'statement of financial position'.
- (2) The 'cash flow statement' is re-named as the 'statement of cash flows'.
- (3) IAS1 has introduced a new requirement to present 'other comprehensive income' items, in addition to the usual income statement items, on the face of the financial statements. The information about income may be presented in a single statement (a 'statement of comprehensive income') or in two separate statements, the income statement and a 'statement of comprehensive income'.

There are other changes in terminology. A fully summary is covered below:

Old Terminology	New Terminology
Balance sheet	Statement of financial position
Cash flow statement	Statement of cash flows
Minority interest(s)	Non-controlling interest(s)
Balance sheet date	End of the reporting period
After the balance sheet date	After the reporting period
Owners	Equity holders

The financial management function

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Financial management

- The nature of financial management
- Financial management, management accounting and financial accounting

1 Financial management

1.1 The nature of financial management

Financial management is about planning and controlling the financial affairs of an organisation, to ensure that the organisation achieves its objectives, particularly its financial objectives. This involves decisions about:

- how much finance the business needs for its operations, both its day-to-day operations and for longer-term investment projects
- where the finance should be obtained from: long-term finance is raised as equity capital (share capital and profits) or as debt capital, and short-term finance is obtained mainly from trade suppliers and bank overdrafts
- what should be the balance between long-term and short-term finance, and what should be the balance between equity capital and debt capital (in other words, what should be the capital structure of the organisation?)
- investing short term cash surpluses
- ensuring that the providers of finance are suitably rewarded: the organisation must make sure that it can meet the interest payments on its borrowing, and companies must ensure that shareholders receive an appropriate dividend out of profits
- where appropriate, protecting the organisation against financial risks.

1.2 Financial management, management accounting and financial accounting

Financial management has a strong accounting element, and in large organisations it is usual to find that professional accountants are involved in financial accounting, management accounting and financial management.

Financial accounting is concerned primarily with maintaining a system of accounts (the ledger accounts) and preparing financial statements for shareholders and other external users of financial information, i.e. financial reporting.

Management accountants provide information, both mainly financial but also non-financial, to assist management with making decisions about planning and controlling the resources of the organisation. Whereas financial accounting is concerned largely with reporting externally about historical performance, management accounting is concerned with internal reporting to decision-makers

within the organisation. Management accounting information might be either historical or forward-looking in nature.

Essentially, however, both financial accounting and management accounting are concerned with the provision and reporting of information.

Financial management is different. As its name suggests, it is concerned mainly with managing the finances of an organisation – raising finance and putting it to efficient and effective use by investing it. Financial managers have a management function as well as an advisory function to senior management.

The relationship between financial accounting, management accounting and financial management

There is often a close relationship between these three areas of finance and accounting.

- One aspect of financial accounting is the assessment of financial performance and financial position using accounting ratios such as return on capital employed, gearing, profitability ratios and working capital ratios. Users of financial reports can try to use the information in financial statements to make predictions about the future. Ratio analysis is also an element of financial management, because the attitude of shareholders and other investors to a company will depend largely on prospects for its financial performance and the strength of its capital structure.
- An aspect of financial management is longer-term financial planning, including the setting of financial objectives and targets. Longer-term targets and strategies have to be converted into shorter-term detailed plans. Longer-term financial plans are converted into detailed plans through the budgeting process. Budget preparation is generally regarded as a management accounting function.
- An aspect of management accounting is strategic management accounting. This is concerned with providing senior management with information to assist with the long-term (strategic) planning and control. This is an area where financial management and management accounting overlap. Capital investment appraisal (DCF analysis) is also regarded as an aspect of both financial management and management accounting.
- Working capital management is another aspect of operations where financial accounting, management accounting and financial management overlap. Financial management is concerned with the efficient management of inventory, receivables, payables and cash, so that investment in working capital is not excessive but at the same time the entity has enough cash or alternative sources of liquidity at all times to meet its needs. However staff in the financial accounting department might have the day-to-day responsibility for trade receivables, in particular the collection of payments. An aspect of management accounting is to provide information for inventory control, such as information about economic order quantities and reorder levels.

You should therefore find that some aspects of your previous studies of financial accounting and management accounting will be relevant to the study of financial management.

Financial objectives

- Financial objectives, corporate objectives and corporate strategy
- Identifying the main financial objective

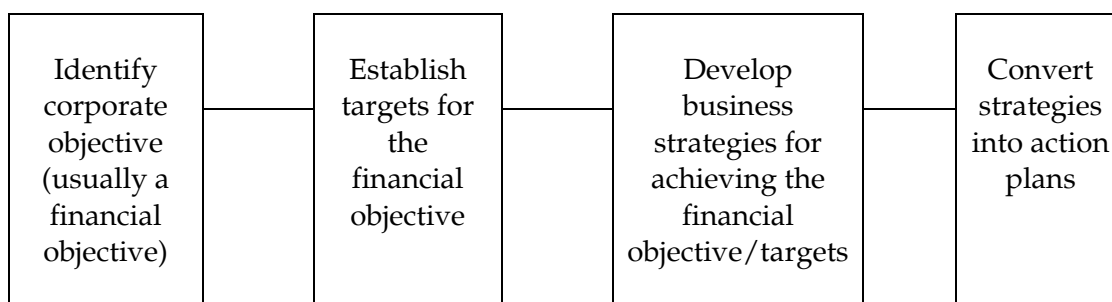
2 Financial objectives

2.1 Financial objectives, corporate objectives and corporate strategy

A corporate objective is a purpose or aim that a company is trying to achieve. Although there are differing views about what corporate objectives should be, it is generally accepted that the main purpose of a company should be to provide benefits for its owners, the shareholders, in the form of a financial return on their investment.

The main corporate objective might therefore be expressed as a financial objective, such as maximising shareholder wealth or maximising profits. Quantified targets can be established for some financial objectives, such as a target of increasing profits by at least 10% per year for the next ten years.

Plans are formulated for the achievement of the corporate objective. In a large company, longer-term plans are formulated as strategies, for which shorter-term plans are then prepared. Setting the financial objective and financial targets for a company is therefore the initial stage in an extensive process of strategy formulation and implementation. The process can be shown in a simple diagram, as follows.



Business strategies and action plans include financial strategies and plans.

2.1 Identifying the main financial objective

A financial objective can be expressed in a number of different ways, and there are advantages and weaknesses or limitations with each. Three commonly-used financial objectives are to maximise:

- shareholder wealth
- profitability
- growth in earnings per share.

Maximising shareholder wealth

The overall objective of a company might be stated as maximising the wealth of its owners, the shareholders. Shareholder wealth is increased by dividend payments and a higher share price. Corporate strategies are therefore desirable if they result in higher dividends, a higher share price, or both.

However, there are some problems with assuming that the financial objective of a company should be shareholder wealth maximisation.

- What should be the time period for setting targets for wealth maximisation?
- How will wealth creation be measured, and how can targets be divided into targets for dividend payments and targets for share price growth?
- Share prices are often affected by general stock market sentiment, and short-term increases or falls in a share price might be caused by investor attitudes rather than any real success or failing of the company itself.

The objective of maximising shareholder wealth is generally accepted as a sound basis for financial planning, but is not practical in terms of actually setting financial performance targets and measuring actual performance against the target. Other financial objectives might therefore be used instead, in the expectation that if these objectives are achieved, shareholder wealth will be increased by an optimal amount.

Maximising profits

A company might express its main financial objectives in terms of profit maximisation, and targets can be set for profit growth over a strategic planning period. If the underlying objective is to maximise shareholder wealth, targets should be set for growth in profits after tax because these are the profits that are distributable to the company's owners.

Profit growth objectives have the advantage of simplicity. When a company states that its aim is to increase profits by 20% per year for the next three years, the intention is quite clear and easily understood – by managers, investors and others.

The main problem with an objective of maximising profits is to decide the time period over which profit performance should be measured.

- Short-term profits might be increased only by taking action that will have a harmful effect on profits in the longer term. For example, a company might avoid replacing ageing equipment in order to avoid higher depreciation and interest charges, or might avoid investing in new projects if they will make losses initially – regardless of how profitable they might be in the longer term.
- It is often necessary to invest now to improve profits over the longer term. Innovation and taking business risks are often essential for long-term success. However, longer-term success is usually only achieved by making some sacrifices in the short term.

In practice, managers often focus on short-term profitability, and give insufficient thought to the longer term:

- Partly because much of their remuneration might depend on meeting annual performance targets. Annual cash bonuses, for example, might be dependent on making a minimum amount of profit for the year.
- Partly because managers often do not expect to remain in the same job for more than a few years; therefore short-term achievements might mean more to them than longer-term benefits after they have moved on to a different position or job.

Another problem with an objective of profit maximisation is that profits can be increased by raising and investing more capital. When share capital is increased, total profits might increase due to the bigger investment, but the profit per share might fall. This is why a company's financial objective might be expressed in terms of profit per share or growth in profit per share.

Growth in earnings per share

The most common measure of profit per share is earnings per share or EPS. A financial objective might be to increase the earnings per share each year, and possibly to grow EPS by a target amount each year for the next few years. If there is growth in EPS, there will be more profits to pay out in dividends per share, or there will be more retained profits to reinvest with the intention of increasing earnings per share even more in the future. EPS growth should therefore result in growth in shareholder wealth over the long term.

However, there are some problems with using EPS growth as a financial objective. It might be possible to increase EPS through borrowing and debt capital. If a company needs more capital to expand its operations, it can raise the money by borrowing. Tax relief is available on the interest charges, and this reduces the effective cost of borrowing. Shareholders benefit from any growth in profits after interest, allowing for tax relief on the interest, and EPS increases. However, higher financial gearing (the ratio of debt capital to total capital) can expose shareholders to greater financial risk. As a consequence of higher gearing, the share price might fall even when EPS increases.

Financial objectives: conclusion

The main points to note about a company's financial objective are as follows.

- It is generally accepted that the main financial objective of a company should be to maximise (or at least increase) shareholder wealth.
- There are practical difficulties in selecting a suitable measurement for growth in shareholder wealth. Financial targets such as profit maximisation and growth in EPS might be used, but no financial target on its own is ideal.
- Financial performance is therefore assessed in a variety of ways: by the actual or expected increase in the share price, growth in profits, growth in EPS, and so on.

Note: If you have already studied financial reporting, you will probably remember the financial accounting rules for measuring EPS, including adjustments for rights issues and also fully diluted EPS. For the purpose of financial management, you should not be required to make any complicated calculations of earnings per share, and it should be sufficient to measure EPS simply as the profits after taxation divided by the number of equity shares (ordinary shares) in issue.

Stakeholders

- Stakeholders and their objectives
- Conflicts between different objectives
- Agency theory
- Measuring the achievement of financial objectives
- Incentive schemes (management reward schemes)

3 Stakeholders

3.1 Stakeholders and their objectives

Although the theoretical objective of a private sector company might be to maximise the wealth of its owners, other individuals and groups have an interest in what a company does and they might be able to influence its corporate objectives. Anyone with an interest in the activities or performance of a company are 'stakeholders' because they have a stake or interest in what happens.

It is usual to group stakeholders into categories, with each category having its own interests and concerns. The main categories of stakeholder group in a company are usually the following.

- **Shareholders.** The shareholders themselves are a stakeholder group. Their interest is to obtain a suitable return from their investment and to 'maximise their wealth'. However there might be different types of shareholder in a company: some shareholders are long-term investors who have an interest in longer-term share price growth as well as short-term dividends and gains. Other shareholders might be short-term investors, hoping for a quick capital gain and /or high short-term profits and dividends.
- **Directors and senior managers.** An organisation is led by its board of directors and senior executive management. These are individuals whose careers, income and personal wealth might depend on the company they work for.
- **Other employees.** Similarly other employees in a company have a personal interest in what the company does. They receive their salary or wages from the company, and the company might also offer them job security or career prospects. However, unlike directors and senior executives, other employees might have less influence on what the company does, unless they have strong trade union representation or have some other source of 'power' and influence, such as specialist skills that the company needs and relies on.
- **Lenders.** When a company borrows money, the lender or lenders are stakeholders. Lenders might be banks or investors in the company's bonds. The main concern for lenders is to protect their investment. If the company is heavily in debt, credit risk might be a problem, and lenders might be concerned about the ability of the company to meet its interest and principal repayment obligations. They might also want to ensure that the company does not continue to borrow even more money, so that the credit risk increases further.

- **The government.** The government also has an interest in companies, especially large companies, for a variety of reasons.
 - The government regulates commercial and industrial activity; therefore it has an interest in companies as a regulator.
 - Companies are an important source of taxation income for the government, both from tax on corporate profits but also from tax on employment income and sales taxes.
 - Companies are also employers, and one of the economic aims of government might be to achieve full employment.
 - Some companies are major suppliers to the government.
- **Customers.** Customers have an interest in the actions of companies whose goods or services they buy, and might be able to influence what companies do.
- **Suppliers.** Similarly major suppliers to a company might have some influence over its actions.
- **Society as a whole.** A company might need to consider the concerns of society as a whole, about issues such as business ethics, human rights, the protection of the environment, the preservation of natural resources and avoiding pollution. Companies might need to consider how to protect their 'reputation' in the mind of the public, since a poor reputation might lead to public pressure for new legislation, or a loss in consumer (customer) support for the company's products or services.

Companies might therefore state their objectives in terms of seeking to increase the wealth of their shareholders, but subject to a need to satisfy other stakeholders too - rewarding employees well and being a good employer, acting ethically in business, and showing due concern for social and environmental issues.

The ability of stakeholders to influence what a company does will depend to a large extent on:

- the extent to which their interests can be accommodated and do not conflict with each other
- the power of each group of stakeholders to determine or influence the company's objectives and strategies.

3.2 Conflicts between different stakeholder objectives

Different stakeholders have differing interests in a company, and these might be incompatible and in conflict with each other. When stakeholders have conflicting interests:

- either a compromise will be found so that the interests of each stakeholder group are satisfied partially but not in full
- or the company will act in the interests of the most powerful stakeholder group, so that the interests of the other stakeholder groups are ignored.

In practice there might be a combination of these two possible outcomes. A company might make small concessions to some stakeholder groups but act mainly in the interests of its most powerful stakeholder group (or groups).

Some examples of conflicting interests of stakeholder groups are as follows.

- If a company needs to raise more long-term finance, its directors and shareholders might wish to do so by raising more debt capital, because debt capital is usually cheaper than equity finance. (The reason why this is so will be explained in a later chapter.) However, existing lenders might believe that the company should not borrow any more without first increasing its equity capital – by issuing more shares or retaining more profits. The terms of loan agreements (the lending ‘covenants’) might therefore include a specification that the company must not allow its debt level (gearing level) to exceed a specified maximum amount.
- The government might want to receive tax on a company’s profits, whereas the company will want to minimise its tax liabilities, through ‘efficient’ tax avoidance schemes.
- A company cannot maximise returns to its shareholders if it also seeks to maintain a contented work force, possibly by paying them high wages and salaries.
- A company cannot maximise short-term profits if it spends money on environmental protection measures and safe waste disposal measures.

However the most significant conflict of interest between stakeholders in a large company, especially a public company whose shares are traded on a stock market, is generally considered to be the conflict of interests between:

- the shareholders and
- the board of directors, especially the executive directors, and the other senior executive managers.

This perceived conflict of interests is fundamental to agency theory and the concepts of good corporate governance that have developed from agency theory.

3.3 Agency theory

Agency theory was developed by Jensen and Meckling (1976) who defined the agency relationship as a form of contract between a company’s owners and its managers, where the owners appoint an agent (the managers) to manage the company on their behalf. As a part of this arrangement, the owners must delegate decision-making authority to the management.

The owners expect the agents to act in the best interests of the owners. Ideally, the ‘contract’ between the owners and the managers should ensure that the managers always act in the best interests of the shareholders. However, it is impossible to arrange the ‘perfect contract’, because decisions by the managers (agents) affect their own personal interests as well as the interests of the owners. Managers will give priority to their personal interests over those of the shareholders.

When this happens, there is a weakness or failing on the governance of the company.

Agency conflicts

Agency conflicts are differences in the interests of a company's owners and managers. They arise in several ways.

- **Moral hazard.** A manager has an interest in receiving benefits from his or her position as a manager. These include all the benefits that come from status, such as a company car, use of a company airplane, lunches, attendance at sponsored sporting events, and so on. Jensen and Meckling suggested that a manager's incentive to obtain these benefits is higher when he has no shares, or only a few shares, in the company. The biggest problem is in large companies.
- **Effort level.** Managers may work less hard than they would if they were the owners of the company. The effect of this 'lack of effort' could be lower profits and a lower share price. The problem will exist in a large company at middle levels of management as well as at senior management level. The interests of middle managers and the interests of senior managers might well be different, especially if senior management are given pay incentives to achieve higher profits, but the middle managers are not.
- **Earnings retention.** The remuneration of directors and senior managers is often related to the size of the company, rather than its profits. This gives managers an incentive to grow the company, and increase its sales turnover and assets, rather than to increase the returns to the company's shareholders. Management are more likely to want to re-invest profits in order to make the company bigger, rather than payout the profits as dividends.
- **Risk aversion.** Executive directors and senior managers usually earn most of their income from the company they work for. They are therefore interested in the stability of the company, because this will protect their job and their future income. This means that management might be risk-averse, and reluctant to invest in higher-risk projects. In contrast, shareholders might want a company to take bigger risks, if the expected returns are sufficiently high.
- **Time horizon.** Shareholders are concerned about the long-term financial prospects of their company, because the value of their shares depends on expectations for the long-term future. In contrast, managers might only be interested in the short-term. This is partly because they might receive annual bonuses based on short-term performance, and partly because they might not expect to be with the company for more than a few years. Managers might therefore have an incentive to increase accounting return on capital employed (or return on investment), whereas shareholders have a greater interest in long-term share value.

Agency costs

Agency costs are the costs that the shareholders incur when professional managers to run their company.

- Agency costs do not exist when the owners and the managers are exactly the same individuals.
- Agency costs start to arise as soon as some of the shareholders are not also directors of the company.
- Agency costs are potentially very high in large companies, where there are many different shareholders and a large professional management.

There are three aspects to agency costs:

- They include the **costs of monitoring**. A company establishes systems for monitoring the actions and performance of management, to try to ensure that management are acting in their best interests. An important example of monitoring is the requirement for the directors to present an annual report and audited accounts to the shareholders, setting out the financial performance and financial position of the company. Preparing accounts and having them audited has a cost.
- Agency costs also include the costs to the shareholder that arise when the managers take decisions that are not in the best interests of the shareholders (but are in the interests of the managers themselves). For example, agency costs arise when a company's directors decide to acquire a new subsidiary, and pay more for the acquisition than it is worth. The managers would gain personally from the enhanced status of managing a larger group of companies. The cost to the shareholders comes from the fall in share price that would result from paying too much for the acquisition.
- The third aspect of agency costs is costs that might be incurred to provide incentives to managers to act in the best interests of the shareholders. These are sometimes called **bonding costs**. The main example of bonding costs are the costs of remuneration packages for senior executives. These costs are intended to reduce the size of the agency problem. Directors and other senior managers might be given incentives in the form of free shares in the company, or share options. In addition, directors and senior managers might be paid cash bonuses if the company achieves certain specified financial targets.

Reducing the agency problem

Jensen and Meckling argued that in order to reduce the agency problem, incentives should be provided to management to increase their willingness to take 'value-maximising decisions' – in other words, to take decisions that benefit the shareholders by maximising the value of their shares.

Several methods of reducing the agency problem have been suggested. These include:

- Devising a remuneration package for executive directors and senior managers that gives them an incentive to act in the best interests of the shareholders.
- Fama and Jensen (1983) argued that an effective board must consist largely of **independent non-executive directors**. Independent non-executive directors have no executive role in the company and are not full-time employees. They are able to act in the best interests of the shareholders.
- Independent non-executive directors should also take the decisions where there is (or could be) a conflict of interest between executive directors and the best interests of the company. For example, non-executive directors should be responsible for the remuneration packages for executive directors and other senior managers.

These ideas for reducing the agency problem are contained in codes of corporate governance.

3.4 Measuring the achievement of financial objectives

It has been suggested that the financial objective for a company might be stated as maximisation of shareholder wealth, or possibly in terms of profitability and earnings per share, or growth in profits or EPS.

When a financial objective is established, actual performance should be measured against the objective. In your examination, you might be required to comment on the relative success or failure of a company to achieve its objectives. To do this you might need to calculate one or more suitable performance measurements.

Financial objectives are commonly measured using ratio analysis. Financial ratios can be used to make comparisons:

- Comparisons over a number of years. By looking at the ratios of a company over a number of years, it might be possible to detect improvements or a deterioration in the financial performance or financial position of the entity. Ratios can therefore be used to make comparisons over time, and to identify changes or trends
- Comparisons with the similar ratios of other, similar companies for the same period.
- In some cases, perhaps, comparisons with 'industry average' ratios.

Return on capital employed (ROCE)

Profit-making companies should try to make a profit that is large enough in relation to the amount of money or capital invested in the business. The most important profitability ratio is return on capital employed or ROCE.

For a single company:

$$\text{ROCE} = \frac{\text{Profit before interest and taxation}}{\text{Share capital and reserves} + \text{Long-term debt capital}} \times 100\%$$

The capital employed is the share capital and reserves, plus long-term debt capital such as bank loans, bonds and loan stock.

Where possible, use the average capital employed during the year. This is usually the average of the capital employed at the beginning of the year and end of the year.



Example

Sting Company achieved the following results in Year 1.

	1 st January Year 1	31 st December Year 1
	\$	\$
Share capital of \$1	200,000	200,000
Share premium	100,000	100,000
Accumulated profits	500,000	600,000
Bank loans	200,000	500,000
	\$	
Profit before taxation	210,000	
Taxation	75,000	
Profit after taxation	135,000	

Interest charges on bank loans were \$30,000. Dividend payments to shareholders were \$45,000. Sales during the year were \$5,800,000.

Required

Calculate the return on capital employed for Year 1.



Answer

Capital employed at the beginning of the year = \$1,000,000.

Capital employed at the end of the year = \$1,400,000.

Average capital employed = $[\$1,000,000 + \$1,400,000] / 2 = \$1,200,000$.

Profit before interest and taxation = $\$210,000 + \$30,000 = \$240,000$.

ROCE = $\$240,000 / \$1,200,000 = 0.20$ or 20%.

Return on equity

Return on equity measures the return on investment that the shareholders of the company have made. This ratio normally uses the values in the statement of financial position (balance sheet values) of the shareholders' investment, rather than market values of the shares.

$$\text{ROSC} = \frac{\text{Profit after taxation}}{\text{Share capital and reserves}} \times 100\%$$

The average value of shareholder capital should be used if possible. This is the average of the shareholder capital at the beginning and the end of the year.

Profit after taxation is used as the most suitable measure of return for the shareholders, since this is a measure of earnings (available for payment as dividends or for reinvestment in the business).



Example

Using the figures in the previous example:

Shareholders' capital at the beginning of the year = \$200,000 + \$100,000 + \$500,000 = \$800,000.

Shareholders' capital at the end of the year = \$200,000 + \$100,000 + \$600,000 = \$900,000.

Average shareholders' capital employed = $[\$800,000 + \$900,000] / 2 = \$850,000$.

Return on equity = $135,000 / 850,000 \times 100\% = 15.88\%$.

Note that the return on equity is not directly comparable with ROCE because ROCE is a before-tax measure of return whereas return on equity is measured after tax.

Earnings per share and dividend per share

The earnings per share (EPS) is a measure of the profit after taxation (and preference share dividend, if any) per equity share, during the course of a financial year. The EPS might be:

- a historical EPS, as reported in the company's financial statements, or
- a forward-looking EPS, which is the EPS that the company will expect to achieve in the future, usually in the next financial year.

Dividend per share may be important for shareholders who are seeking income from shares rather than capital growth. The company may have a dividend policy which aims for steady growth of dividend per share.



Example

Using the figures in the previous example:

EPS = profit after tax / Number of ordinary shares = $\$135,000 / 200,000 = 67.5\text{c}$ per share

Dividend per share = $\$45,000 / \$200,000 = 22.5\text{c}$ per share

Changes in share price and dividend

Financial performance can also be measured by the return provided to shareholders over a period of time such as a financial year. The total return consists of dividend payments plus the increase in the share price during the period (or minus the fall in the share price).

This total return, often called the **Total Shareholder Return** or **TSR**, can be expressed as a percentage of the value of the shares at the beginning of the period.



Example

At 1 January the market value of a company's shares was \$8.40 per share.

During the year dividends of 45 cents per share were paid and at 31 December the share price was \$9.00.

The share price has risen by \$0.60; therefore $TSR = \frac{\$0.60 + 0.45}{\$8.40} = 0.125$ or 12.5%.

3.5 Incentive schemes (management reward schemes)

This chapter has so far made the point that the main objective of a company should be a financial objective, but there are different ways of stating this objective and in measuring the extent to which the objective has been achieved.

There are different stakeholder groups with an interest in a company, and these are likely to have conflicting interests. The main conflict of interests is the agency problem and the different interests of shareholders and senior executive managers and directors.

This raises the question: Can the agency problem be reduced and can managers be persuaded to focus on returns to shareholders as the main objective of the company? Managers may be encouraged to work in the best interests of the company if there are remuneration incentive schemes (reward schemes) linked to profits, earnings, share price or Total Shareholder Return.

Most, if not all, large stock market companies have remuneration schemes for their executive directors and other senior managers, and the purpose of such schemes is to make the personal interests of the directors and managers similar to those of the shareholders. By achieving a financial performance that is in the interests of the shareholders, directors and managers will also obtain personal benefits for themselves.

Structure of a remuneration package for senior executives

The structure of a remuneration package for executive directors or senior managers can vary, but it is usual for a remuneration package to have at least three elements.

- A **basic salary** (with pension entitlements). Basic salaries need to be high enough to attract and retain individuals with the required skills and talent.
- Annual performance incentives, where the reward is based on achieving or exceeding specified annual performance targets. The performance target might be stated as profit or earnings growth, EPS growth, achieving a profit target or achieving a target for TSR. Some managers might also have a non-financial performance target. Some managers might have several annual performance

targets, and there is a reward for achieving each separate target. **Annual rewards** are usually in the form of a **cash bonus**.

- **Long-term performance incentives**, which are linked in some way to share price growth or TSR over a longer period of time (in practice typically three years). Long-term incentives are usually provided in the form of **share awards** or **share options** in the company. The purpose of these awards is to give the manager a personal incentive in trying to increase the value of the company's shares. As a holder of shares or share options, the manager will benefit financially from a rising share price.

Share awards

With a share award scheme, the company purchases a quantity of its own shares and awards these to its executive directors and other senior managers on condition that certain 'long-term' financial targets are achieved, typically over a three-year period.

Share options

A company might award share options to its executives. A share option gives its holder the right to purchase new shares in the company on or after a specified date in the future, typically from three years after the options have been awarded. The right to buy new shares in the company is at a fixed price (an 'exercise price') that is specified when the share options are awarded. Typically the exercise price is the market price of the shares at the time the options are awarded. The holder of a share option gains from any increase in the share price above the exercise price, and so has a direct personal interest in a rising share price.

For example, a company might award share options to its chief executive officer. If the market price of the shares at the date of the award is, say, \$7.00, the CEO might be given 500,000 share options at \$7 per share, exercisable from three years after the date of the option award. If the share price three years later is, say, \$10, the CEO will be able to buy 500,000 new shares at \$7 and sell them immediately at \$10, to make a personal financial gain of \$1,500,000.

Improving corporate governance

- Approaches to corporate governance for large companies
- The board of directors
- Financial reporting and the external auditors: the audit committee
- Directors' remuneration
- Internal control and risk management
- Communication with shareholders
- Stock exchange listing practices

4 Improving corporate governance

4.1 Approaches to corporate governance for large companies

A more extensive approach to reducing the agency problem and trying to ensure that companies are managed in the best interests of shareholders is to apply rules or guidelines of 'best practice' in corporate governance. Corporate governance is a term that is used to describe the way in which a company is 'governed' on behalf of its owners by the board of directors. Many countries now have codes or rules of best corporate governance practice for large stock market companies.

There are two broad approaches to establishing 'best practice' in corporate governance.

- One approach is to establish a voluntary code of practice that all major stock market companies are expected to comply with. A voluntary code is likely to consist of general principles of good corporate governance, and some more detailed rules or provisions.
- The other approach is to legislate to impose good corporate governance requirements on companies.

Most companies have followed the lead given by the UK from the early 1990s, and have introduced a voluntary code of corporate governance for major stock market companies. In the UK, this voluntary code is called the Combined Code on Corporate Governance. (Although corporate governance in the UK is based mainly on voluntary practice, there are some aspects of governance that are subject to legislation and statutory requirements, particularly requirements relating to reporting to shareholders and directors' duties to their company).

The most notable example of a statutory approach to corporate governance is the USA, which introduced a number of governance requirements for stock market companies in the Sarbanes-Oxley Act 2002.

Elements of good corporate governance

Remuneration and management reward schemes are one aspect of corporate governance, but there are other aspects too. Measures recommended by the UK Combined Code for achieving good corporate governance relate to:

- the board of directors: the board's responsibilities and the composition of the board
- financial reporting and the independence of the external auditors
- directors' remuneration
- internal control and risk management
- communications between the company and its shareholders, and the rights and responsibilities of shareholders (particularly investment institutions such as pension funds and insurance companies).

The provisions of the UK Combined Code are described briefly below, to give you some idea of the nature of measures that might be taken to reduce the agency problem and ensure as much as possible that companies are governed in the interests of their shareholders.

4.2 The board of directors

Responsibilities of the board

The board of directors should reserve certain decisions for the board as a whole and should not delegate these decision-making powers to the executive management. The decisions reserved for the board would include decisions about major strategic investments. The purpose of this requirement is to ensure that major decisions are taken by the directors, not by executive management.

Composition of the board

To prevent the board from being dominated by a single individual, the positions of chairman and CEO should not be held by the same individual. The chairman is responsible for leading the board of directors and representing the company as a figurehead, for example in communicating with the shareholders. The CEO is responsible for leading the executive management team of the company.

To prevent the CEO (or chairman) from exerting excessive influence, the board should include a sufficient number of independent non-executive directors (NEDs). In large UK listed companies, at least half the board, excluding the chairman, should be independent NEDs. The purpose of this requirement is to ensure that there are individuals on the board of directors who do not have a conflict of interests and are more likely to consider the best interests of the shareholders when making their decisions.

Board committees

The board should delegate certain responsibilities to committees of the board, which should report back to the main board. The three board committees identified by the

Combined Code are a nominations committee (for appointing directors), an audit committee (to communicate with the external auditors, recommend the appointment and annual fees of the auditors, review the need for internal audit function, etc) and remuneration committee (to consider remuneration policy and negotiate the remuneration of individual directors).

The audit and remuneration committees should consist entirely of independent NEDs, to avoid undue influence in these matters by executive directors. The nomination committee should have a majority of independent NEDs. The purpose of board committees is to ensure that independent non-executive directors make the decisions or recommendations on matters where executive directors are likely to have a strong conflict of interests.

Fulfilling responsibilities as directors adequately

The Combined Code states that directors should be able to give enough of their time to the company in order to carry out their responsibilities. However, it does not specify any limit to the number of (non-executive) directorships any individual should hold.

Instead, the Code states that the board as a whole, each of the board committees and all individual directors (including the chairman) should be subject to an annual performance review. In principle, any individual who performs badly may be asked to resign from the board.

4.3 Financial reporting and the external auditors: the audit committee

To reduce the influence of the executive directors on the external auditors, certain powers should be delegated by the board to the audit committee. The powers and responsibilities of the audit committee should include the following:

- Discussing the annual audit plan with the external auditors
- Discussing with the external auditors any significant accounting issues that affect the content of the annual report and accounts
- Reviewing the auditors' performance. Where this is poor, the committee may recommend a change of auditors to the board of directors (which would then propose a change of auditors to the shareholders)
- Recommending the audit fee to the board of directors
- Monitoring the independence of the external auditors from influence by the executive directors. One way of doing this is to monitor the amount of non-audit work carried out for the company by the auditors. The audit committee should ensure that the audit firm does not over-rely on income from the company, either from the audit fee or fees for non-audit work.

There has been much debate about whether there should be a compulsory rotation of audit firms, so that companies are required to change their audit firm at least every five or seven years. This proposal was strongly opposed by companies and audit firms.

An alternative suggestion is to require the rotation of key audit partners, who should not remain as auditor for a particular company for more than a specified number of years. There is no requirement in the Combined Code about audit partner rotation, but the 8th European Union Directive requires the compulsory rotation of key audit partners after no more than seven years.

4.4 Directors' remuneration

The board should delegate to a remuneration committee (consisting of independent NEDs) responsibilities for:

- remuneration policy for executive directors, and
- negotiating the remuneration of individual executive directors.

In the UK, quoted companies are required by law to present a directors' remuneration report in the annual report and accounts and invite the shareholders to approve the report at the annual general meeting of the company. The principles of remuneration and reward schemes, described earlier, should normally be applied.

4.5 Internal control and risk management

The board of directors must review the internal control system, and risk management system of the company, and satisfy themselves that suitable control systems are in place. The board should report to shareholders that they have done so. (The responsibility for carrying out an annual review of risk management and the internal control system may be delegated to the audit committee.)

The purpose of this requirement is to ensure that the board of directors are aware of the significant risks to which the company (and so its shareholders) are exposed, and are also held responsible for ensuring that adequate control and risk management systems are in place as protection against those risks.

4.6 Communication with shareholders

The Combined Code requires the board of a company to promote good relations and good communications with their shareholders.

In addition, institutional investors have a responsibility for maintaining a dialogue with the company's board of directors.

A legal requirement throughout the European Union is that companies should prepare an annual business review, setting out the operating and financial position of the company in easy-to-understand language.

4.7 Stock exchange listing practices

In some countries, the voluntary code of corporate governance is supported by stock exchange requirements or requirements by the financial markets regulator.

In the UK, all listed companies (i.e. stock market companies whose shares are on the 'official list' and traded on the London Stock Market) are required to comply with Listing Rules as a condition of maintaining their listed status. These rules are issued and enforced by the Financial Services Authority, which is the UK's regulator of the financial markets.

One of the Listing Rules is that listed companies must state in their annual report and accounts that they have:

- complied with the general principles of corporate governance in the Combined Code and
- either complied with all the detailed provisions (specific requirements) in the Combined Code, or have not complied. If they have not complied with every provision, they must explain the reasons for their non-compliance. This is referred to as '**comply or explain**'.

As a consequence of voluntary governance codes supported by stock exchange (or similar) requirements, major companies should in general be managed in the best interests of the shareholders and the agency problem should be controlled.

Not-for-profit organisations

- Financial management in not-for-profit organisations
- Value for money (VFM)
- Measuring the achievement of objectives

5 Not-for-profit organisations

5.1 Financial management in not-for-profit organisations

Not-for-profit organisations are entities whose main purpose or objective is non-financial. They include charity organisations and government departments and agencies, including the state health service, state schools and universities, and administrative departments of government.

Every not-for-profit organisation has a main purpose or objective. In a health service, the main objective is to provide health care. In an education system, schools and universities exist to provide education. Charities exist to provide aid and support for specific causes.

However, not-for-profit organisations should also have important financial objectives, even if these objectives are not their main objective, and they need financial management. In particular, not-for-profit organisations need to survive, and to do so they must operate within the limitation of the amount of resources and finance they have at their disposal. They cannot allow spending to exceed the amount of funds available, and they also need to ensure that the available funds are used in the best way possible.

5.2 Value for money

Whereas profit or financial return is an important concept for the financial management of companies, value for money (VFM) is an important concept in not-for-profit organisations. VFM is based on the view that not-for-profit organisations should make the optimum use of available spending, and to do this the organisation must provide value for money (VFM). Value for money has three elements, sometimes known as the '3Es':

- **Economy.** Economy means operating in a way that does not waste money. Expenditure should be controlled and unnecessary spending should be avoided.
- **Efficiency.** Efficiency means using resources in the most efficient way possible, and getting the most out of them. For example, employees should work efficiently and the aim should be to achieve high productivity levels.
- **Effectiveness.** Effectiveness means using resources and spending money so as to achieve targets and objectives.



Example

A state school might be expected to achieve value for money in the following ways.

- **Economy.** The school should not spend money unnecessarily on resources. For example it should negotiate favourable prices for the purchase of school books and it should not have a larger teaching staff than it needs.
- **Efficiency.** The school should use its available resources in the most efficient way possible. It might be required to avoid small class sizes and achieve a minimum teacher-pupils ratio. It might also be required to ensure that pupils make full use of available information technology systems or library resources.
- **Effectiveness.** The school should achieve good results. Pupils should be expected to pass their examinations with good grades.

A large number of different measurements might be established for economy, efficiency and effectiveness, and key targets might be selected for the most important objectives.

5.3 Measuring the achievement of objectives

Setting objectives in not-for profit organisations can be a complex task.

- There are no shareholders. Instead there might be a number of different but influential stakeholder groups. In a state school for example, the government is an important stakeholder as owner of the school, but other influential stakeholders might include pupils, parents of the pupils, educational specialists and universities.
- It might be possible to identify a single main objective, but in many not-for-profit organisations there need to be multiple objectives. These should be objectives for economy and efficiency as well as effectiveness.
- If there are multiple objectives it may be difficult to decide which are most important. Different objectives may be more important to some stakeholders than to others. Targets for effectiveness are likely to be the main objectives, because these relate to the purpose for which the not-for-profit organisation exists.
- It may be difficult to define targets that are clearly linked to objectives and which are also measurable. For example, it might be difficult to establish a limited number of key objectives for a hospital or a national health service.
- Limitations on funding restrict the objectives that are achievable.

A variety of methods can be used to measure the achievement of objectives.

- Targets may be set for both financial and non-financial performance. For example, a charity may set a target of 80% of funding to be used for good causes and that spending on administration should be no more than 20% of funds received.
- A suitable target might be set by using benchmarking. Comparisons may be made with other similar organisations in the public or private sector and best practice identified. This could form the basis for the target set.

- Budgeting systems should be used for planning and monitoring expenditure. Government funding may be provided for specific purposes such as capital expenditure. This will be monitored to ensure that the specific objective is met.

The financial management environment

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The economic environment

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1 The economic environment

Companies operate within an economic and financial environment, and changes in the conditions within this environment can be important for financial management. This chapter provides a brief survey of factors that might need to be taken into consideration by companies, and that might affect the decisions that management take.

1.1 Government economic policy and macroeconomic policy targets

Macroeconomics refers to economics at a national or international level, as distinct from microeconomics, which is the economics of individual firms and markets, and macroeconomic policy is formulated by the country's government. Macroeconomic policy, and changes in economic policy and economic conditions, can have important consequences for corporate objectives and management decisions.

In advanced economies, there are normally two main macroeconomic policy objectives:

- to achieve sustained real growth in the national economy
- to achieve 'full employment'.

Success in achieving and maintaining 'full' employment depends to a large extent on success in achieving sustained real economic growth.

1.2 Economic growth and gross domestic product (GDP)

Economic growth is measured by the rate of growth in economic activity each year within a country. There are three measures of economic activity: gross domestic product (GDP), gross national product (GNP) and national income. These three measures have many common characteristics, and the differences between them are

not important for the purpose of studying financial management. This text refers to GDP.

GDP can be measured in any of three ways:

- by the volume of output of goods and services, and other economic activity, each year: the output approach
- by the amount of income earned each year by individuals and organisations within the year (e.g. company profits and the wages and salaries of individuals): this is the income approach
- by the amount of spending in the economy each year: this is the expenditure approach

Total GDP should be the same in total using any of the three methods of measurement. However, the expenditure approach to measuring GDP is the most useful for the purpose of analysis. Using this approach the total value of GDP within a given period, typically one year, can be expressed in the following formula:

$$\text{GDP} = C + G + I + (X - M)$$

where

C = total annual consumption spending each year (by companies as well as individuals): this is spending on goods and services other than capital investment

G = spending by the government (on consumption and investment by government)

I = investment spending (other than investment spending by government)

X = the value of exports of goods and services

M = the value of imports of goods and services

(X - M) is therefore the annual balance of trade (sometimes referred to as the 'balance of payments') for the country in international trade.

This formula shows that growth in GDP from one year to the next can be obtained through higher spending on consumption, higher government spending, more investment or an improvement in the balance of trade. However, growth is only achievable if an increase in C, G or I does not result in a matching fall in one of the other elements in the formula.

- For example the government might increase its annual spending by raising taxation. In raising taxation, it will reduce the spending power of individuals and companies, and as a consequence there might be a matching fall in consumption spending C or investment by companies I.
- Companies might want to increase investment spending, but to do so they will need to raise extra funds from somewhere. Funds for investment come from savings by individuals and organisations, and higher savings will result in less money for consumption.

GDP and inflation

The formula for GDP is a 'money' measurement that ignores inflation. There is a difference between:

- growth in GDP in money terms and
- growth in GDP in 'real' terms, which is growth after the effects of inflation have been removed.

For example, if GDP grows at an annual rate of 3% but the annual general rate of inflation is 2%, real growth in the economy is only 1%. If GDP grows at 3% but the rate of inflation is 5%, there will be 'negative growth' of about 2% in real terms (i.e. GDP will be about 2% less in real terms than in the previous year).

The government will be concerned about inflation for two reasons:

- It will want to achieve real growth in national income each year, not simply growth in 'money' terms.
- A high rate of inflation can have harmful effects on the economy and lead eventually to a fall in the rate of economic growth (and possibly economic recession).

There are several reasons why the government will try to prevent excessive inflation.

- Inflation results in a transfer of wealth within the economy in ways that might be considered unfair. Individuals on fixed incomes, such as many people with fixed pensions, will find that the real value of their income falls each year. Other members of society, such as owners of property, might benefit from rising asset prices.
- Inflation creates pressure for general cost increases. Employees will demand higher annual pay rises if the rate of inflation is rising. Higher employment costs might force employers to put up the prices of their goods and services, and at the same time avoid as many extra costs as possible – by making some workers redundant, perhaps, or by deferring investment spending.
- Experience has shown that a high rate of inflation, and high inflationary expectations, has the effect eventually of reducing real growth in the economy.

For the government, an economic policy objective to support the aims of growth in national income and full employment might therefore be to limit the rate of annual price inflation.

1.3 Economic policy

A government uses economic policy to try to influence economic conditions, with the objective of achieving sustained growth and full employment and restricting the rate of inflation. There are two main aspects of economic policy:

- fiscal policy and
- monetary policy.

1.4 Fiscal policy and its effect on business

Fiscal policy relates to government spending, taxation and borrowing.

The central government spends enormous amounts of money every year, and higher government spending increases GDP. However, government spending has to be financed, and the money is obtained from:

- taxation, and
- borrowing.

When the government plans an increase in its spending programme, it will probably seek to finance the higher spending, in full or in part, through higher taxation. Taxation is raised from a variety of sources, but the main sources of tax income are likely to be:

- the taxation of income of individuals
- the taxation of profits of companies
- indirect taxation on expenditure, in the form of a sales tax or value added tax.

When the government spends more than it raises in taxes, it has to borrow the difference. In advanced economies, the main sources of borrowing for the government are:

- to obtain long-term finance, to issue government bonds (known as Treasuries in the US and gilt-edged securities or gilts in the UK)
- also to obtain long-term finance, the government might offer savings and investment schemes to individuals. (In the UK, these are operated by the National Savings Bank)
- to obtain short-term funding, to issue short-term financial instruments known as Treasury bills. (Treasury bills are a form of short term borrowing because the borrowed money is repaid when the bills are 'redeemed', usually after 91 days.)

Fiscal policy and business

Fiscal policy affects business in a variety of ways.

- Companies might try to minimize their tax liabilities, possibly by transferring business operations to low-tax countries.
- The investment decisions by companies could be affected by tax. For example, the government might offer some tax relief for new investments, and companies will expect to receive tax allowances for capital investment.
- Spending decisions by customers could be affected by the rate of sales tax or value added tax. If the government increases the rate of value added tax, the volume of customer demand for the goods and services of companies will probably fall.
- Other tax changes can affect the rate of growth in the economy. For example, an increase in rates of income tax on individuals will reduce their spending ability.

If the government borrows by issuing bonds, investors will be attracted by the risk-free nature of investing in the bonds. (These bonds are regarded as risk-free because the government is most unlikely to default on its debts, especially when the debt is

denominated in the national currency. If it needs to it can print more money to pay off its debts.)

Government borrowing might affect borrowing by companies. If companies also want to borrow by issuing bonds, they will need to offer a higher rate of interest to investors than the interest rate on government bonds, to persuade them to put their money in risky corporate bonds rather than risk-free government bonds.

1.5 Monetary policy and inflation

Monetary policy is policy relating to monetary issues in the economy, in particular:

- the rate of inflation
- interest rates
- the exchange rate for the domestic currency against foreign currencies.

As explained earlier, there is a link between economic growth and the rate of inflation. Excessive inflation is associated with an 'over-heating' economy, leading to a slow-down in economic growth and possibly economic recession.

A major target of the government's monetary policy is likely to be control over inflation. This is currently the main objective of monetary policy, for example, in the US, the eurozone countries and the UK. In these countries, interest rate policy is the main instrument of economic policy for controlling the rate of inflation.

The link between interest rates and the rate of inflation can be summarised as follows.

In order to reduce the rate of inflation in the long term it is essential to reduce general expectations about what the future rate of inflation will be. Inflation will increase when inflationary expectations are high.

To reduce inflationary expectations, the authorities must be seen to take action to reduce inflationary pressures whenever these become evident. In the UK, USA and eurozone, the 'authorities' are the central bank.

The central bank can take action by raising the rate of interest at which it lends money to other banks. This rate of interest is sometimes called the 'central bank base rate'.

There is a 'transmission effect' in the economy, whereby the effect of the increase in the base rate works its way through to the rest of the economy. If banks have to pay more to borrow from the central bank, they will put up their interest rates to borrowers. In time higher costs of borrowing might reduce the demand by companies and individuals to borrow, and this in turn might reduce consumption spending.

- If spending in the economy is rising too quickly, and there is a risk of inflation, interest rates should therefore be raised. Higher interest rates will eventually discourage borrowing and the growth in credit, and so restrict the growth in spending
- If on the other hand the economy could grow more quickly without the threat of inflation, interest rates might be lowered, to stimulate spending and investment.

For companies, the implications of interest rate policy are perhaps fairly clear. If the central bank alters its rate of interest on lending to banks, this is likely to affect the rate at which companies can borrow from banks, and changes in the cost of borrowing might affect investment decisions.

1.6 Monetary policy and the exchange rate

Monetary policy can also affect the value of a country's currency. In general terms:

- higher interest rates are likely to attract more investors into buying investments in the currency, and
- lower interest is likely to persuade investors to sell their investments in the currency.

Changes in interest rates, by affecting supply and demand for the currency, can therefore alter its exchange rate value.

It would be possible for the government or central bank to make the exchange rate a key economic policy target, possibly with the aim of stabilising the value of the currency and encouraging international trade. However if the authorities use interest rates to manage the value of the country's currency in the foreign exchange markets, interest rate policy cannot be used at the same time as a policy weapon for controlling inflation.

1.7 Monetary policy and business

Businesses might be affected by the monetary policies of the government in a variety of ways.

- In the long term, businesses benefit from government control over the rate of inflation and restricted rises in prices, because real economic growth is likely to be greater.
- Changes in interest rates affect the cost of borrowing, and so profits. Higher interest rates on long-term finance might deter companies from making some new investments, which will result in a reduction in their capital spending.
- Changes in interest rates might affect spending by customers. For example, higher interest rates might reduce consumer spending, and so make it more difficult for companies to sell their goods and services.
- Changes in the exchange rate affect companies that sell goods to other countries or buy from suppliers in other countries.
 - If there is a fall in the value of the currency, the products of exporting companies become cheaper to foreign buyers and export demand should increase. However, the cost of imported goods, priced in other currencies, will rise. This could lead to an inflationary spiral as higher costs lead to higher prices and higher wage demands.
 - If there is an increase in the value of the currency, the products of exporting companies become more expensive to foreign buyers and export demand is likely to fall. The cost of imported goods, priced in other currencies, will fall. This will reduce the costs for companies of purchases from abroad, but could also increase the market competition from imported goods.

In your examination, you might be required to consider the implications for a company of a change in economic conditions, or a change in economic policy by the government, by considering how a company might be affected by the change and respond to it.

1.8 Other influences of government on business

Government can influence the activities and performance of businesses in other ways, in addition to the effects of fiscal policy and monetary policy. The study guide for the F9 Financial Management syllabus refers to four specific areas where planning and decision-making by companies might be affected by government policy and regulation:

- Competition policy
- Government assistance for business
- Green policies
- Corporate governance regulations

1.9 Competition policy

The government might have laws or regulations for preventing anti-competitive actions by companies.

There might be rules preventing the creation of 'monopolies'. A monopoly is a company that is so large that it dominates the industry and market in which it operates.

There are some advantages for society in having monopolies, when a company needs to be very large in order to benefit fully from 'economies of scale' that reduce the costs of output products or services. Some of the benefits of lower costs for the producer might be passed on to customers in the form of lower prices. It has been argued that monopoly supply is necessary in utility industries, such as the provision of water, gas and electricity supplies.

Adverse consequences of monopoly

Monopolies are often considered 'undesirable' because they are often able to control prices and output of goods and services to a market. For example, a monopoly might be able to restrict the supply of goods or a service to a market, and in doing so might be able to raise prices. This will boost the company's profits at the expense of its customers. In a more competitive market, supply is not restricted and prices are more competitive and 'fair'.

It is also possible that when a company holds a monopoly position in its market, it has no incentive to innovate and develop new products, because there is no competition creating pressures for product development. There is also no incentive to improve managerial and operational efficiency in a monopoly.

Government regulation of monopolies

A government might try to regulate and control monopolies and other anti-competitive behaviour by companies in several ways.

- One way of regulating monopolies is to establish a government body with the power to investigate and, if necessary, prevent proposed mergers or takeovers. Proposed mergers or takeovers that would create a monopoly might be prohibited, or allowed subject to certain conditions (such as a requirement that the merged company must sell off parts of its business to prevent the creation of a monopoly).
- In addition, if a company grows to such a large size that it might become a monopoly the government might order that the company should be broken up into several smaller companies.

The government might also prohibit anti-competitive practices by companies, and give a government body powers to investigate cases where anti-competitive practices are suspected. An example of such a practice is a **cartel arrangement** between companies, whereby all the companies in the cartel reach a secret agreement to:

- restrict the supply of goods to the market, and 'divide' the market between themselves in agreed shares, and
- control the prices charged to customers by charging the same price and avoiding price competition.

In the UK, the Competition Commission has powers to investigate proposed mergers and takeovers, existing monopolies and suspected cartel arrangements. In some cases, UK companies might be deterred from making a takeover bid for a rival company because of the expectation that the takeover will be investigated and then prohibited by the Competition Commission.

1.10 Government assistance for business

The government might provide aid to companies in particular industries, or companies investing in particular parts of the country (such as development areas).

- Cash grants might persuade a company to invest in a country or region where they are available, rather than in other areas where they are not.
- In some cases, there might be competition between the development agencies in different countries to offer grants to foreign companies in order to persuade them to invest in their country.

1.11 Green policies

Companies might make profits because they do not have to take account of the full economic cost of their activities. The economic cost of business activity includes not only the direct costs of the business operations but also social costs. Social costs include the costs of damage to the environment and the costs of having to clean up waste and pollution created by business activities. These costs created by companies are sometimes referred to as '**externalities**'.

Many of these social costs are paid for by government, and so are paid by the taxpayer, but there is a growing recognition of these costs in some countries, where the government has developed 'green policies' aimed at either:

- reducing the amount of social costs or externalities, or
- making companies pay for the social costs they incur.

The government might therefore have a range of 'green' policies for the protection of the environment and promotion of 'sustainable business'. These include policies for:

- the prevention or reduction of pollution of the air, land or water (rivers and seas)
- protection of natural resources such as deep sea fish stocks or hardwood timber forests
- the development of 'cleaner' and environmentally-friendly energy sources.

Many companies have been directly affected by 'green policy' legislation or regulations, and it seems inevitable that regulation will become more extensive and more restrictive over time, and that companies will react to the new regulations in the most appropriate way to protect their interests. Examples of ways in which companies might need to react include:

- investing in technology that reduces pollution from factories and other manufacturing centres
- developing products or packaging that are more 'environmentally friendly, such as robust biodegradable packaging materials
- trading in 'carbon credits' in industries where these apply. Companies that create excessive levels of pollution might be able to avoid fines or penalties from the government by purchasing carbon credits in the market (a market that has been in existence for only a few years so far).

In addition if companies have to pay for the environmental costs they incur, these costs will be reflected in product prices charged by the companies. Product prices should therefore reflect more fairly their full economic cost.

1.12 Corporate governance regulations

The issues involved in corporate governance have been described earlier. It is with noting, however, that the government might respond to serious financial mismanagement in companies with more regulation and restrictions on corporate activity.

Bad corporate governance might result in financial mismanagement which then might lead on to a corporate scandal and possibly the collapse of the company. The initial demand for better corporate governance in the UK was prompted by financial scandals in several companies, including the Mirror Group Newspapers and Polly Peck International in the 1980s, which threatened to destroy investor confidence in the stock market. Similarly the Sarbanes-Oxley Act was passed in the USA in 2002 as a result of several corporate scandals, including Enron and WorldCom, two of the largest corporations in the world at the time. The aim of the legislation was not only to prevent similar scandals in the future, but to restore confidence to the stock markets.

At the time of revising this text, there are pressures for greater regulation of banks, particularly in the USA and Europe, following the 'sub-prime mortgage' lending scandal in 2007, as a result of which banks lost billions of dollars and some required financial support from the authorities or had to raise new equity finance to restore

their capital. There is a view that stricter regulation is needed to restore confidence and liquidity in the lending markets.

The financial management framework

- Businesses and sources of finance
- Financial intermediaries
- Capital markets and money markets

2 The financial management framework

2.1 Businesses and sources of finance

Businesses raise new finance to invest. Long-term finance is needed to invest in long-term assets and working capital. Short-term finance might be needed to help with cash flow problems, and to ensure that the entity has enough funds to pay its suppliers and liabilities on time. Finance has a cost, because the providers of finance to a company expect a return on their investment.

Financial management involves deciding how to raise additional finance, and for how long, and ensuring that the providers of finance receive the returns to which they are either entitled (in the case of lenders) or which they expect (in the case of shareholders). Financial managers therefore need to have an understanding of the financial markets.

The main sources of new finance for companies include:

- banks which might provide short-term lending facilities such as an overdraft or longer-term loan
- the capital markets
- the money markets.

2.2 Financial intermediaries

Borrowers of finance include companies, governments and individuals that need to raise money. Providers of finance are individuals, companies and other organisations with surplus funds to invest. Although it is possible for borrowers to obtain funding directly from an investor, it is usual for borrowers and investors/lenders to be brought together by financial intermediaries in the financial markets.

A financial intermediary is a person or organisation that operates between savers (investors) and borrowers. Their role is to re-direct the funds of savers and investors to the individuals and organisations that need to obtain finance.

Without financial intermediaries, it would be difficult for businesses to find individuals willing to provide all the money they need, for the length of time that they need it and at a cost they are willing to pay.

Banks as financial intermediaries

Banks are financial intermediaries. They take deposits from customers, and lend this money to other customers in the form of bank loans and bank overdrafts. If a company needs to borrow, it can go to a bank (the intermediary), instead of having to find an individual or an organisation with spare funds for lending.

Banks are important financial intermediaries because:

- they are a major source of debt finance for many companies and individuals
- they also create new credit.

The role of banks in credit creation is unique. Suppose that banks receive new customer deposits of \$1 million. The banks can re-lend some of this money, but will hold some in the form of cash or near-cash investments, to cover the possibility that some of the deposits will be withdrawn. When banks lend money, this money becomes new customer bank deposits. In other words, by lending money, banks create more bank deposits, which can be lent. The new money that is lent becomes more new bank deposits, which can also be lent.

In performing an intermediary role, banks perform several functions.

- They are able to accept small deposits from customers and lend in much larger amounts to borrowers. Without banks, loans in large amounts would be difficult to obtain.
- Banks also to provide **maturity transformation**. Many bank deposits are short-term in nature and deposits can be withdrawn on demand or by giving only short notice. On the other hand, many borrowers want loans for several years – far longer than most customers are willing to keep deposits or savings accounts. Banks are able to accept short-term deposits and lend to borrowers over longer terms. In other words, short-term deposits are transformed by banks into longer-term loans.
- Banks also provide **risk transformation** for savers. If an individual lent money directly to a borrower, the individual would be faced with the risk of default by the borrower. However, if an individual deposits money with a bank and the bank re-lends the money to a borrower, the bank would be exposed to the credit risk from the borrower. The individual's credit risk would be limited to the risk of insolvency of the bank. Generally, this risk is much lower.

Banks are an important source of finance for all types of business and all sizes of business. In the case of small businesses, bank loans and overdrafts (and possibly lease finance) are the only readily-available source of borrowed capital.

Other financial intermediaries

The term 'financial intermediary' can be used to describe any person or organisation that brings together investors and individuals or organisations seeking to raise funds. In this sense, financial intermediaries include:

- some investment banks and commercial banks, that deal in the capital markets with investors (buying and selling shares or bonds in the 'secondary' markets)
- stock markets, which provide a market place for trading in shares.

The financial markets

- Domestic and international equity and bond markets: the capital markets
- The money markets
- The trade-off between risk and return

3 The financial markets

The financial markets bring together organisations and individuals wishing to obtain finance and organisations and individuals wishing to invest.

In addition to the bank lending markets, the financial markets can be classified as capital markets or money markets. The capital markets can be classified into:

- equity markets, and
- bond markets.

3.1 Domestic and international equity and bond markets: the capital markets

Capital markets are financial markets for primary issues and secondary market trading in long-term investments: equities and bonds. The capital markets are both national ('domestic') and international.

Many countries have at least one stock market. Although some bonds might be traded on stock markets, the main purpose of stock markets is to trade in shares of companies.

There is a **primary market** and a **secondary market** for shares.

- The primary market is used by companies to sell shares to investors for the first time, for example by issuing new shares to raise cash. The primary capital markets are therefore a source of new long-term capital for companies, governments and other organisations.
- The secondary market is used by investors to sell shares that they own, or to buy shares that are already in issue.

A successful primary market relies on a large and liquid secondary market, because when investors buy shares in the primary market, they want to know that they can sell their investment at any time at a fair market price.

Functions of a stock market

A stock market is a market place for buying and selling shares in companies that apply to have their shares traded on the exchange and whose application is accepted. It acts as both a primary market and a secondary market for shares.

In the UK, companies must obtain a listing for their shares from the financial services regulator, and also apply to have their shares traded on the stock exchange.

The major stock exchanges trade shares of domestic companies (companies registered in the same country) but also the shares of some international companies. For example, many UK companies have their shares traded both in the UK (on the London Stock Exchange) and in the US (for example, on the New York Stock Exchange).

The **international stock markets** therefore consist mainly of national stock exchanges that also trade shares of some foreign companies. However the New York Stock Exchange owns Euronext which in turn owns the national stock exchanges of France, Belgium and the Netherlands.

The main functions of a stock exchange are to:

- provide a system in which shares can be traded in a regulated manner
- enforce rules of business conduct on market participants, to ensure fair dealing
- ensure that there is an efficient system for providing new financial information about companies to investors in the market
- provide a system for recording information about the prices at which shares are bought and sold, and providing share price information to participants in the market.

The bond markets

There are also **domestic bond markets**. Bonds are debt instruments issued by governments, government agencies, international organisations and companies. Most bonds are issued for a fixed period of time (maturity) after which they are redeemed by the issuer, usually at their face value. During the time they are in issue, the issuer pays interest to the bondholders, usually once, twice or quarterly in each year at a fixed rate of interest. For example, a government might issue \$100 million of 6% Treasury Stock with a maturity of 15 years. It would pay interest of \$6 million in each year to the investors in the bonds (the bondholders) and redeem the bonds at the end of 15 years for \$100 million. Investors can trade the bonds in a secondary bond market, and so invest or disinvest at any time of their choosing.

In the US, the largest bond market is for US government bonds (Treasuries), but there is also a large and active market for corporate bonds, which are bonds issued by companies. In the UK, there is a large bond market for UK government bonds (gilts) but only a very small domestic market for corporate bonds.

There are **international bond markets**. (At one time, these bond markets were called the 'eurobond markets'.) The international bond markets are used by large companies, governments and international organisations to issue bonds, usually in a major currency (US dollars or euros). The markets are organised by international investment banks. These banks advise issuers and organise the selling of the bonds to investors.

International bonds are also traded in a secondary market, although much of the trading is arranged by telephone and e-mail. There is also an electronic trading platform for trading bonds electronically.

The bond markets are not accessible to small companies. The international bond markets are used by governments and very large companies to issue bonds denominated mainly in either US dollars or euros (although bonds in other currencies such as Japanese yen, Swiss francs or British pounds might occasionally be issued). Smaller non-US companies are able to borrow in the US corporate bond market, by issuing bonds denominated in dollars. However, foreign companies need to be fairly large and well-established to persuade US investors to buy their bonds.

3.2 The money markets

Money markets are for trading in financial instruments with a much shorter maturity. As a general guide, the maturity of instruments in the money markets is not usually longer than one year, but the maturity of many transactions and instruments is less than three months, even 'overnight'.

Examples of money market transactions and instruments are as follows:

- the interbank market
- Treasury bills
- Certificates of Deposit (CDs)
- the repo market.

Interbank market

The interbank market describes large-scale short-term lending and borrowing between banks. Large-scale lending is known as 'wholesale lending'. Banks with a short-term funding deficit will borrow from banks with a short-term surplus. Interest rates in the interbank market are significant, because when most large companies borrow from banks, they usually pay a floating rate of interest (a variable interest rate) that is linked to the benchmark interest rate in the money market. In the UK, the benchmark interbank rate is called the London Inter-bank Offered Rate or LIBOR, and there is a LIBOR rate for different maturities of lending, such as seven-day LIBOR, one-month LIBOR, three month LIBOR, six-month LIBOR and so on. A company might arrange to borrow from its bank at, say, the three-month LIBOR rate plus 1%, with interest payable every three months.

Interbank lending can be in a variety of currencies but predominantly US dollars and euros.

Treasury bills

There is a market for Treasury bills and other bills of exchange, particularly bills of exchange payable by banks (bank bills). A bill of exchange is a financial instrument acknowledging a short-term debt. The buyer of a bill or holder of a bill can hold the bill until maturity, when it should be redeemed. Alternatively, the bill holder can sell the bill in a secondary market before maturity. Bills are redeemable at face value (at 'par') and do not pay interest; therefore their market value is always below their redemption value/face value. The bills are traded at a discount, and the market for bills is known as the **discount market**.

Certificates of Deposit (CDs)

There is also a money market for Certificates of Deposit (CDs). A CD is a financial instrument issued by a bank, acknowledging that the bank is holding a short-term bank deposit on which interest is being earned. At the end of the deposit period, the holder of the CD is entitled to take the deposit with interest. A company placing a deposit with a bank for a fixed short term, say six months, can ask the bank to provide it with a CD; if the company subsequently needs the cash before the end of the deposit period, it can sell the CD in the secondary market. The advantage of a CD for the bank is that it can hold onto the deposit for the full period to maturity, even if the original depositor needs cash earlier.

Repo market

The repo market is a market for the sale and repurchase of short-term financial instruments, in particular Treasury bills, government bonds with a very short time remaining to maturity and some bank bills. A repo transaction is the simultaneous agreement to sell a quantity of financial instruments and to buy them back again at a later date, say 14 days later, at a higher price. The difference between the sale and the repurchase price represents, in effect, interest on a cash loan secured by the financial instruments in the transaction. This is the money market used by central banks to manage the interest rate.

3.3 The trade-off between risk and return

When investors put money into financial investments, they expect to receive a return on their investment. In most cases, they also expect to accept some investment risk. Investment risk is the risk that returns will not be as high as expected.

For example:

- an investment might fall in value, as well as rise in value; for example, shares can go up or down in price
- the investment will lose all its value, for example if a company goes into liquidation, there is a risk that shareholders will lose their entire investment
- borrowers will not repay what they owe in full or on time. For example, if a company goes into liquidation, its bondholders will not be repaid in full, although there might be some receipts from the sell-off of the collapsed company's assets.
- Investors in bonds rely on the creditworthiness of the bond issuer. Some bond issuers are more creditworthy than others, and so the investment is less risky.

In the case of equities, investors buy shares hoping for some dividends out of the profits each year, and for some increase over time in the share price. Equity returns are therefore a combination of dividends and capital gain. However, unprofitable companies might pay no dividends, and share prices might fall. Equity investors can therefore face a substantial risk of negative returns.

As a general rule, investors will demand a higher return for putting their money into higher-risk investments. Each investor has his own preference for risk and returns, and will build an investment portfolio that appears to provide a suitable balance or 'trade-off' between risk and return.

A guide to the risk in capital instruments is as follows:

Highest risk	Equities	<ul style="list-style-type: none"> ■ Risk of lower dividends and a falling share price. ■ If the company goes into liquidation, equity shareholders are the last in line for payment from the sale of the company's assets. ■ Shareholders are not entitled to any dividend unless there are distributed profits available after paying all interest obligations and any dividend payment obligations to preference shareholders.
High risk	Junk bonds	<ul style="list-style-type: none"> ■ Bonds issued by companies that are considered a high credit risk. Junk bonds have a 'sub-investment grade' credit rating. A high interest yield is required to compensate investors for the high risk of default.
	Corporate bonds with an investment grade rating	<ul style="list-style-type: none"> ■ Bonds issued by companies with a higher credit rating are 'investment grade rating'. Top-rated bonds are 'triple-A rated' (credit rating AAA). ■ The better the credit rating, the lower the credit risk and the lower the yield paid to bondholders.
Low risk	Government bonds	<ul style="list-style-type: none"> ■ Bonds issued by a government in their own currency, such as gilts issued by the UK government or Treasuries issued by the US government, are considered risk-free. Investors consider the risk of default by the issuer to be zero. ■ The interest yield on domestic government bonds of a government in a stable economy is therefore considered 'risk free'. In financial management, we refer to this interest yield as the 'risk-free rate of return'.

The same principle applies to interest rates on bank loans. Banks will charge a higher rate of interest on loans where they consider the credit risk to be higher. Therefore:

- the interest rate on secured loans will be lower than the rate for unsecured loans to the same borrower
- the interest rate on a subordinated loan will be higher than the rate on a senior loan to the same borrower. (A subordinated loan ranks below a senior loan in the right to payment of interest, and the right to repayment out of selling the borrower's assets in the event of the borrower's default and liquidation).

Financial managers should be interested in risk and return in financial investments, and the risks and returns from the financial markets (for example, the equity markets) as a whole. However, financial managers do not concern themselves with the investment decisions of investors, and how individual investors make the trade-off between risk and return in their personal investment portfolio.

Separating the risk and return characteristics of market investments from the individual investment decisions of investors (and their individual preferences for risk and return) is known as the **Separation Theorem**.

Working capital management

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Financing working capital

- The nature and elements of working capital
- The objectives of working capital management
- Investment in working capital
- Determining the level of working capital investment
- Financing working capital: short-term or long-term finance

1 Financing working capital

1.1 The nature and elements of working capital

Working capital is the capital (finance) that an entity needs to support its everyday operations. To operate a business, an entity must invest in inventories and it must sell its goods or services on credit. Holding inventories and selling on credit costs money.

Some of the finance required for operations is provided by taking credit from suppliers. This means that the suppliers to an entity are helping to support the business operations of that entity. Some short-term operating finance might also be obtained by having a bank overdraft.

Cash and short-term investments are also elements of working capital. Some cash might be held for operational use, to pay liabilities. Surplus cash in excess of operational requirements might be invested short-term to earn some interest.

Working capital can therefore be defined as the net current assets (or net current operating assets) of a business.

The total investment in working capital is calculated as:

	\$	\$
<hr/>		
Current assets:		
Inventory		X
Trade receivables		X
Short-term investments		X
Cash		X
		<hr style="width: 50%; margin-left: auto; margin-right: 0;"/>
		X
Minus current liabilities:		
Bank overdraft	(X)	
Trade payables	(X)	
Other current liabilities	(X)	
		<hr style="width: 50%; margin-left: auto; margin-right: 0;"/>
		(X)
Investment in working capital		<hr style="width: 50%; margin-left: auto; margin-right: 0;"/>
		X

Working capital is financed by long-term capital.

1.2 The objectives of working capital management

The management of working capital is an aspect of financial management, and is concerned with:

- ensuring that the investment in working capital is not excessive
- ensuring that enough working capital is available to support operating activities.

Note on surplus cash and short-term investments. For entities with surplus cash, there is also the management problem of how to use the surplus. If the surplus is only temporary, it might be invested in short-term financial assets. The aim should be to select investments that provide a suitable return without undue risk, and that can be converted back into cash without difficulty when the money is eventually required. The management of surplus cash is discussed in more detail in a later chapter.

Avoiding excessive working capital

An aim of working capital management should be to avoid excessive investment in working capital. As stated earlier, working capital is financed by long-term capital (equity or debt) which has a cost.

It can be argued that it is essential to hold inventory and to offer credit to customers, so investment in current assets is unavoidable. However, the investment in inventory and trade receivables does not provide any additional financial return. So investment in working capital has a cost without providing any direct financial return.

Avoiding liquidity problems

On the other hand, a shortage of working capital might result in liquidity problems due to having insufficient operational cash flows to pay liabilities when payment is due. Operational cash flows come into a business from the sale of inventories and payment by customers: inventory and trade receivables are therefore a source of future cash income. These must be sufficient for the payment of liabilities.

A company that has insufficient working capital might find that it has to make payments to suppliers (or other short-term liabilities) but does not have enough cash or bank overdraft facility to do so, because its current assets are insufficient to generate the cash inflows that are needed and when payment falls due. Liquidity problems, when serious, can result in insolvency.

The conflict of objectives with working capital management

A conflict of objectives therefore exists with working capital management. Over-investment should be avoided, because it reduces profits or returns to shareholders. Under-investment should be avoided because it creates a liquidity risk. These issues are explained in more detail below.

1.3 Investment in working capital

The total amount that an entity invests in working capital should be managed carefully.

- The investment should not be too high, with excessive inventories and trade receivables. If the investment is too high, the entity is incurring a cost (the interest cost of the investment) without obtaining any benefits.
- The investment should not be too low. In particular the entity should not rely, for its financing of operations, on large amounts of trade credit from suppliers or a large bank overdraft. If working capital is too low, there could be a risk of having insufficient cash and liquidity.

The amount to invest in working capital depends on the trade-off between:

- the benefits of having sufficient finance to support trading operations without excessive liquidity risk, and
- the costs of financing the working capital.

Benefits of investing in working capital

There are significant benefits of investing in working capital:

- Holding inventory allows the entity to supply its customers on demand.
- Entities are expected by many customers to sell to them on credit. Unless customers are given credit (which means having to invest trade receivables) they will buy instead from competitors who will offer credit.
- It is also useful for an entity to have some cash in the bank to meet demands for immediate payment.

Disadvantages of excessive investment in working capital

However, money tied up in inventories, trade receivables and a current bank account earns nothing. Investing in working capital therefore involves a cost. The cost of investing in working capital is the reduction in profit that results from the money being invested in inventories, receivables or cash in the bank account, rather than being invested in wealth-producing assets and long-term projects.

The cost of investing in working capital can be stated simply as:

Average investment in working capital × Annual cost of finance (%)

= Annual cost of working capital investment.

1.4 Determining the level of working capital investment

The target level of working capital investment in an organisation is a policy decision which is dependent on several factors including;

- the length of the working capital cycle
- management attitude to risk

The length of the working capital cycle

Different industries will have different working capital requirements. The working capital cycle measures the time taken from the payment made to suppliers of raw materials to the payments received from customers. In a manufacturing company this will include the time that:

- raw materials are held in inventory before they are used in production
- the product takes in the production process
- finished goods are held in inventory before being purchased by a customer.

The working capital cycle will also be affected by the **terms of trade**. This is the amount of credit given to customers compared to the credit taken from suppliers. In a manufacturing company it may be normal practise to give customers lengthy periods of credit.

The level of working capital in manufacturing industry is therefore likely to be higher than in retailing where goods are bought in for re-sale and may not be held in inventory for a very long period and where most sales are for cash rather than on credit terms.

Management attitude to risk

High levels of working capital are expensive but low levels of working capital are high risk.

- An aggressive working capital policy will seek to keep working capital to a minimum. Low finished goods inventory will run the risk that customers will not be supplied and will instead buy from competitors. Low raw material inventory may lead to stock-outs (or 'inventory-outs') and therefore high costs of idle time or expensive replacement suppliers having to be found. Tight credit control may alienate customers and taking long periods of credit from suppliers may run the risk of them refusing to supply on credit at all. However low levels of working capital will be cheap to finance and if managed effectively could increase profitability.
- A conservative working capital policy aims to keep adequate working capital for the organisation's needs. Inventories are held at a level to ensure customers will be supplied and stock-outs will not occur. Generous terms are given to customers which may attract more customers. Suppliers are paid on time.

Risk-seeking managers may prefer to follow a more aggressive working capital policy and risk-averse managers a more conservative working capital policy.

1.5 Financing working capital: short-term or long-term finance?

Working capital may be permanent or fluctuating.

- **Permanent working capital** refers to the minimum level of working capital which is required all of the time. It includes minimum levels of inventories, trade receivables and trade payables.
- **Fluctuating working capital** refers to working capital which is required at certain times in the trade cycle. For example it may be economic for companies to purchase raw materials in bulk. The finance required to fund the purchase of the order will be a temporary requirement because eventually the raw material

will be made into a product and sold to customers. The levels of fluctuating working capital may be higher if companies have seasonal demand. For example manufacturers of ski-ing equipment might build up inventories of products before the winter season.

Long-term finance, such as equity and debt, is expensive but low risk. Short-term finance is less expensive but there is a higher risk of it being withdrawn. The type of financing used within the business may depend on management attitude to risk.

- **Aggressive funding policies** use long-term finance to fund non-current assets and short-term finance to fund all working capital requirements
- **Matching funding policies** use long-term finance to fund non-current assets and permanent working capital. Fluctuating working capital is funded using short-term finance.
- **Conservative funding policies** use long-term finance to fund non-current assets, permanent working capital and a proportion of fluctuating working capital. Minimal short-term finance is used.

Entity 1		Entity 2	
<i>Assets</i>	<i>Equity and liabilities</i>	<i>Assets</i>	<i>Equity and liabilities</i>
Non-current assets	Long-term finance	Non-current assets	Long-term finance
Current assets	Current liabilities	Current assets	Current liabilities

Entity 1: An aggressive funding policy. Most of the current assets are financed by current liabilities (short-term finance). Short-term finance is generally cheaper than long-term finance, because trade payables do not have any obvious cost. (However, bank overdraft costs can be high). Therefore, an entity can save money, in theory, by financing its current assets mainly from current liabilities.

Entity 2: A conservative funding policy. The entity is financing most of its current assets with long-term finance. Potentially, this will reduce profitability due to the higher cost of financing. However, the liquidity risk to Entity 2 should be much less than for Entity 1.

The benefits of using short-term finance (trade payables and a bank overdraft) rather than long-term finance are as follows:

- **Lower cost.** Trade credit is the cheapest form of short-term finance – it costs nothing. The supplier has provided goods or services but the entity has not yet had to pay.
- **Much more flexible.** A bank overdraft is variable in size, and is only used when needed.

However, although there are the benefits of low cost and flexibility with short-term finance, there are also risks in relying too much on short-term finance.

- Short-term finance runs out more quickly and has to be renewed. Suppliers must be asked for trade credit every time goods or services are bought from them.
- A bank overdraft facility is risky, because the bank has the right to demand immediate repayment of an overdraft at any time. When an entity needs a higher bank overdraft, this can often be the time that the bank decides to withdraw the overdraft facility.

Cash operating cycle

- The nature of the cash operating cycle
- Elements in the cash operating cycle
- Calculating the inventory turnover period
- Calculating the average collection period
- Calculating the average payables period
- Analysing the cash operating cycle
- Changes in the cash flow cycle and implications for operating cash flow

2 Cash operating cycle

2.1 The nature of the cash operating cycle

An important way of assessing the adequacy of working capital and the efficiency of working capital management is to calculate the length of the cash operating cycle, also called the working capital cycle. This cycle is the average length of time from:

- paying suppliers for goods and services received, to
- receiving cash from customers for sales of finished goods or services.

The cash operating cycle is linked to the business operating cycle. A business operating cycle is the average length of time between obtaining goods and services from suppliers to selling the finished goods to suppliers.

A cash operating cycle differs significantly for different types of business. For example, a company in a service industry such as a holiday tour operator does not have much inventory, and it might collect payments for holidays from customers in advance. The time between paying suppliers and receiving cash from customers might be very short.

In contrast a manufacturing company might have to hold large inventories of raw materials and components, work in progress and finished goods, and most of its sales will be on credit so that it has substantial trade receivables too. The time between paying for raw materials and eventually receiving payment for finished goods could be lengthy.

Retail companies have differing cash operating cycles. Major supermarkets have a very short cash operating cycle, because they often sell goods to customers before they have even paid their suppliers for them. This is because supermarkets enjoy very fast turnover of most items and their sales are for cash. In contrast a furniture retailer might hold inventory for a much longer time before selling it, and some customers might arrange to pay for their purchases in instalments.

Cash operating cycle and working capital requirements

The cash operating cycle is a key factor in deciding the minimum amount of working capital required by a company. A longer cash operating cycle means a larger investment in working capital.

The cash operating cycle, and each of the elements in the cycle, must be managed to ensure that the investment in working capital is not excessive (i.e. the cash cycle is not too long) nor too small (i.e. the cash cycle is too short, perhaps because the credit period taken from suppliers is too long).

2.2 Elements in the the cash operating cycle

There are three main elements in the cash operating cycle:

- The average length of time that inventory is held before it is used or sold
- The average credit period taken from suppliers
- The average length of credit period taken by (or given to) credit customers.

The cash operating cycle can be measured as:	<i>days</i>
Average inventory turnover period	X
Plus: Average time for customers to pay (‘debtor days’ or ‘average collection period’)	X
Minus: Average period of credit taken from suppliers.	(X)
= Cash operating cycle	<u> </u> X

Measuring the cash operating cycle: a manufacturing business

For a manufacturing business, it might be appropriate to calculate the inventory turnover period as the sum of three separate elements:

- the average time raw materials and purchased components are held in inventory before they are issued to production (raw materials inventory turnover period), plus
- the production cycle (which relates to inventories of work-in-progress), plus
- the average time that finished goods are held in inventory before they are sold (finished goods inventory turnover).

2.3 Calculating the inventory turnover period

For a company in the **retail sector** or **service sector** of industry, the average inventory turnover period is normally calculated as follows:

$$\text{Inventory turnover period} = \frac{\text{Average inventory}}{\text{Annual cost of sales}} \times 365 \text{ days}$$

If possible, average inventory should be used to calculate the ratio because the year-end inventory level might not be representative of the average inventory in the

period. Average inventory is usually calculated as the average of the inventory levels at the beginning and end of the period. However, the year-end inventory should be used when opening inventory is not given and average inventory cannot be calculated.

For companies in the retailing or service sector, the cost of sales is normally used 'below the line' in calculating inventory turnover. However, if the value for annual purchases of materials is given, it might be more appropriate to use the figure for purchases instead of cost of sales.

For a **manufacturing company**, the total inventory turnover period is the sum of the raw materials turnover period, production cycle and finished goods turnover period, calculated as follows.

Turnover period for:		Days
Raw material	= (Average raw material inventory / Annual raw material purchases) × 365 days	A
Production cycle	= (Average WIP / Annual cost of sales) × 365 days	B
Finished inventory	= (Average finished inventory / Annual cost of sales) × 365 days	C
Total		<u>A + B + C</u>

Inventory turnover and the turnover period

Inventory turnover is the inverse of the inventory turnover period.

- If the average inventory turnover period is 2 months, this means that inventory is 'turned over' (used) on average six times each year (= 12 months/2 months).
- If the inventory turnover is 8 times each year, we can calculate the average inventory turnover period as 1.5 months (= 12 months/8) or 46 days (= 365 days/8).

2.4 Calculating the average collection period

The average period for collection of receivables can be calculated as follows:

$$\text{Average collection period} = \frac{\text{Average trade receivables}}{\text{Annual sales}} \times 365 \text{ days}$$

When normal credit terms offered to customers are 30 days (i.e. the customer is required to pay within 30 days of the invoice date), the average collection period should be about 30 days. If it exceeds 30 days, this would indicate that some customers are taking longer to pay than they should, and this might indicate inefficient collection procedures for receivables.

2.5 Calculating the average payables period

The average period of credit taken from suppliers before payment of trade payables can be calculated as follows:

$$\text{Average payment period} = \frac{\text{Average trade payables}}{\text{Annual purchases}} \times 365 \text{ days}$$

The average payment period should be close to the normal credit terms offered by suppliers in the industry.

- If the average payment period is much shorter than the industry average, this might suggest that the company has not negotiated reasonable credit terms from suppliers, or that invoices are being paid much sooner than necessary, which is inefficient working capital management.
- If the average payment period is much longer than the industry average, this might indicate that the company has succeeded in obtaining very favourable credit terms from its suppliers. Alternatively, it means that the company is taking much longer credit than it should, and is failing to comply with its credit terms. This might be an indication of either cash flow problems or (possibly) unethical business practice.



Example

Extracts from the statement of financial position (balance sheet) and income statement of a company are set out below.

	\$
<hr/>	
Inventories:	
Raw materials	864,000
Work in progress	448,128
Finished goods	1,567,893
Trade receivables	1,425,600
Trade payables	604,800
Annual purchases	1,745,000
Annual cost of sales	5,272,128
Annual sales	5,802,400

Required

Calculate the length of the cash operating cycle for the company.



Answer

Item		Days
Raw material turnover	$(864,000/1,745,000) \times 365 \text{ days}$	181
Production cycle	$(448,128/5,272,128) \times 365 \text{ days}$	31
Finished goods turnover	$(1,567,893/5,272,128) \times 365 \text{ days}$	109
Credit period given to customers	$(1,425,600/5,802,400) \times 365 \text{ days}$	90
		411

Minus:

Credit period from suppliers	$(604,800/1,745,000) \times 365 \text{ days}$	<u>(127)</u>
Cash operating cycle		<u>284</u>

In this example, it takes the company 284 days on average from paying for the goods and services that go into making its products, before it gets paid the cash from the sales. If the cash cycle gets longer, this would mean having to find ever-increasing amounts to finance the investment in inventory and trade receivables, and it could result in serious cash flow and liquidity problems for the business.

2.6 Analysing the cash operating cycle

The cash operating cycle can be analysed to assess whether the total investment in working capital is too large or possibly too small. The analysis can be made by comparing each element of the cash operating cycle, and the cash operating cycle as a whole, with:

- the cash operating cycle of other companies in the same industry
- the company's own cash operating cycle in previous years, to establish whether it is getting longer or shorter.

Comparisons with other companies in the industry

As a general rule, the inventory turnover period, average collection period and average payment period should be about the same for all companies operating in the same industry. If there are differences, there might be reasons. For example a company with an unusually large proportion of sales to other countries might have a longer average collection period because of the longer time that it takes to deliver goods to customers.

If it is not possible to explain significant differences in any ratio between a company's own turnover periods and the industry average, the differences might be due to inefficient working capital management (or possibly efficient management). For example an unusually long inventory turnover period compared with the industry average might indicate inefficiency due to excessive holding of inventory. Slow-moving inventory might also indicate that a write off of obsolete inventory might be necessary at some time in the near future.

Comparisons with previous years: trends

There might be a noticeable trend over time in a company's turnover ratios from one year to the next. A trend towards longer or shorter turnover and cycle times should be investigated.

A particular cause for concern might be a trend towards longer inventory turnover periods and longer average collection times, which might be an indication of excessive inventories (inefficient inventory management) or inefficient collection procedures for trade payables.



Example

In the financial year just ended, a retailing company had closing inventory costing \$425,000 and sales in the year were \$4.5 million. In the previous year, closing inventory was \$320,000 and sales during that year were \$4.3 million.

In this example, end-of-year inventory levels are used to calculate inventory turnover periods, because average inventory for the previous year cannot be calculated.

- Average inventory turnover in the current year = $\$425,000 / \$4.5 \text{ million} \times 365 = 34$ days.
- Average inventory turnover in the previous year = $\$320,000 / \$4.3 \text{ million} \times 365 = 27$ days.

The average turnover period has increased by 7 days. This might have implications for profitability, as follows.

- If the turnover period had remained 27 days in the current year, closing inventory would be \$333,000 ($= 27/365 \times \4.5 million). This is \$95,000 less than the actual inventory level, suggesting that with better inventory management, working capital might have been lower by about \$95,000.
- If the higher inventory level at the end of the year indicates that it is taking longer to sell inventory, this might suggest that the inventory will not be sold unless the retail company has a sale and the goods are sold at a low gross profit margin.

2.7 Changes in the cash cycle and implications for operating cash flow

When there are changes in the length of the cash operating cycle, this has implications for cash flow as well as working capital investment.

- A longer cash operating cycle, given no change in sales or the cost of sales, increases the total investment in working capital. An increase in the inventory turnover period means more inventory, and an increase in the average collection period means more trade receivables. A reduction in the average payables period means fewer trade payables, which also increases working capital.
- An increase in working capital reduces operational cash flows in the period.

The reverse is also true. A shorter cash operating cycle results in less working capital investment, and the fall in working capital increases operating cash flows in the period.

The link between changes in the cash cycle and operating cash flows can be seen in the statement of cash flows:

Extract from a statement of cash flows	\$
Profit after adjustment for non-cash items such as depreciation	X
Increase in inventory	(X)
Increase in trade receivables	(X)
Reduction in trade payables	<u>(X)</u>
Operating cash flows (before interest and tax payments)	<u>X</u>

An increase in working capital has a direct effect on cash flows by reducing operating cash flows below the level of operating profit by the amount of the increase.

Managing working capital: liquidity

- Liquidity
- Liquidity ratios
- Sales revenue net working capital ratio

3 Other working capital ratios

The previous section explained the cash operating cycle and the relevance of turnover periods for inventory, trade receivables and trade payables for cash flow and the size of investment in working capital.

Other working capital ratios can also be used to analyse whether a company has too much or too little working capital, and whether it has adequate liquidity.

3.1 Liquidity

Liquidity for an entity means having access to sufficient cash to meet all payment obligations when they fall due. The main sources of liquidity for a business are:

- cash flows from operations: a business expects to make its payments for operating expenditures out of the cash that it receives from operations. Cash comes in when customers eventually pay what they owe (and from cash sales)
- holding 'liquid assets': these are assets that are either in the form of cash already (money in a bank account) or are in the form of investments that can be sold quickly and easily for their fair market value
- access to a 'committed' borrowing facility from a bank (a 'revolving credit facility'). Large companies are often able to negotiate an arrangement with a bank whereby they can obtain additional finance whenever they need it.

A key element of managing working capital is to make sure the organisation has sufficient liquidity to meet its payment commitments as they fall due. Having sufficient liquidity is a key to survival in business.

If there is insufficient liquidity, then even if the entity is making profits, it will go out of business. If the entity cannot pay what it owes when the payment is due, legal action will probably be taken to recover the unpaid money and the entity will be put into liquidation. In practice, banks are usually the unpaid creditors who put illiquid entities into liquidation.

The liquidity of a business entity can be assessed by analysing:

- its liquidity ratios and
- the length of its cash operating cycle (explained earlier).

3.2 Liquidity ratios

A liquidity ratio is used to assess the liquidity of a business. There are two liquidity ratios:

- **Current ratio** = Current assets/ Current liabilities; and
- **Quick ratio (or acid test ratio)** = (Current assets – Inventory)/Current liabilities

You should use the values in the **closing balance sheet** to calculate these two ratios.

The purpose of a liquidity ratio is to compare the amount of liquid assets held by a company with its current liabilities. This is because the money to pay the current liabilities should be expected to come from the cash flows generated by the liquid assets.

Unlike the cash operating cycle ratios, the liquidity ratios include all current assets (including cash and short-term investments) and all current liabilities (including any bank overdraft and current tax payable).

Analysing the liquidity ratios

If the liquidity ratios are too high, this indicates that there is too much investment in working capital. If the liquidity ratios are low, this indicates that the company might not have enough liquidity, and might be at risk of being unable to settle its liabilities when they fall due. So how do we assess whether the liquidity ratios are too high or too low.

The liquidity ratios of a company may be compared with:

- the liquidity ratios of other companies in the same industry, to assess whether the company's liquidity ratios are higher or lower than the industry average or norm and
- changes in the company's liquidity ratios over time and whether its current assets are rising or falling in proportion to its current liabilities.

It has sometimes been suggested that there 'ideal liquidity ratios and that:

- the 'ideal' current ratio might be 2:1.
- the 'ideal' quick ratio might be 1:1.

When the ratios are below these 'ideal' levels, management might need to consider how liquidity might be improved.

However, these 'ideal' ratios are only a very general guide.

- The 'normal' or 'acceptable' liquidity ratios vary significantly between different industries. The ideal liquidity ratios depend to a large extent on the 'ideal' or 'normal' turnover periods for inventory, collections and payments to suppliers.
- A high ratio might be attributable to an unusually large holding of cash. When a company has surplus cash or short-term investments, this might be temporary and the company might have plans for how the cash will be used in the near future.

The most appropriate way of using liquidity ratios is probably to monitor changes in the ratio over time. When the ratios fall below a 'safe' level, and continue to fall, the entity might well have a serious liquidity problem.

Note

Which of the two liquidity ratios is more significant? The answer to this question is that it depends on the normal speed of turnover for inventory. If inventory is held only for a short time before it is used or sold, the current ratio is probably a more useful ratio, because inventory is a liquid asset (convertible into cash within a short time).

On the other hand, if inventory is slow moving, and so fairly illiquid, the quick ratio is probably a better guide to an entity's liquidity position.

**Example**

	20X7	20X8	20X9
	\$m	\$m	\$m
Inventory	130	240	225
Trade receivables	245	312	400
Cash	100	54	23
Current assets	475	606	648
Current liabilities	(200)	(300)	(450)
Net current assets	275	306	198

In addition, the following information is available:

Credit sales	1,500	1,530
Cost of goods sold	1,120	1,200

Required

Assess the entity's liquidity position, using:

- inventory turnover time
- the average collection time
- liquidity ratios.

**Answer**

When the information is available, you should use average inventory and average trade receivables for the year, rather than the year-end value. It is assumed that average values for the year are the average of the beginning-of-year and end-of-year values.

Inventory turnover

Average inventory:

$$20X9 = (240 + 225)/2 = 232.5$$

$$20X8 = (130 + 240)/2 = 185.0$$

Inventory turnover:

$$20X9 = (232.5/1,200) \times 365 \text{ days} = 71 \text{ days}$$

$$20X8 = (185/1,120) \times 365 \text{ days} = 60 \text{ days.}$$

Inventory turnover was slower in 20X9 than in 20X8. This could be an indication of problems with inventory management, as well as deteriorating liquidity.

The slower inventory turnover implies that we are not converting the stock to cash as quickly as before. As a result more money is being tied up in working capital.

Average time for customers to pay

Average trade receivables:

$$20X9 = (312 + 400)/2 = 356.0$$

$$20X8 = (245 + 312)/2 = 278.5$$

Average time for credit customers to pay

$$20X9 = (356/1,530) \times 365 \text{ days} = 85 \text{ days}$$

$$20X8 = (278.5/1,500) \times 365 \text{ days} = 68 \text{ days}$$

As with inventory turnover, the payment time for trade receivables is worsening and trade receivables are not converting to cash as quickly as before. This implies that the liquidity position is deteriorating.

Liquidity ratios

Current ratio

	20X7	20X8	20X9
Current assets/current liabilities	475/200	606/300	648/450
	= 2.38 times	= 2.02 times	= 1.44 times

The liquidity position of the business, as measured by the current ratio, has become much worse in 20X9 compared with 20X8 and 20X6. It could well be getting worse continually. Creditor payments were covered by nearly 2.5 times in 20X7. By 20X9, the cover had shrunk to around 1.5 times. This indicates a potential problem for the business, possibly in the near future.

However, before making this judgement you should want to know the reasons for the deterioration in inventory turnover time and the average time for customers to pay, because these will be linked to the deterioration in the current ratio.

Quick ratio

	20X7	20X8	20X9
(Current assets - Inventories)/Current liabilities	345/200	366/300	423/450
	= 1.73 times	= 1.22 times	= 0.94 times

This ratio confirms the analysis. The liquidity position is getting worse. However, a ratio of 0.94 is only just below the 'ideal' quick ratio of 1.0 times; therefore further analysis should be carried out to assess the problem, and what must be done to resolve it. It might be appropriate to prepare a cash flow forecast for the next few months, to assess the possible need for cash in the near future.

3.3 Sales revenue: net working capital ratio

The sales revenue: net working capital ratio is another ratio that might be used to assess whether the investment in working capital is too large or insufficient. This is because it might be assumed that the amount of working capital should be proportional to the value of annual sales, because there should be a certain amount of working capital to 'support' a given quantity of sales.

'Net working capital' is simply total current assets less total current liabilities.



Example

Last year a company had sales revenue of \$20 million. Its average current assets were \$2.8 million and its average current liabilities were \$1.1 million.

Last year its sales: net working capital ratio was 12.5 times. The current average sales: net working capital ratio for other companies in the same industry is 12.4 times.

Current year

Net working capital = \$1.7 million

Sales: net working capital ratio = \$20 million/\$1.7 million = 11.8 times

Analysis

The company's sales: net working capital ratio has fallen since the previous year. It is now below the industry average.

A lower ratio means that working capital is now larger relative to sales revenue. This might be an indication that the investment in working capital is getting too large.

- If the ratio had remained at 12.5, the same as last year, working capital would be \$1.6 million (= \$20 million/12.5). This suggests that working capital might now be about \$100,000 more than necessary.
- If the ratio had been 12.4, the industry average, working capital would be about \$1.61 million (= \$20 million/12.4). This suggests that working capital might now be about \$90,000 more than necessary.

This analysis is not necessarily conclusive, but it might be sufficient to justify a closer investigation into working capital investment, the reasons for the change in the ratio and whether measures might be taken to improve the management of working capital (and in doing so increase the ratio back towards the industry average).

Overtrading

- The meaning of overtrading
- Symptoms of overtrading
- Consequences of overtrading and possible remedial action

4 Overtrading

4.1 The meaning of overtrading

Overtrading means carrying on an excessive volume of trading in relation to the amount of long-term capital invested in the business. A company that is overtrading has inadequate capital for the volume of sales revenue it is earning.

Although it is possible for any business entity to overtrade, it is probably most common in small companies that are now expanding rapidly, with a very high rate of sales growth.

4.2 Symptoms of overtrading

A company that is overtrading will usually show most of the following symptoms.

- A high rate of annual sales growth.
- Low profitability. The company might be reducing its gross profit margin in order to grow sales quickly. As it grows, the company might also incur much higher expenses, such as higher administration costs, which reduce the net profit margin.
- Because profitability is low, retained profits are also low. Retained profits are an important source of new equity, but the company is not increasing its equity investment quickly enough because there are insufficient profits.
- The growth in sales revenue will also mean a large increase in inventory and trade receivables. Working capital management might become less efficient, because systems that operated well when the company was small (such as inventory control and collection of receivables) no longer operate efficiently when the company is larger. Turnover times for inventory and collections might increase.
- The company might also need to acquire some new non-current assets to support the growth in sales volume.
- The growth in assets has to be financed by equity and liabilities. Because profits are low, equity capital increases only by a small amount. The growth in assets is therefore financed by liabilities, and in particular by current liabilities.
- The increase in current liabilities takes the form of:
 - a much longer time to pay suppliers, so that the average payments period increases substantially and trade payables in the statement of financial position (balance sheet) are much higher
 - a very big increase in its bank overdraft.



Example

Vesuvius is a rapidly-growing company. Its summarised financial statements for the current financial year (just ended) and the previous year are as follows.

Summarised income statements

	Current year	Previous year
	\$000	\$000
Revenue	4,000	3,000
Cost of sales	2,400	1,500
Gross profit	1,600	1,500
Operating expenses	1,550	1,250
Net profit	50	250

Summarised statements of financial position

	Current year		Previous year	
	\$000	\$000	\$000	\$000
Non-current assets	2,000		1,800	
Current assets				
Inventory	600		300	
Trade receivables	650		330	
Cash	nil		20	
	1,250		650	
Total assets	3,250		2,450	
Equity and liabilities				
Share capital	1,800		1,800	
Retained earnings	500		450	
Current liabilities	2,300		2,250	
Trade payables	450		200	
Bank overdraft	500		nil	
	950		200	
	3,250		2,450	

This is a company that displays all the symptoms of overtrading.

- Sales in the current year are 33.3% higher than in the previous year. This is a very high rate of sales growth.
- Profits are low. The gross profit margin has fallen to 40% in the current year compared with 50% in the previous year. The company might be reducing its sales prices in order to sell more goods.
- Net profit fell from \$250,000 in the previous year to just \$50,000 in the current year. All this profit has been retained, but the growth in equity and reserves is small in relation to the growth in the size of the business.

- There has been a big increase in inventory, by 100%. The average turnover period for inventory increased to 91 days in the current year $[(600/2,400) \times 365]$ from 73 days in the previous year $[(300/1,500) \times 365]$.
- The average time to collect trade receivables has also increased substantially, by \$320,000 or 97%. The average collection period was 59 days in the current year $[(650/4,000) \times 365]$ but only 40 days in the previous year $[(330/3,000) \times 365]$.
- There has been some increase in non-current assets, which has been largely financed by current liabilities – probably bank overdraft.
- There has been a very large increase of \$250,000 or 125% in trade payables, as well as a movement from a cash surplus of \$20,000 to a bank overdraft of \$500,000. The increase in trade payables is due not only to the growth in sales volume and cost of sales, but also to an increase in the average payment period to 68 days in the current year $[(450/2,400) \times 365]$ from 49 days in the previous year $[(200/1,500) \times 365]$.

4.3 Consequences of overtrading and possible remedial action

The consequences of overtrading are eventual insolvency, unless remedial measures are taken. Insolvency will occur if sales continue to grow and overtrading continues because a company cannot finance its growth in business indefinitely with growth in current liabilities.

In the previous example, the company's bank will eventually refuse to allow any more overdraft, and might even withdraw the existing overdraft facility if it believes that the company cannot repay what it already owes. The company's suppliers will also eventually refuse to allow longer credit.

Overtrading therefore eventually leads to inadequate liquidity due to insufficient long-term capital funding.

Remedial action

The action to restore the financial position when a company is overtrading is either to increase capital or reduce the volume of business that the company is conducting. The aim should be to achieve a better ratio of long-term capital to sales, and a suitable level of working capital investment.

One way of increasing long-term capital is to increase profits. A company that is overtrading should look for ways of improving both the gross profit and net profit margins, by cutting costs or increasing sales prices. Higher profits will enable the company to improve its operating cash flows and also to increase its equity capital by retaining more profit.

However, a problem with trying to resolve a problem of overtrading by improving profits is that the company might not have time to build up cash flows and profits soon enough. The bank might withdraw its overdraft facility without notice, making the company insolvent.

Management of working capital: inventory control

Contents

- 1 Material purchase quantities: Economic order quantity
- 2 Reorder level and buffer stock
- 3 Just-in-Time (JIT) and other inventory management methods

Material purchase quantities: Economic Order Quantity

- Minimising materials costs
- Holding costs and ordering costs
- Economic order quantity (EOQ)
- EOQ: changes in the variables in the formula

1 Material purchase quantities: Economic Order Quantity

Many companies, particularly manufacturing and retailing companies, might hold large amounts of inventory. They usually hold inventory so that they can meet customer demand as soon as it arises. If there is no inventory when the customer asks for it (if there is a 'stock-out' or 'inventory-out') the customer might buy the product from a competitor instead. However holding inventory also creates costs.

1.1 Minimising materials costs

Companies that purchase and consume large quantities of materials should try to minimise the total costs. For any item of materials, these consist of:

- the cost of materials purchased (purchase costs)
- the costs of making purchase orders to buy the material (ordering costs)
- the costs of holding inventory.

In most cases, the most significant cost is the purchase cost of the materials. However, ordering costs and holding costs might also be substantial.

1.2 Holding costs

Holding costs for inventory include costs such as:

- the interest cost of the investment in inventory
- the costs of losses through holding inventory, due to obsolescence, deterioration in the condition of the inventory and theft of inventory items
- the costs of insurance of inventory.

The investment in inventory has a cost. Capital is tied up in inventory and the capital investment has a cost. Inventory has to be paid for, and when an organisation holds a quantity of inventory it must therefore obtain finance to pay for it. For example suppose that a company holds between 0 units and 10,000 units of an item of material that costs \$10 per unit to purchase. The cost of the materials held in store therefore varies between \$0 and \$100,000. On average the cost of the inventory in store is likely to be about \$50,000. This inventory must be financed, and it is usual to assume (for simplicity) that it is financed by borrowing that has an interest cost. In this example, if the interest cost of holding inventory is 5% per year, the cost per year of holding the inventory would be \$2,500 ($= \$50,000 \times 5\%$).

There are also running expenses incurred in holding inventory, such as the warehousing costs (warehouse rental, wages or salaries of warehouse staff). A distinction can be made between variable inventory holding costs (cost of capital, cost of losses through deterioration and loss) and fixed inventory costs (wages and salaries, warehouse rental). Changing inventory levels will affect variable inventory holding costs but not fixed costs.

1.3 Order costs

Order costs are the costs of making orders to purchase a quantity of a material item from a supplier. They include costs such as:

- the cost of delivery of the purchased items, if these are paid for by the buyer
- the costs associated with placing an order, such as the costs of telephone calls
- costs associated with checking the inventory after delivery from the supplier.

1.4 Economic order quantity (EOQ)

The Economic Order Quantity model (EOQ) is a mathematical model that can be used to calculate the quantity of inventory to order from a supplier each time that an order is made.

The aim of the model is to identify the order quantity for any item of inventory that will minimise total annual inventory costs.

Assumptions in the basic EOQ model

Several assumptions in the basic EOQ model, as follows:

- There are no bulk purchase discounts for making orders in large sizes. All units purchased for each item of material cost the same unit price.
- Annual demand for the inventory item is constant throughout the year.
- The order lead time (the time between placing an order and receiving delivery from the supplier) is predictable, so that the delivery of a new order is always timed to coincide with running out of inventory.
- As a result, there are never any stock-outs.
- Also as a result, the minimum inventory level at any time is 0, and the maximum inventory level is the size of the order quantity.

The EOQ model formula

If the price of materials is the same, no matter what the size of the purchase order, the purchase order quantity that minimises total costs is the quantity at which ordering costs plus the costs of holding inventory are minimised.

This order quantity or purchase quantity that minimises the total annual cost of ordering the item plus holding it in store is called the economic order quantity or EOQ.

- EOQ minimises Ordering costs + Holding costs

- Ordering costs each year = $\left(\frac{C_o \times D}{Q}\right)$
- Inventory holding costs each year = $\left(\frac{Q}{2}\right) \times C_H$

where:

Q = the quantity of materials purchased in each order (EOQ)

D = the annual demand for the materials

C_o = the cost of making an order for materials

C_H = the cost of holding one unit of material in store for one year

Notes:

- There will be an immediate supply of new materials (Q units) as soon as existing quantities in store run down to 0. The minimum quantity held in store is therefore 0 units and this always occurs just before a new purchase order quantity is received. The maximum quantity is Q units. The average amount of inventory held is therefore Q/2 and total holding costs each year are $(Q/2) \times C_H$.
- The number of orders each year is D/Q. Total ordering costs each year are therefore $(D/Q) \times C_o$.

The economic order quantity (EOQ) is the order size that will minimise the total of these costs during a period (normally one year), given the assumptions stated above.

The formula for the EOQ is as follows:

$$\text{Economic order quantity (EOQ)} = \sqrt{\frac{2C_o D}{C_H}}$$

This formula is given to you in the examination (on the formulae sheet), although you should be able to learn it.



Example

A company uses 120,000 units of Material X each year, which costs \$3 for each unit. The cost of placing an order is \$605 for each order. The annual cost of holding inventory each year is 10% of the purchase cost.

What is the order quantity for Material X that will minimise annual costs?

a**Answer**

$$EOQ = \sqrt{\frac{2C_oD}{C_H}}$$

Where:

$$C_o = 605$$

$$D = 120,000$$

$$C_H = 10\% \times 3 = 0.3$$

$$= \sqrt{\left(\frac{2 \times 120,000 \times 605}{0.3}\right)} = \sqrt{484,000,000} = 22,000 \text{ units}$$

The economic order quantity is 22,000 units, which means that the average number of orders placed with suppliers will be 5.45 orders each year ($= 120,000/22,000$).

EOQ: Annual holding costs = Annual ordering costs

It might be useful to know that the EOQ is also an order quantity where the total annual costs of ordering and the total annual holding costs are exactly the same. In the example above:

- EOQ = 22,000 units
- Annual ordering costs $= (C_o \times D)/Q = \$605 \times 120,000/22,000 = \$3,300$
- Annual holding costs $= (Q/2) \times C_H = (22,000/2) \times \$0.30 = \$3,300$.
- Ordering costs and holding costs each year are both \$3,300.

Total annual ordering costs and annual holding costs are always the same whenever the purchase quantity for materials is the EOQ and the assumptions on which the EOQ is based (described earlier) apply.

1.5 Optimum order quantity with price discounts for large orders

The optimum purchase quantity for materials is the order size that minimises the total costs of:

- Annual purchase costs $= (D \times \text{price per unit})$
- Ordering costs each year $= \frac{(C_o \times D)}{Q}$
- Inventory holding costs each year $= \left(\frac{Q}{2}\right) \times C_H$

When the EOQ formula is used to calculate the purchase quantity, it is assumed that the purchase cost per unit of material is a constant amount, regardless of the order quantity.

In some cases, however, a supplier might offer a discount on the purchase price for orders above a certain quantity. When this situation arises, the order quantity that minimises total costs will be either:

- the economic order quantity, or
- the **minimum** order quantity necessary to obtain the price discount.

To identify the order quantity that minimises costs, you need to calculate the total costs each year of purchases, ordering costs and holding costs, for both order quantities (the EOQ and the minimum order quantity to obtain the discount).

If a supplier offers a discount for order quantities above a certain amount and a larger discount orders above an even larger quantity, you need to compare total costs for the EOQ and for each minimum quantity at which a different purchase discount applies.



Example

A company uses 120,000 units of Material X each year, which costs \$3 for each unit before discount. The costs of making an order are \$605 for each order. The annual cost of holding inventory is 10% of the purchase cost. The supplier will offer a price discount of \$0.10 per unit for orders of 25,000 up to 40,000 units, and a discount of \$0.20 per unit for orders of 40,000 units or more.

What is the order quantity that will minimise total costs?



Answer

The economic order quantity, ignoring discounts, is 22,000 units (see earlier example). The order quantity that will minimise costs is therefore one of the following:

- 22,000 units, the economic order quantity
- 25,000 units, the smallest quantity required above the EOQ to get a discount of \$0.10 per unit
- 40,000 units, the smallest quantity required above the EOQ to get a discount of \$0.20 per unit.

	Order quantity		
	22,000 units	25,000 units	40,000 units
	\$	\$	\$
Annual purchase costs (120,000units) (W1)	360,000	348,000	336,000
Annual ordering costs $\frac{(Co \times D)}{Q}$ (W2)	3,300	2,904	1,815
Holding costs $\left(\frac{Q}{2}\right) \times C_H$ (W3)	3,300	3,625	5,600
Total costs	366,600	354,529	343,415

Conclusion

The order quantity that minimises total costs is 40,000 units. This is over \$23,000 cheaper than buying the economic order quantity.

Workings**(W1) Annual purchase costs**

Order quantity		Annual purchase cost
		\$
Units		
22,000 (= EOQ)	$120,000 \times \$3$	360,000
25,000	$120,000 \times \$3 - 0.10$	348,000
40,000	$120,000 \times \$3 - 0.20$	336,000

(W2) Annual ordering costs

Order quantity		Annual ordering costs
		\$
Units		
22,000 (= EOQ)	$(120,000/22,000) \times \605	3,300
25,000	$(120,000/25,000) \times \605	2,904
40,000	$(120,000/40,000) \times \605	1,815

(W3) Annual holding costs

Order quantity		Annual holding costs
		\$
Units		
22,000 (= EOQ)	$(22,000/2) \times \$0.3$	3,300
25,000	$(25,000/2) \times \$0.29$	3,625
40,000	$(40,000/2) \times \$0.28$	5,600

Reorder level and buffer stock

- Minimising materials costs
- Holding costs and ordering costs
- Economic order quantity (EOQ)
- EOQ: changes in the variables in the formula

2 Reorder level and buffer stock

2.1 Inventory reorder level and other warning levels

So far, it has been assumed that when an item of materials is purchased from a supplier, the delivery from the supplier will happen immediately. In practice, however, there is likely to be some uncertainty about when to make a new order for materials in order to avoid the risk of running out of inventory before the new order arrives from the supplier. There are two reasons for this.

- There is a **supply 'lead time'**. This is the period of time between placing a new order with a supplier and receiving the delivery of the purchased items. The length of this supply lead time might be uncertain and might be several days, weeks or even months.
- The daily or weekly usage of the material might not be a constant amount. During the supply lead time, the actual usage of the material may be more than or less than the average usage.

If demand for an inventory item exceeds the available quantity of inventory during the reorder period, there will be a stock-out (inventory-out). When there is a stock-out of a key item of materials, there might be a hold-up in production and a disruption to the production schedules. This in turn may lead to a loss of sales and profits. Stock-outs therefore have a cost.

Management responsible for inventory control might to know:

- what the reorder level should be for each item of materials, in order to avoid any stock-out: the reorder level is the level of inventory at which a new order for the item should be placed with the supplier
- whether the inventory level for each item of material appears to be too high or too low
- what the reorder level should be for each item of materials, if stock-outs can be allowed to happen.

In an inventory control system, if there is uncertainty about the length of the supply lead time and demand during the lead time there might be three warning levels for inventory, to warn management that:

- the materials item should now be reordered (the reorder level)
- the inventory level is too high (a maximum inventory level) or
- the inventory level is getting dangerously low (a minimum inventory level).

2.2 Reorder level avoiding stock-outs and buffer stock

If the management policy is to avoid stock-outs entirely, the reorder level should be high enough to ensure that no stock-out occurs during the supply lead time. A new quantity of materials should be ordered when current inventory reaches the reorder level for that material.

- If the supply lead time (time between placing an order and receiving delivery) is certain and demand during the lead time is constant, the reorder level is:

$$[\text{Demand for the material item per day/week}] \times [\text{Lead time in days/weeks}]$$

- If the supply lead time is uncertain, and demand during the lead time is also uncertain, there should be a safety level of inventory. The **reorder level should be:**

$$[\text{Maximum demand for the material item per day/week}] \times [\text{Maximum supply lead time in days/weeks}]$$

Safety inventory ('buffer stock' or 'safety stock')

The reorder level is therefore set at the maximum expected consumption of the material item during the supply lead time. This is more than the average usage during the supply lead time. As a result, more inventory is held than is needed on average.

If the order quantity is Q , the average inventory level is $Q/2 + \text{'safety inventory'}$.

Safety inventory is the average amount of inventory held in excess of average requirements in order to remove the risk of a stock-out (or 'inventory out'). The size of the safety inventory is calculated as follows:

Reorder level	(Maximum demand per day × Maximum lead time)	Units A
Average usage in the lead time period	(Average demand per day × Average lead time)	B
Safety inventory		<u>(A - B)</u>

The cost of holding safety inventory is the size of the safety inventory multiplied by the holding cost per unit.

2.3 Maximum inventory level

The inventory level should never exceed a maximum level. If it does, something unusual has happened to either the supply lead time or demand during the supply lead time.

When demand during the supply lead time is uncertain and the supply lead time is also uncertain, the maximum inventory level is:

$$\text{Reorder level} + \text{Reorder quantity} - [\text{Minimum demand for the material item per day/week} \times \text{Minimum supply lead time in days/weeks}]$$

This maximum level should occur at the time that a new delivery of the item has been received from the supplier. The supply lead time is short; therefore there are still some units of inventory when the new delivery is received.

2.4 Minimum inventory level

The inventory level could be dangerously low if it falls below a minimum warning level. When inventory falls below this amount, management should check that a new supply will be delivered before all the inventory is used up, so that there will be no stock-out.

When demand during the supply lead time is uncertain and the supply lead time is also uncertain, the minimum (warning) level for inventory is:

Reorder level – [Average demand for the material item per day/week × Average lead time in days/weeks]



Example

A company uses material item BC67. The reorder quantity for this material is 12,000 units. There is some uncertainty about the length of the lead time between ordering more materials and receiving delivery from the supplier. There is also some variability in weekly demand for the item.

<u>Supply lead time (weeks)</u>	
Average	2.5
Maximum	3
Minimum	1
<u>Demand per week (units)</u>	
Average	1,200
Maximum	1,500
Minimum	800

Required

Calculate the reorder level, the maximum inventory level and the minimum inventory level for material item BC67.



Answer

Re-order level = [Maximum demand for the material item per day/week] × [Maximum lead time in days/weeks]

Maximum demand per week	1,500 units
Maximum lead time (weeks)	3 weeks
Re-order level	4,500 units

Buffer stock (safety inventory) = Reorder level - [Average demand for the material item per week] × [Average lead time in weeks]
 = 4,500 – (1,200 × 2.5) = 1,500 units.

The annual cost of having the buffer stock = 1,500 units × Holding cost per unit per year.

Maximum inventory level = Reorder level + Reorder quantity - [Minimum demand for the material item per day/week × Minimum lead time in days/weeks]

		Units
Re-order level		4,500
Reorder quantity		12,000
Minimum demand per week	800 units	
Minimum lead time (weeks)	× 1 week	
		<u>(800)</u>
Maximum inventory level		<u>15,700</u>

Minimum inventory level = Reorder level - [Average demand for the material item per day/week × Average lead time in days/weeks]

		Units
Re-order level		4,500
Average demand per week	1,200 units	
Average lead time (weeks)	× 2.5 weeks	
Subtract:		<u>(3,000)</u>
Minimum inventory level		<u>1,500</u>

The minimum inventory level is the buffer stock quantity.

e

Example

An examination question on inventory management might combine a test of your understanding of the EOQ model and reorder level or buffer stock. Here is an example.

A company orders 50,000 units of an item when the inventory level falls to 100,000 units. Annual consumption of the item is 1,800,000 units per year. The holding cost per unit is \$1.50 per unit per year and the cost of making an order for delivery of the item is \$375 per order. The supply lead time is 2 weeks and you should assume a 50-week year and constant weekly demand for the item.

Required

Calculate the cost of the current ordering policy and calculate how much annual savings could be obtained using the EOQ model.

a

Answer

Weekly demand = 1,800,000/50 weeks = 36,000 units.

Current policy

The reorder level is 100,000 units, therefore there is buffer stock.

Buffer stock = 100,000 units - (36,000 units × 2 weeks) = 28,000 units.

Average inventory = 50,000 units/2 + Buffer stock = 25,000 + 28,000 = 53,000 units.

Annual cost of current policy	\$
Order costs: $\$375 \times (1,800,000/50,000)$	13,500
Holding costs: $53,000 \times \$1.50$	79,500
	<u>93,000</u>

EOQ

It is assumed that the company intends to maintain a buffer stock of 28,000 units.

$$\text{EOQ} = \sqrt{\left(\frac{2 \times 1,800,000 \times 375}{1.5}\right)} = \sqrt{900,000,000} = 30,000 \text{ units}$$

Annual cost of EOQ policy	\$
Order costs: $\$375 \times (1,800,000/30,000)$	22,500
Holding costs of EOQ : $(30,000/2) \times \$1.50$	22,500
Holding cost of buffer stock: $28,000 \times \$1.50$	42,000
	<u>87,000</u>
Cost of current policy	<u>93,000</u>
Annual saving by ordering EOQ	<u>6,000</u>

2.5 Using a probability table to decide the optimal reorder level

When a company is prepared to accept the risk of stock-outs, the optimal reorder level might be estimated using probabilities of demand (and probabilities of the supply lead time) to calculate the reorder level that has the lowest expected value of total cost.

A probability table can be prepared. For each possible reorder level under consideration, we can calculate:

- the probable demand in the lead time between order and delivery
- the risk of having excess inventory (buffer stock) and its cost
- the risk of stock-outs, and their cost.

The reorder level selected might be the reorder level at which the expected value (EV) of cost is minimised.



Example

Entity X uses item Z in its production process. It purchases item Z from an external supplier, in batches.

For item Z, the following information is relevant:

Holding cost	\$15 per unit per year
Stock out cost	\$5 for each stock-out
Lead-time	1 week
EOQ	270 units

Entity X operates for 48 weeks each year. Weekly demand for unit Z for production is variable, as follows:

Units demanded during the lead time	Probability
70	10%
80	20%
90	30%
100	40%

Required

Suggest whether a reorder level of 90 units or 100 units would be more appropriate.

a

Answer

The average demand in the lead-time is:

$$[(70 \times 10\%) + (80 \times 20\%) + (90 \times 30\%) + (100 \times 40\%)] = 90 \text{ units}$$

Average annual demand is 48 weeks \times 90 units = 4,320 units.

Since the EOQ is 270 units, entity X will expect to place $\frac{4,320}{270}$ orders = 16 orders each year. Therefore there will be 16 lead times each year.

Setting up the probability table

Reorder level	Average buffer stock	Stock-outs and probability	EV of annual stock-outs	Annual holding cost of buffer stock	Total EV of cost
90	0	0.4 probability of 10 stock-outs each lead-time. EV of stock outs = $0.4 \times 10 \times 16$ lead times = 64 stock-outs	$64 \times \$5 = \320	\$0	\$320
100	10	0 stock-outs	\$0	$10 \times £15 = \$150$	150

Note: **Average buffer stock** is estimated as = Reorder level minus average demand in the lead time.

Other reorder levels (110 units, 80 units, 70 units, and so on) could be tested until the least-cost reorder level is found.

In comparing reorder levels of 90 and 100 units, a reorder level of 100 units is preferable, because it has a lower EV of cost. When inventory falls to 100 units, Entity X would place a new order for 270 units.

Just-in-Time (JIT) and other inventory management methods

- Minimising materials costs
- Holding costs and ordering costs
- Economic order quantity (EOQ)
- EOQ: changes in the variables in the formula

3 Just-in-time (JIT) and other inventory management methods

3.1 JIT production and JIT purchasing

Just-in-Time (JIT) management methods originated in Japan in the 1970s. JIT is a radically different approach to inventory management compared with management using the EOQ model and reorder levels.

The principle of JIT is that producing items for inventory is wasteful, because inventory adds no value, and holding inventory is therefore an expense for which there is no benefit.

If there is no immediate demand for output from any part of the system, a production system should not produce finished goods output for holding as inventory. There is no value in achieving higher volumes of output if the extra output goes into inventory as has no immediate use.

Similarly, if there is no immediate demand for raw materials, there should not be any of the raw materials in inventory. Raw materials should be obtained only when they are actually needed.

It follows that in an ideal production system:

- there should be no inventory of finished goods: items should be produced just in time to meet customer orders, and not before (= **just in time production**)
- there should be no inventories of purchased materials and components: purchases should be delivered by external suppliers just in time for when they are needed in production (= **just in time purchasing**).

'Just-in-time purchasing is a purchasing system in which material purchases are contracted so that the receipt and usage of the materials, to the maximum extent, coincide' (CIMA Official Terminology).

3.2 Practical implications of JIT

JIT production

It is important that items should be available when required. Finished goods must be available when customers order them, and raw materials and components must be supplied when they are needed for production.

In practice, this means that:

- Production times must be very fast. If there is no inventory of finished goods, production has to be fast in order to meet new customer orders quickly.
- Production must be reliable, and there must be no hold-ups, stoppages or bottlenecks. Poor quality production, leading to rejected items and scrap, is unacceptable.
- Deliveries from suppliers must be reliable: suppliers must deliver quickly and purchased materials and components must be of a high quality (so that there will be no scrapped items or rejected items in production).

JIT purchasing

JIT depends for its success not only on highly efficient and high-quality production, but also on efficient and reliable supply arrangements with key suppliers. For successful JIT purchasing, there must be an excellent relationship with key suppliers. Collaborative long-term relationships should be established with major suppliers, and purchasing should not be based on selecting the lowest price offered by competing suppliers.

By implementing a JIT system, an entity will be working with its key ('strategic') suppliers to implement a manufacturing system that will:

- reduce or eliminate inventories and WIP
- reduce order sizes, since output is produced to meet specific demand and raw material deliveries should be timed to coincide with production requirements
- ensure deliveries arrive in the factory exactly at the time that they are needed.

The overall emphasis of a JIT purchasing policy is on consistency and quality, rather than looking for the lowest purchase price available.

3.4 Problems with JIT

There might be several problems with using JIT in practice.

- Zero inventories cannot be achieved in some industries, where customer demand cannot be predicted with certainty and the production cycle is quite long. In these situations, it is necessary to hold some inventories of finished goods.
- It might be difficult to arrange a reliable supply system with key suppliers, whereby suppliers are able to deliver materials exactly at the time required.

- If the EOQ model succeeds in minimising total costs of holding costs and ordering costs, this suggests that with a JIT purchasing system, ordering costs might be very high.

3.5 Other inventory control systems

EOQ and JIT are two methods of managing and controlling inventory and purchasing quantities. Other systems might be used.

Two bin system

When a two-bin system is used in a warehouse or stores department, each item of inventory is stored in two bins or large containers. Inventory is taken from Bin 1 until it is empty, and a new order is placed sufficient to fill Bin 1 again.

However, the delivery of more units of the item will take time, and since Bin 1 is empty, units are now taken from Bin 2. Bin 2 is large enough to continue supplying the item until the new delivery arrives. On delivery both bins are replenished and units are once again supplied from Bin 1.

This cycle continues indefinitely.

Periodic review system

In a periodic review system, there is a reorder quantity and a reorder level for each item of inventory.

Inventory levels are checked periodically, say every one, two, three or four weeks. If the inventory level for any item has fallen below its reorder level, a new order for the reorder quantity is placed immediately.



Example

Suppose that the demand for an inventory item each week is 400 units, and inventory control is applied by means of a three-weekly periodic review. The lead-time for a new order is two weeks.

The minimum inventory level should therefore be $(3 \text{ weeks} + 2 \text{ weeks}) = 5 \text{ weeks} \times 400 \text{ units} = 2,000 \text{ units}$. If the inventory level is found to be lower than this level at any periodic review, a new order for the item should be made.

ABC method of inventory control

With the ABC method of inventory control, it is recognised that some items of inventory cost much more than others to hold. Inventory can perhaps be divided into three broad categories:

- Category A inventory items, for which inventory holding costs are high.
- Category B inventory items, for which inventory holding costs are fairly high, but not as high as for category A items.

- Category C inventory items, for which inventory holding costs are low and insignificant. Holding excessive amounts of these inventory items would not affect costs significantly.

The ABC approach to inventory control is to control each category of inventory differently, and apply the closest control to those items in the most costly category, A. For example:

- Category A items might be controlled by purchasing the EOQ as soon as the inventory level falls to a set reorder level.
- Category B items might be controlled by a periodic review system, with orders placed to restore the inventory level to a maximum level.
- Category C items might be purchased in large quantities, and controlled by means of a two-bin system.

Management of receivables and payables

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Costs and benefits of giving credit

- Benefits of giving credit
- Cost of giving credit

1 Costs and benefits of giving credit

Business entities that sell to other businesses normally sell on agreed credit terms. Often 'standard' credit terms are applied for most business transactions, such as 30 days or 60 days from the date of the invoice. Most sales to consumers are for cash, but some businesses might even sell to consumers on credit.

It is generally assumed that if customers are allowed time to pay what they owe, they will take the full period of credit. For example, if a customer is allowed 30 days to pay an invoice, it is generally assumed that the customer will not pay until day 30.

1.1 Benefits of giving credit

By giving credit, sales volume will be higher. Higher sales volumes result in higher contribution, and higher profit.

If a business does not give credit to customers, customers are likely to buy from competitors who do offer credit.

1.2 Cost of giving credit

There are several costs of giving credit.

- **Finance costs:** There is a finance cost. Trade receivables must be financed. The longer the period of credit allowed to customers, the bigger the investment in working capital must be. The cost of investing in trade receivables is usually calculated as: Average trade receivables in the period \times Cost of capital for the period
- **Bad debt costs:** Selling on credit creates a risk that the customer might never pay for the goods supplied. The cost of bad debts is usually measured as the amount of sales revenue due from the customers, that is written off as non-collectable.
- **Administration costs:** Additional administration costs might be incurred in negotiating credit terms with customers, and monitoring the credit position of customers. In dealing with problems about the cost of trade receivables, you should consider only the incremental administration costs incurred as a consequence of providing credit.



Example

Green Company currently offers customers 30 days' credit. Annual credit sales are \$12 million, the contribution/sales ratio is 25% and bad debts are 1% of sales. The company has estimated that if it increased credit to 60 days, total annual sales would increase by 10%, but bad debts would rise to 1.5% of sales. The cost of capital for Green Company is 9%.

Assume that a year has 360 days.

Required

Estimate the effect on annual profit of increasing the credit period from 30 to 60 days.

a

Answer

Annual sales will increase from \$12 million to \$13.2 million.

		\$
Current average receivables	$30/360 \times \$12 \text{ million}$	1,000,000
Average receivables with credit of 60 days	$60/360 \times \$13.2 \text{ million}$	2,200,000
Increase in average receivables		<u>1,200,000</u>

Annual interest cost of increase in trade receivables = $\$1,200,000 \times 9\% = \$108,000$.

	\$	\$
Annual contribution with credit 30 days		3,000,000
Annual contribution with credit 60 days		<u>3,300,000</u>
Increase in annual contribution		300,000
Bad debts with credit 30 days ($1\% \times \$12 \text{ million}$)	120,000	
Bad debts with credit 60 days ($1.5\% \times \$13.2 \text{ million}$)	<u>198,000</u>	
Increase in bad debts	78,000	
Annual interest cost of extra receivables	<u>108,000</u>	
Total extra cost of longer credit		<u>186,000</u>
Net annual gain from increasing credit to 60 days		<u>114,000</u>

The management of trade receivables

- Giving credit
- Monitoring payments
- Efficient collection of debts
- Bad debts and reducing bad debts

2 The management of trade receivables

Giving credit to customers results in higher costs, in particular higher interest costs and some bad debts. These costs must be kept under control. To do this, trade receivables must be properly managed.

Good management of trade receivables involves systems for:

- deciding whether to give customers credit, and how much credit to give them
- monitoring payments
- collecting overdue payments.

2.1 Giving credit

There should be procedures for deciding whether to give credit to a customer, and if so, how much. The procedures should differ between existing customers wanting extra credit, and new customers asking for credit for the first time. This is because existing customers already have a credit history. A company knows from experience whether an existing customer is likely to pay on time, or might have difficulty with payments.

When deciding whether or not to give extra credit to an existing customer, the decision can therefore be based largely on whether the customer has paid promptly in the past, and so whether on the basis of past performance the customer appears to be a good credit risk.

For new business customers, a variety of credit checks might be carried out.

- Asking for trade references from other suppliers to the customer who already give credit
- Asking for a reference from the customer's bank
- Making credit checks to discover whether any court judgements have been made against the customer for non-payment of debts
- Credit checks on small businesses can be purchased from credit reference agencies
- For business customers, asking for a copy of the most recent financial statements and carrying out a ratio analysis. Banks can usually persuade a business customer to provide a copy of its financial statements for decisions about granting a bank loan; but it is much more difficult for non-banks to do so, for decisions about giving trade credit

- Using reports from the company's salesmen. If a company sales representative has visited the business premises of the customer, a report about the apparent condition of the customer's business might be used to decide about whether or not to offer credit.

Usually, a company establishes credit policy guidelines that should be followed when giving credit to a new business customer. For example, a company might have a credit policy that for a new business customer, subject to a satisfactory credit check, it would be appropriate to offer credit for up to \$2,000 for 30 days. This credit limit might then be reviewed after several months, if the customer pays invoices promptly within the credit terms.

The credit terms set for each customer will consist of:

- A **credit period**: The customer should be required to pay invoices within a stated number of days. Credit limits of 30 days or 60 days are common.
- A **credit limit**: This is the maximum amount of credit that the customer will be permitted. The limit is likely to be small at first for a new customer, increasing as the trading relationship develops.
- **Interest charges on overdue payments**: It might also be a condition of giving credit that the customer agrees to pay interest on any overdue payment. However, interest charges on late payments can create bad feeling, and customers who are charged interest might take their business to a rival supplier. Interest charges on late payments are therefore uncommon in practice.

(Note: Credit checks on individuals should be carried out by companies that give credit to customers, such as banks and credit card companies. Many companies, however, might give credit to corporate customers but ask for cash payment/credit card payment from individuals.)

2.2 Monitoring payments

A company should have a system for monitoring payments of invoices by customers. A regular report should be produced listing the unpaid debts, and which of these are overdue. This report might be called an 'aged debtors list'.

A typical report might summarise the current position by showing how much money is owed by customers and for how long the money has been owed. A simple example of a summary is shown below.

	Total	0 – 30 days	31 – 60 days	60 – 90 days	Over 90 days
	\$	\$	\$	\$	\$
Receivable	17,894,100	12,506,900	4,277,200	1,045,000	65,000

The report will also provide a detailed list of the unpaid invoices in each time period. By monitoring regular reports, the team responsible for collecting payments can decide which customers to 'chase' for payment and also to assess whether collections of receivables is under control. In the example above, if the company has normal credit terms of 30 days, it might be concerned that such a large amount of receivables – over \$5 million, remain unpaid after 30 days.

2.3 Efficient collection of debts

When credit is given to customers, there should be efficient procedures for ensuring that customers pay on time, and that action is taken to obtain overdue payments.

Procedures for efficient debt collection include the following:

- sending invoices to customers promptly, as soon as the goods or services have been provided.
- sending regular statements to credit customers, showing how much they owe in total and how much is currently due for payment. Statements act as a reminder to customers to make a payment.
- ensuring that credit terms are not exceeded, and the customer is not allowed to take longer credit or more credit than agreed.

Procedures for chasing overdue payments include:

- telephone calls
- reminder letters
- taking a decision to withhold further supplies and further credit until an overdue debt is paid.

In extreme cases, measures might include:

- using the services of a debt collection agency.
- sending an official letter from a solicitor, threatening legal action.
- legal action – obtaining a court judgement against the customer to force the customer to pay. This is a measure of last resort, to be taken only when there is a breakdown in the trading relationship.

2.4 Bad debts and reducing bad debts

When a company gives credit, there will be some bad debts. Bad debts are an expense in the income statement and have a direct impact on profitability. A company should try to minimise its bad debts, whilst accepting that even with efficient collection procedures some losses are unavoidable. For example some customers might become insolvent and go out of business still owing money.

There are several ways in which bad debts can be reduced:

- More extensive and careful credit checking procedures when deciding whether to give credit to customers
- More efficient collection procedures
- Reducing the amount of credit in total. As the total amount of credit given to customers increases, there will be an increase in the cost of bad debts, and the proportion of receivables that become bad debts. Reducing the total amount of credit will therefore reduce bad debts. However reducing the amount of credit to customers will probably result in lower sales revenue and lower gross profit.

**Example**

A company has annual sales of \$20 million and all customers are given credit of 60 days. Gross profit on sales is 40%. Currently bad debts are 1.5% of sales. The cost of capital for the company is 10%.

Management is concerned about the high level of bad debts and they estimate that by reducing credit terms to 30 days for all customers, bad debts can be reduced to 0.5% of sales. However total sales revenue is likely to fall by 5% as a consequence of making the credit terms less generous.

Required

Calculate the estimated effect on annual profit of reducing the credit terms from 60 days to 30 days.

**Answer****Current situation**

Annual gross profit on current level of sales = $40\% \times \$20 \text{ million} = \$8,000,000$.

Current average trade receivables = $(60/365) \times \$20 \text{ million} = \3.29 million .

Current level of bad debts = $1.5\% \times \$20 \text{ million} = \$300,000$

	\$
Cost of investment in trade receivables ($10\% \times \$3.29 \text{ million}$)	329,000
Cost of bad debts	300,000
	<u>629,000</u>

Consequences of reducing credit to 30 days

Average trade receivables = $(30/365) \times 95\% \text{ of } \$20 \text{ million} = \$1.56 \text{ million}$.

Bad debts = $0.5\% \times 95\% \text{ of } \$20 \text{ million} = \$95,000$

	\$
Fall in gross profit ($5\% \times \$8,000,000$)	400,000
Cost of investment in trade receivables ($10\% \times \$1.56 \text{ million}$)	156,000
Cost of bad debts	95,000
	<u>651,000</u>

The effect of offering stricter credit terms would be to reduce annual profit by \$22,000 ($651,000 - 629,000$) due to the loss in sales and gross profit that would occur.

Debt factors and invoice discounting

- Debt factors and the services they provide
- The costs of factoring services
- Benefits and disadvantages of using a factor
- Evaluation of a factor's services
- Invoice discounting

3 Debt factors and invoice discounting

3.1 Debt factors and the services they provide

Companies might use a factoring organisation to assist with the management of receivables and also to help with the financing of receivables.

Debt factors are specialist organisations. They specialise in:

- assisting client firms to administer their trade receivables ledger
- providing short-term finance to client firms, secured by the trade receivables
- in some cases, providing insurance against bad debts.

The services of a debt factor can be particularly useful for a small-to-medium-sized company that:

- has a large number of credit customers
- does not have efficient debt collection procedures and therefore has a fairly high level of bad debts, and
- does not have sufficient finance for its working capital.

A debt factor offers three main services to a client business:

- the administration of the client's trade receivables
- credit insurance
- debt finance.

Trade receivables administration

A factor will take over the administration of trade receivables on behalf of a client. It sends out invoices on behalf of the client. Each invoice shows that the factor has issued the invoice, and the invoice asks for payment to be made to a bank account under the control of the factor. The factor collects the payments, and chases customers who are late with payment. The factor is also responsible for the client's trade receivables ledger, recording details of invoices and payments received in the ledger on behalf of the client.

The factor makes a charge for this service, typically an agreed percentage of the value of invoices sent out.

Credit insurance

If the factor is given the task of trade receivables administration, it may also agree (for an additional fee) to provide insurance against bad debts for the client. This is known as **without recourse factoring** or **non-recourse factoring**. If a customer of the client fails to pay an invoice that was issued by the factor, the factor will accept the bad debt loss itself, and the factor will pay the client the full amount of the unpaid invoice.

A factor will only provide without recourse factoring for invoices that are approved in advance by the factor. This is to prevent the client from giving credit to high-risk customers and exposing the factor to the risk of bad debts.

However, factors also provide **with recourse factoring**. With this type of arrangement, if a customer of the client fails to pay an invoice, the factor will not pay anything to the client, and the client must suffer the bad debt loss. (If the factor has already made a payment to the client against the security of the receivable, the client must repay the money it has received.)

Debt finance

The factor will provide advances of up to 80% of the face value of the client's trade receivables, for all receivables that are approved by the factor. The finance is provided at an agreed rate of interest, and is repayable when the customers' invoices are eventually paid. In effect, this means that when a customer pays the factor will remit the remaining 20% of the money to the client, less the interest (and other fees).

3.2 The costs of factoring services

The costs of a factoring service might therefore consist of:

- a service fee for the administration and collection of trade receivables
- a commission charge, based on the total amount of trade receivables, for a non-recourse factoring service, and
- interest charges for finance advanced against the trade receivables.

3.3 Benefits and disadvantages of using a factor

The benefits of using a factor are as follows:

- there should be savings in internal administration costs, because the factor administers the trade receivables ledger.
- with non-recourse factoring, there is a reduction in the cost of bad debts.
- a factor is a source of finance for trade receivables.

The disadvantages of using a factor are as follows.

- Interest charges on factor finance are likely to be higher than other sources of finance.
- Effect on customer goodwill. The factor is unlikely to treat the client's customers with the same degree of care and consideration that the client's own sales ledger administration team would.
- The client's reputation may be affected by the need to use a factor. Customers might believe that using a factor is a sign of financial weakness.

3.4 Evaluation of a factor's services

An examination question might ask you to assess the cost of using the services of a factor, and compare this cost with an alternative policy for administering the trade receivables ledger and financing trade receivables. To deal with examination questions of this type, you need to compare the total costs of the alternative policies.

As indicated above, the costs you will probably need to consider are:

- costs of receivables ledger administration
- costs of bad debts
- financing costs for trade receivables.



Example

Blue Company has annual credit sales of \$1,000,000. Credit customers take 45 days to pay. Bad debts are 2% of sales. The company finances its trade receivables with a bank overdraft, on which interest is payable at an annual rate of 15%.

A factor has offered to take over administration of the receivables ledger and collections for a fee of 2.5% of the credit sales. This will be a non-recourse factoring service. It has also guaranteed to reduce the payment period to 30 days. It will provide finance for 80% of the trade receivables, at an interest cost of 8% per year.

Blue Company estimates that by using the factor, it will save administration costs of \$8,000 per year.

Required

What would be the effect on annual profits if Blue Company decides to use the factor's services? (Assume a 365-day year).



Answer

		\$
Current average trade receivables	$45/365 \times \$1 \text{ million}$	123,288
Average receivables with the factor	$30/365 \times \$1 \text{ million}$	82,192

It is assumed that if the factor's services are used, 80% will be financed by the factor at 8% and the remaining 20% will be financed by bank overdraft at 15%.

Annual interest costs		\$
Current situation	$\$123,288 \times 15\%$	18,493
With the factor	$(80\% \times \$82,192 \times 8\%) + (20\% \times \$82,192 \times 15\%)$	<u>(7,726)</u>
Saving in annual interest costs		<u>10,767</u>
Summary of comparative costs		\$
Saving in annual interest costs		10,767
Annual saving in bad debts (2% of \$1 million)		20,000
Annual saving in administration costs		<u>8,000</u>
		38,767
Annual costs of factor's services (2.5% of \$1 million)		<u>(25,000)</u>
Net increase in profit by using the factor		<u>13,767</u>

3.5 Invoice discounting

Invoice discounting is similar to the provision of finance by a factor. A difference is that whereas a factor provides finance against the security of all approved invoices of the client, an invoice discounter might provide finance against only a small number of selected invoices.

Another difference between a debt factor and an invoice discounter is that the invoice discounter will **only** provide finance services. An invoice discounter will not administer the trade receivables ledger or provide protection against the risk of bad debt. The invoice to the customer is sent out by the client firm, and payment is collected by the client firm (and paid into a special bank account set up for the purpose).



Example

A company might need to arrange finance for an invoice for \$3 million to a customer, for which the agreed credit period is 90 days. An invoice discounter might be prepared to finance 80% of the invoiced amount, at an interest rate of 10%.

The company will issue the invoice to the customer for \$3 million. The invoice discounter provides the company with a payment of \$2.4 million (80% of \$3 million).

After 90 days, the invoice discounter will expect repayment of the \$2.4 million advance, plus interest of \$59,178.

If the customer pays promptly, this repayment will be made out of the \$3 million invoice payment by the customer. The invoice discounter will take \$2,459,178 and the remaining \$540,822 will go to the company.

Settlement discounts

- The nature of settlement discounts
- Evaluating a settlement discount

4 Settlement discounts

4.1 The nature and purpose of settlement discounts

The cost of financing trade receivables can be high. More important perhaps, if a company has a large investment in trade receivables, it might have cash flow problems and liquidity difficulties.

A company might therefore try to minimise its investment in trade receivables. One way of doing this is to ensure that collection procedures are efficient. Another policy for reducing trade receivables is to offer a discount for early payment of an invoice. This type of discount is called a settlement discount (or early settlement discount, or cash discount).

For example, a company might offer its customers normal credit terms of 60 days, but a discount of 2% for payment within ten days of the invoice date. If customers take the discount, there will be a reduction in average trade receivables.

4.2 Evaluating a settlement discount

The benefit of a settlement discount is that it reduces average trade receivables, and this reduces the annual interest cost of investing in trade receivables.

On the other hand, the discounts taken by customers reduce annual profit.

Evaluating a proposal to offer settlement discounts to customers therefore involves comparing the improvements in cash flow and reductions in interest cost with the cost of the discounts allowed.

The implied interest cost of settlement discounts

One way of evaluating a settlement discount is to calculate the implied interest cost of offering settlement discounts.

For example, suppose that a company offers its customers normal credit terms of 60 days, but a discount of 2% for payment within ten days of the invoice date.

This discount policy implies that the company is prepared to accept \$98 on day ten rather than accepting \$100 on day 60. Financially, the company considers it beneficial to have \$98 'now' rather than \$100 in 50 days' time. This implies an average annual interest cost of:

$$\left[1 + \left(\frac{2}{98} \right) \right]^{\frac{365}{(60-10)}} - 1 = 0.1566 \text{ or } 15.66\%$$

If it costs the company less to borrow money to finance its trade receivables, it would be cheaper to offer credit of 60 days, and not to offer the discount of 2% for payment within ten days.

A formula for calculating the implied cost of offering a settlement discount is:

$$\left[1 + \left(\frac{d}{100 - d} \right) \right]^{\frac{365}{t}} - 1$$

Where:

- d = the size of the discount.
- t = the difference in days between normal credit terms and the maximum credit period for taking advantage of the settlement discount.



Example

Entity X borrows on overdraft at an annual interest rate of 15%.

Customers are normally required to pay within 45 days. Entity X offers a 1.5% discount if payment is made within ten days.

What is the effective annual cost of offering the settlement discount, and is the discount policy financially justified?



Answer

By giving the discount, Entity X is effectively losing \$1.50 in every \$100 of its cash receipts from customers to get the money 35 days earlier (45 days – 10 days).

The effective annual cost of the settlement discount is:

$$\left[1 + \left(\frac{1.5}{98.5} \right) \right]^{\frac{365}{35}} - 1 = 0.1707, \text{ say } 17\%$$

Therefore, offering the settlement discount is not worthwhile. It is cheaper to borrow on overdraft at 15%.

Calculating the total annual costs

An alternative method of calculating the cost of settlement discounts, compared with a policy of not offering discounts, would be to compare the total annual costs with each policy.



Example

Entity X borrows on overdraft at an annual interest rate of 15%.

It has annual credit sales of \$5 million, and all customers buy on credit. Customers are normally required to pay within 45 days. Entity X offers a 1.5% discount if payment is made within ten days. 60% of customers take the discount.

What is the annual cost of the discount policy?



Answer

Cost of annual settlement discounts = \$5 million \times 60% \times 1.5% = \$45,000.

Average receivables without the discount policy = $\left(\frac{45}{365}\right) \times \$5 \text{ million} = \$616,438$.

Average receivables with the discount policy:

		\$
Customers who will not take the discount	$(45/365) \times 40\% \times \5 million	246,575
Customers who will take the discount	$(10/365) \times 60\% \times \5 million	82,192
Total receivables with the discount policy		328,767

The net cost or benefit of the discount policy can be calculated as follows.

		\$
Interest cost of receivables:		
Without discount policy	$\$616,438 \times 15\%$	92,466
With discount policy	$\$328,767 \times 15\%$	49,315
Interest saved with the discount policy		43,151
Cost of annual settlement discounts		45,000
Extra annual cost of discount policy		1,849

In this case, the settlement discount will be expected to reduce annual profit by about \$1,800.

Management of working capital for foreign trade

- The additional problems with foreign trade
- Obtaining quicker payment
- Protection against credit risks
- Forward exchange contracts to hedge against foreign currency risk

5 Management of working capital for foreign trade

5.1 The additional problems with foreign trade

When a business entity sells to customers in other countries, and the customer is in a country with a different currency, there are extra problems for working capital management, and risks for the business. The extra risks are:

- The **longer time period** between despatching goods to the customer and receiving payment. When goods are shipped to another country, it could take several weeks before the customer receives the goods. Foreign customers are usually unwilling to pay for goods until they are certain of receipt.

If a longer payment period is allowed for foreign customers, the investment in trade receivables will be larger than if normal credit is allowed, and the interest cost will therefore be higher.

- There is a **greater risk of bad debt**. If a foreign customer does not pay, it will be more difficult and expensive to take action to collect the debt. For example, the company might have no understanding of the legal procedures for collecting unpaid debts in other countries.
- **Foreign currency risks**. If a company invoices its foreign customers in a foreign currency, there will be a foreign exchange risk. This is the risk that the value of the foreign currency will deteriorate between the time of issuing the invoice to the customer and the time of receiving payment. A movement in foreign exchange rates could even wipe out the expected profit on a foreign sale.

5.2 Obtaining quicker payment

In many cases, a company that sells to foreign customers must accept that it will have to wait longer for payment. A large investment in foreign trade receivables could therefore be unavoidable, and the interest cost has to be accepted.

However, in some cases it might be possible to arrange quicker payment. One method of both reducing the bad debt risk and obtaining quicker payment is to arrange an export sale using a **letter of credit**.

A letter of credit is an arrangement in which the exporter undertakes to provide the foreign buyer with specific documents that provide evidence that the goods have been shipped. The required documents normally include suitable shipping and insurance documents, and an invoice.

If the exporter delivers the specified documents to a bank representing the foreign buyer, the buyer agrees to make the payment. Payment is usually arranged by means of a bank bill of exchange. A bank representing the foreign buyer undertakes to pay a bill of exchange, for the amount of the invoice at a future date (the end of the credit period for the foreign buyer). Since the bank is undertaking to pay the bill of exchange, the exporter's credit risk is not the foreign buyer, but the bank. The credit risk should therefore be low.

If the exporter wants quicker payment, it can arrange with its own bank for the bill of exchange to be sold in the discount market. Bills are sold in the discount market for less than their face value; therefore by selling a bank bill to get quicker payment, the exporter incurs a cost. (When the bank bill reaches maturity, the bank will make its payment to the holder of the bill. The bank will recover the money from its client, the foreign buyer).

Letters of credit are fairly expensive to arrange, but they offer the benefits to an exporter of:

- lower credit risk and
- if required, earlier payment (minus the discount on the bank bill when it is sold).

5.3 Protection against credit risks

As indicated above, the credit risk in foreign trade can be reduced by arranging an irrevocable letter of credit.

Another method of reducing the credit risk might be to buy **credit risk insurance**.

Credit insurance is available from specialist organisations, and also possibly from some banks/insurance companies.

5.4 Forward exchange contracts to hedge against foreign currency risk

There is a risk that if a sale to a foreign buyer is priced in a foreign currency, the value of the foreign currency could depreciate in the time between selling the goods and eventually receiving payment.

For example, suppose that goods are sold by a UK company to a buyer in the US for \$550,000, and the customer is given 90 days' credit. Suppose also that the exchange rate when the goods were shipped was £1 = \$1.80 and that when the customer eventually pays three months later, the exchange rate is £1 = \$2.

When the goods were sold, the expected income in sterling was \$300,000 (= \$540,000/1.80). Because of the change in the exchange rate, the actual sterling value of the dollar receipts is just \$270,000 (= \$540,000/2.00).

There has been a loss on exchange of \$30,000 in this transaction.

An exporter who is concerned about the risk to income and profit from adverse exchange rate movements during a credit period can 'hedge' the risk by arranging a forward exchange contract.

A **forward exchange contract** is an agreement made 'now' with a bank for the purchase or sale of a quantity of one currency in exchange for another, for settlement at a specified future date.

In the preceding example, the company might have been able to arrange a forward exchange contract to sell \$540,000 in exchange for sterling, for settlement in three months' time. Suppose the exchange rate in the forward contract is £1 = \$1.8250. The foreign exchange contract would oblige the bank to buy the \$540,000 in three months' time (and would oblige the company to sell the \$540,000) in exchange for £295,890 (= \$540,000/1.8250).

The exporter would therefore know in advance exactly how much it will be earning in its domestic currency from an export sale.

Forward exchange contracts and other methods of hedging foreign currency risks are explained in more detail in a later chapter.

Management of trade payables

- Trade payables as a source of finance
- Settlement discounts from suppliers

6 Management of trade payables

6.1 Trade payables as a source of finance

Trade credit is an excellent source for financing short-term working capital needs. The supplier has provided goods or services that have not yet been paid for, and which may or may not already have been used.

Trade credit allows the buyer to hold or make use of goods obtained from suppliers without yet having to pay for them. It therefore postpones the need to find the cash to make payments for goods and services purchased.

Unlike other sources of finance, including a bank overdraft or a bank loan, trade credit does not have any cost.

However, goods are supplied on agreed credit terms. The supplier expects to receive payment at the end of the agreed credit period. If a buyer tries to take advantage of trade credit, and delay payment until after the agreed credit period has ended, the trading relationship between supplier and buyer could become difficult and unfriendly.

A company should therefore take advantage of the trade credit terms it is offered, and negotiate the best credit terms that it can get, because it is a free source of finance for working capital. However it should not exceed the amount of credit allowed.

6.2 Settlement discounts from suppliers

A supplier might offer a settlement discount for early payment. The value of a settlement discount from a supplier should be assessed in the same way as the cost of a settlement discount to customers. If the value of taking the settlement discount is higher than the cost of having to finance the payment by bank overdraft, the discount should be taken and the trade debt should be paid at the latest time possible in order to obtain the discount.



Example

Purple is offered a 2% settlement discount if it pays invoices from Supplier X in ten days rather than after the normal 30-day credit period. It can borrow on its overdraft at 12% per annum.

The value of the settlement discount is:

$$\left[\left(1 + \frac{2}{98} \right)^{\left(\frac{365}{30-10} \right)} \right] - 1 = 0.446 = 44.6\%$$

The value of the settlement discount is much higher than the cost of a bank overdraft.

Purple should take the discount and pay invoices on day 10.

Cash management

Contents

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| 1 | The nature of cash management |
| 2 | Cash budgets and cash flow forecasts |
| 3 | Cash models: Baumol model and Miller-Orr model |
| 4 | Other aspects of cash management |

The nature of cash management

- Reasons for holding cash
- Objective of good cash management
- Aspects of cash management

1 The nature of cash management

The importance of cash and liquidity for a business was explained in the earlier section on liquidity ratios. If a company is unable to pay what it owes at the required time, a creditor might take legal action to recover the unpaid amount. Even if such extreme action is not taken, but a company is slow in paying invoices, creditors will be reluctant to provide additional credit.

It is therefore essential for a business to ensure that its cash flows are well managed and that it has sufficient liquidity.

1.1 Reasons for holding cash

There are several reasons why a business entity might choose to hold cash.

- **To settle transactions.** Cash is needed to pay expenses, and to settle debts.
- As a **precaution** against unexpected requirements for cash. A business might hold some additional cash in the event that there is a need to make an unexpected and unforeseen payment.
- For **speculative reasons.** A company might hold some cash that can be used if a business opportunity arises. Some investment opportunities, such as the opportunity to purchase a rival business, might require some element of cash. Holding a 'war chest' of cash might therefore be a strategic measure taken by a company, to take opportunities for developing the business whenever an attractive opportunity arises.

However, cash does not earn a high return. Cash in a normal business bank account earns no interest at all. Holding cash therefore provides a company with liquidity (an ability to pay), but reduces profitability (the lost income resulting from holding cash rather than investing it in business development).

1.2 Objective of good cash management

The objective of good cash management is to hold sufficient cash to meet liabilities as they fall due, whilst making sure that not too much cash is held. Money held as cash is not being invested in the wealth-creating assets of the organisation – thereby affecting profitability.

If a business entity wants to maintain sufficient liquidity, but does not want to hold too much cash, it might consider investing cash that is surplus to short-term requirements. Surplus cash can be invested in short-term financial instruments or even savings accounts, and so can earn some interest (although possibly not much)

until it is needed. When the cash is eventually needed, the investments can be sold, or cash can be withdrawn from the savings accounts.

1.3 Aspects of cash management

You might be required to consider any of the following three aspects of cash management.

- Forecasting cash flow requirements and operational cash flows. This is done by means of cash budgeting or cash flow forecasting. In your examination it is more likely that you will be required to prepare a cash flow forecast rather than a detailed cash budget.
- Deciding how to invest surplus cash in short-term investments.
- Deciding how much cash to keep and how much to invest in short-term investments. In addition, if money is invested in short-term investments, deciding how many investments to sell in exchange for cash when some cash is eventually needed for operational requirements.

Cash budgets and cash flow forecasts

- Cash budgets
- Preparing a cash budget
- Cash flow forecasts

2 Cash budgets and cash flow forecasts

2.1 Cash budgets

A cash budget is a detailed plan of cash receipts and cash payments during a planning period. The planning period is sub-divided into shorter periods, and the cash receipts and payments are forecast/planned for each of the sub-divisions of time.

For an annual master budget, the cash budget might be prepared on a monthly basis, or possibly a quarterly basis. Some business entities prepare new cash budgets regularly, possibly forecasting daily cash flows for the next week, or weekly cash flows for the next month.

The main uses of a cash budget are as follows:

- To forecast how much cash receipts and payments are expected to be over the planning period.
- To learn whether there will be a shortage of cash at any time during the period, or possibly a cash surplus.
- If there is a forecast shortage of cash, to consider measures in advance for dealing with the problem - for example by planning to defer some purchases of non-current assets, or approaching the bank for a larger bank overdraft facility.
- To monitor actual cash flows during the planning period, by comparing actual cash flows with the budget.

2.2 Preparing a cash budget

A cash budget can be prepared by producing a table for the cash receipts and cash payments, containing each item of cash receipt and each item of cash payment. The cash receipts and then the cash payments should be listed in rows of the table, and each column of the table represents a time period, such as one month.

A typical format for a monthly cash budget is shown below.

	January	February	March
Cash receipts	\$	\$	\$
Cash sales	5,000	6,000	5,000
Cash from credit sales			
Credit sales the previous month (month M - 1)	22,000	20,000	24,000
Credit sales in two months ago (month M - 2)	50,000	44,000	40,000
Credit sales in three months ago (month M - 3)			
Other cash receipts	4,000	2,000	2,000
Total cash receipts	<u>81,000</u>	<u>72,000</u>	<u>71,000</u>
Cash payments			
Payments for purchases in current month	6,000	6,600	6,200
Payments for purchases in previous month	8,400	9,000	9,900
Payments of rent	-	30,000	-
Payments of wages and salaries	23,000	23,000	23,000
Dividend payments	-	-	40,000
Payments for non-current assets		70,000	10,000
Other payments	3,000	3,000	3,000
Total cash payments	<u>40,400</u>	<u>141,600</u>	<u>92,100</u>
Receipts minus payments (net cash flow)	40,600	(69,600)	(21,100)
Cash balance at the beginning of the month	45,000	85,600	16,000
Cash balance at the end of the month	<u>85,600</u>	<u>16,000</u>	<u>(5,100)</u>

2.3 Cash flow forecasts

Cash flow forecasts, like cash budgets, are used to predict future cash requirements, or future cash surpluses. However, unlike cash budgets:

- they are prepared throughout the financial year, and are not a part of a formal budget plan
- they are often prepared in much less detail than a cash budget.

The main objectives of cash flow forecasting, like the purposes of a cash budget, are to:

- make sure that the entity is still expected to have sufficient cash to meet its payment commitments as they fall due
- identify periods when there will be a shortfall in cash resources, so that financing can be arranged
- identify whether there will be a surplus of cash, so that the surplus can be invested
- assess whether operating activities are generating the cash that is expected from them.

The main focus of cash flow forecasting is likely to be operating cash flows, although some investing and financing cash flows might also be significant.

Techniques for preparing a cash flow forecast

There are no rules about how to prepare a cash flow forecast. A forecast need not be in the same amount of detail as a cash budget. However there are two basic approaches that might be used:

- producing a cash flow forecast similar to a statement of cash flows prepared using the indirect method
- forecasting cash flows by estimating revenues and costs to arrive at an estimate of earnings before interest, tax and depreciation (EBITDA).

2.4 Cash flow statement approach

One way of preparing a cash flow forecast for a period of time is to produce a statement similar to a statement of cash flows in financial reporting. The general structure of the forecast will therefore be as follows:

Cash flow forecast

	\$	\$
Expected trading profit in the period		34,000
Adjustments for non-cash items:		
Depreciation		<u>22,000</u>
		56,000
Adjustments for working capital		
Increase in inventory	(15,000)	
Increase in trade receivables	(18,000)	
Increase in trade payables	<u>10,000</u>	
		<u>(23,000)</u>
Operational cash flows		33,000
Interest payments		(10,000)
Tax payments (on profits)		<u>(7,000)</u>
Cash flows from operating activities		16,000
Cash flows from investing activities		
Sale of non-current asset	4,000	
Purchase of non-current asset	<u>(25,000)</u>	
		(21,000)

Cash flows from financing activities

Repayment of loan	(12,000)	
Payment of dividend	<u>(15,000)</u>	<u>(27,000)</u>
Net change in cash position		(32,000)
Cash at beginning of forecast period		<u>40,000</u>
Cash at end of forecast period		<u>8,000</u>

Trading profit (profit before interest and tax)

The expected trading profit might be estimated by projecting the current year's trading profit (profit before interest and tax). For example, if trading profits have been increasing by about 5% per year and were \$300,000 in the year just ended, it might be assumed for the purpose of the cash forecast that trading profit will be \$315,000 next year.

Depreciation (and amortisation)

Depreciation is not a cash flow; therefore it must be added back to profit in order to calculate cash flows. Detailed information might be available about non-current assets to enable an accurate estimate of future depreciation charges (and amortisation charges, if there are any intangible assets). Alternatively, it might be assumed that the depreciation charge in the next year will be about the same as in the current year.

An assumption has to be made about depreciation charges, and alternative assumptions might be more appropriate. If you have to make an estimate of depreciation for the purpose of cash flow forecasting in your examination, you should make the most reasonable assumption available on the basis of the information provided in the question.

Changes in inventory, trade receivables and trade payables

The figure for profit must also be adjusted for changes in working capital in order to estimate cash flows from operational activities. The most appropriate assumptions about working capital changes might be one of the following:

- that there will be no changes in working capital
- that inventory, trade receivables and trade payables will increase by the same percentage amount as the growth in sales. For example, if sales are expected to increase by 5%, it might be reasonable to assume that inventory, trade receivables and trade payables will also increase by 5% above their amount at the beginning of the year.

Interest payments and tax payments

Assumptions might be needed about interest and tax payments in the cash flow forecast.

- It might be assumed that interest payments will be the same as interest costs in the current year's income statement, on the assumption that the company's total borrowings will not change significantly and interest rates will remain stable.

- It might be assumed that tax payments will be a percentage of the figure for trading profit.
- However, other assumptions might be more appropriate, given the information provided in an examination question.

Investing cash flows

Investing cash flows might be included in a cash flow forecast if:

- it is expected that additional non-current assets will be purchased in the period
- it is expected that some non-current assets will be sold/disposed of
- it is assumed that some essential replacement of ageing and worn-out non-current assets will be necessary. For example it might be assumed that purchases of replacement non-current assets will be necessary, and the amount of replacements required will be equal approximately to the annual depreciation charge for those assets.

Financing cash flows

It might also be appropriate to include some financing cash flows in the cash flow forecast, where these are expected. In particular, if the company intends to pay an equity dividend, this should be included in the forecast as a cash outflow.

2.5 Revenue and cost estimation approach

Another approach to preparing a cash flow statement is to estimate earnings before interest, tax, depreciation and amortisation (EBITDA) using estimates of revenues and costs.

Cash flow forecast

	\$
Sales revenue forecast	300,000
Cost of sales (% of sales revenue)	<u>(180,000)</u>
Gross profit	120,000
Other expenses (possibly fixed, possibly a % of sales revenue)	<u>(90,000)</u>
Net profit	30,000
Add	
Depreciation and amortisation	<u>26,000</u>
EBITDA	<u>56,000</u>

The figure for EBITDA is equivalent to the figure in the cash flow statement for operational cash flows before working capital adjustments. Adjustments can be made to EBITDA for working capital changes, interest and tax payments, investing cash flows and financing cash flows, in order to arrive at an estimate of the net cash flow surplus or deficit for the period.

Sales revenue forecast

The sales revenue forecast should be based on sales revenue in the previous year with an adjustment for volume growth (and possibly an increase in unit sales prices).

Cost of sales and gross profit

If the ratio of cost of sales: sales and the gross profit margin percentage have been fairly stable in recent years, it might be assumed that these ratios will apply in the future. For example, if sales revenue in the previous year was \$10 million, gross profit has been 60% of sales for the past few years and sales revenue should increase by 5% next year with volume growth the estimate of gross profit for next year will be \$10 million \times 1.05 \times 60% = \$6.3 million.

Other expenses

The estimate for other expenses should be based on reasonable assumptions. For example it might be assumed that these are fixed costs and so will be unchanged next year. Alternatively, it might be assumed that these costs will be the same percentage amount of sales revenue as in previous years.

Other adjustments might be necessary, to allow for known changes in cost (for example, if an exceptionally large increase in raw material costs is forecast, this will affect the gross profit margin. Other costs might be affected by an expectation of an unusually large increase in administrative labour costs, and so on.

Depreciation and amortisation

If the estimates of cost of sales and other expenses include depreciation costs and amortisation costs, these must be added back in order to obtain an estimate of EBITDA.

**Example**

A company wants to make a cash flow forecast for next year. The following information is available.

Annual sales	\$ million
Current year (forecast)	80
Previous year (Year – 1)	75
Year – 2	72
Year – 3	67
Year – 4	64

The company has achieved a gross profit margin of between 57% and 62% in the past four years. Other costs (distribution and administration costs) in the current year are expected to be £36 million. Labour costs make up 25% of other costs. These labour costs are expected to rise by 10% per year for the next two years and then in line with the general rate of cost inflation. The general rate of annual cost inflation for the next few years is expected to be 2%.

The company currently has \$100 million of freehold land (50% land and 50% buildings) and \$40 million (at cost) of other non-current assets. Buildings are depreciated by 2% per year and other non-current assets are depreciated over eight years by the straight-line method to a zero residual value. The investment in

working capital (trade receivables plus inventory, less trade payables) is currently \$120 million.

Required

Prepare an estimate of cash flows from operations for each of the next two years.

a

Answer

Sales revenue has grown by a factor of 1.25 (= 80/64) over the past four years. This gives an average annual growth rate in sales of 5.7% (= fourth root of 1.25, minus 1). It might therefore be assumed that sales growth will be 6% per year in each of the next two years.

The gross profit margin has varied between 57% and 62%. It might therefore be assumed that in the next two years gross profit will be 60% sales.

It might also be assumed that growth in sales and the cost of sales allows for 2% per annum price inflation.

Other costs are \$36 million in the current year, consisting of \$9 million of labour costs and \$27 million of other costs. It might be assumed that these are fixed costs, except that they rise by 10% per year in the case of labour and 2% for other costs.

	Current year		Year 1	Year 2
	\$m		\$m	\$m
Labour	9	(+ 10% p.a.)	9.9	10.9
Other costs	27	(+ 2% p.a.)	27.5	28.1
Total	36		37.4	39.0

Depreciation charges each year are expected to be \$1 million (2% × £50 million) for buildings. For other non-current assets, depreciation will be \$5 million (= \$40 million/8 years).

If sales increase by 6% per year, it is assumed that working capital will grow at the same rate, to \$127 million in Year 1 and \$135 million in Year 2.

An estimate of EBITDA, adjusted for expected working capital changes, can now be prepared.

	Current year	Year 1	Year 2
	£m	£m	£m
Revenue	80.0	84.8	89.9
Cost of sales (40%)	<u>(32.0)</u>	<u>(33.9)</u>	<u>(36.0)</u>
Gross profit (60%)	48.0	50.9	53.9
Other costs: see workings	<u>(36.0)</u>	<u>(37.4)</u>	<u>(39.0)</u>
	12.0	13.5	14.9
Depreciation			
Buildings		1.0	1.0
Other non-current assets		<u>5.0</u>	<u>5.0</u>
EBITDA		19.5	20.9
Increase in working capital		<u>(7.0)</u>	<u>(8.0)</u>
EBITDA adjusted for working capital changes		<u>12.5</u>	<u>12.9</u>

2.6 Free cash flow

The concept of free cash flow might also be used in cash flow forecasts. Free cash flow is the amount of surplus cash flow (or the cash flow deficit) after allowing for all cash payments that are essential and non-discretionary. Free cash flow is the amount of cash flow that management are able to use at their discretion for any purpose.

Free cash flow does not have an exact definition, and there may be differences in assumptions about essential cash flows. However, a useful definition of free cash flow is as follows.

	\$
EBITDA	X
Less:	
Payments of interest	(X)
Payments of taxation	(X)
Changes in working capital (inventory, trade receivables, trade payables)	X or (X)
Essential capital expenditure (replacement of worn-out assets)	<u>(X)</u>
Free cash flow	<u>X or (X)</u>

Free cash flow can be used to pay dividends, make discretionary purchases of non-current assets, repay debt capital to lenders, or retain as a cash surplus.



Example

Suppose that in the previous example the company expects to have interest costs of \$500,000 each year for the next two years, and that taxation will be 25% of EBITDA.

It might be assumed that essential capital expenditure is equal to the depreciation charge on non-current assets.

Free cash flow might therefore be estimated as follows.

	Year 1	Year 2
	£m	£m
Revenue	84.8	89.9
Cost of sales (40%)	(33.9)	(36.0)
Gross profit (60%)	50.9	53.9
Other costs: see workings	(37.4)	(39.0)
	13.5	14.9
Depreciation		
Buildings	1.0	1.0
Other non-current assets	5.0	5.0
EBITDA	19.5	20.9
Interest payments	(0.5)	(0.5)
Tax payments (25% of 19.5 and 20.9)	(4.9)	(5.2)
Increase in working capital	(7.0)	(8.0)
Essential capital expenditure	(6.0)	(6.0)
Free cash flow	1.1	1.2

This forecast suggests that after making essential cash payments, the remaining free cash flow will be just over \$1 million in each year, which might be insufficient to pay for proposed equity dividends or discretionary new capital expenditure projects.

In this example, if the company is hoping to expand it will need to consider ways of raising finance from sources other than operational cash flows.

Cash models: Baumol model and Miller-Orr model

- Purpose of cash models
- Baumol model
- Miller-Orr model

3 Cash models: Baumol model and Miller-Orr model

3.1 Purpose of cash models

Cash models might be used when an entity has periods of surplus cash and periods when cash is needed. A model can be used to decide:

- how much cash to hold and how much to invest short-term to earn interest
- when cash is needed, how many investments to sell (how much cash to obtain).

Two such cash models are the Baumol model and the Miller-Orr model

3.2 Baumol model

The Baumol cash model is based on similar principles to the Economic Order Quantity (EOQ) model for inventory control. It assumes that a company spends cash regularly on expenses and that to obtain the cash it has to sell short-term investments. The company therefore makes regular sales of investments in order to obtain cash to pay its operational expenses.

The purpose of the Baumol cash model is to calculate the optimal amount of cash that should be obtained each time that short-term investments are sold.

The assumptions used in the model are as follows:

- The company uses cash at a constant rate throughout each year (the same amount of cash every day).
- The company can replenish its cash immediately, as soon as it runs out of the cash it has.
- Cash is replenished by selling short-term investments. These investments earn interest. The amount of investments sold, and the amount of cash from selling the investments, is \$X.
- Holding cash has a cost. This is the opportunity cost of not investing the cash to earn interest. The opportunity cost, C_H , can be expressed as an interest rate. For example, if investments earn interest at 4% per year, the annual cost of holding cash is 0.04.
- Selling securities or investments to obtain cash has a transaction cost (similar to the cost of placing an order with the EOQ inventory model). In the model, this is shown as C_o .

The maximum amount of cash is therefore X. The average cash holding is $\frac{X}{2}$

The annual cost of holding cash is therefore $\left(\frac{X}{2}\right) \times C_H$

If the annual demand for cash is \$D, the annual transaction costs of selling securities (short-term investments) is $\left(\frac{D}{X}\right) \times C_O$

The model identifies the optimal amount of cash to obtain by selling securities, X. It is the amount of cash that minimises the total opportunity costs of holding cash and the transaction costs of selling securities.

The total of $\left[\left(\frac{X}{2}\right) \times C_H\right] + \left[\left(\frac{D}{X}\right) \times C_O\right]$ is minimised where $X = \sqrt{\frac{2C_O D}{C_H}}$



Example

Entity KL makes payments to its creditors of \$3 million a year, at an equal rate each day.

Each time it converts investments into cash, it pays transaction charges of \$150.

The opportunity cost of holding cash rather than investing it is 6% per year.

Using the Baumol model, calculate what quantity of investments should be sold whenever more cash is needed by Entity KL.



Answer

$$X = \sqrt{\left(\frac{2 \times 150 \times 3,000,000}{0.06}\right)} = \$122,474$$

This might be rounded to \$122,500.

There would then be $\frac{\$3,000,000}{\$122,500}$ = between 24 and 25 transfers of cash during the year.



Exercise 1

Entity GF invests all cash as soon as it is received, to earn interest at 5%. It incurs cash expenditures of \$16,000,000 each year, and pays for these at a constant rate each day. The cost of converting a batch of investments into cash is \$250, regardless of the size of the transaction.

Required

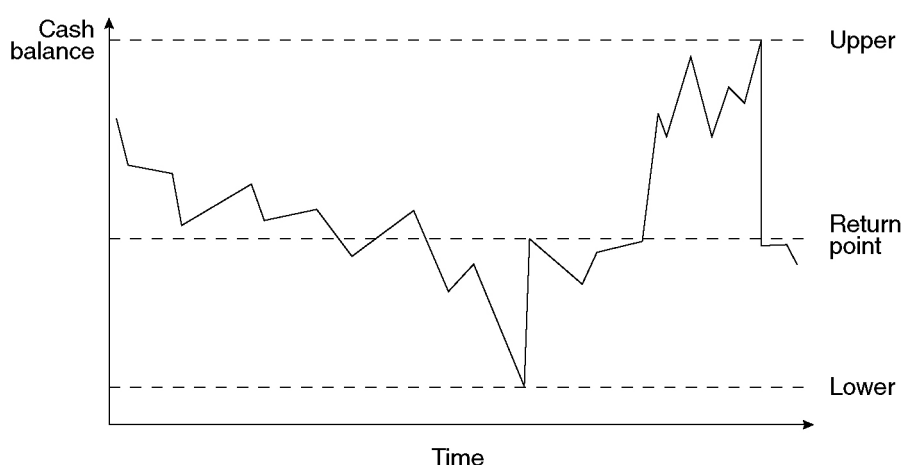
Use the Baumol model to decide how much cash should be obtained each time investments are sold.

3.3 Miller-Orr model

The Baumol model assumes that cash payments are evenly spread over time, and are a constant amount each period. In reality, this is unlikely to happen. There will be much more uncertainty over the timing of cash payments and receipts.

The Miller-Orr model recognises this uncertainty in cash flows, which are measured statistically. Daily cash flows might be positive or negative. The net daily cash flows are then assumed to be normally distributed around the daily average net cash flow. (However, you do not need to know the statistical details of the model.)

The model is used as follows:



- The model has a minimum cash holding. This is called the **lower limit**. This is usually decided by management.
- If the cash balance falls to the lower limit, then investments will be converted into cash, to take the balance back to a predetermined amount, known as the **return point**.
- There is also a maximum cash holding limit, the **upper limit**.
- The difference between the lower limit and the upper limit is called the **spread**.
- If the cash balance reaches the upper limit, cash is used to buy investments. The amount of cash used to buy investments is sufficient to return the cash balance to the return point.
- The cash balance should therefore fluctuate between the upper and lower limits, and should not exceed these limits.
- The distance between the lower limit and the return point is usually $\frac{1}{3}$ of the total spread.
- The distance between the upper limit and the return point is usually $\frac{2}{3}$ of the total spread.

The Miller-Orr model formula for the size of the spread

The Miller-Orr model formula for the size of the spread is as follows:

$$\text{Spread} = 3 \times \left[\frac{\frac{3}{4} \times \text{Transaction cost} \times \text{Variance of cash flows}}{\text{Interest rate as a proportion}} \right]^{1/3}$$

Notes

- The transaction cost is the cost of the sale and purchase of securities
- The variance of cash flows is a statistical measure of the variation in the amount of daily net cash flows.. The variance should relate to the same period of time as the interest rate. For example, if the variance is a variance of daily cash flows, the interest rate (expressed as a proportion) must be a daily interest rate. If in doubt, to calculate a daily interest rate from an annual interest rate, divide the annual interest rate by 365. Alternatively, if you prefer to be more exact, take the 365th root (1 + interest rate), then subtract 1 to get the daily interest rate.
- To convert an annual variance of cash flows to a daily variance, divide by 365.
- Remember also that the variance is the square of the standard deviation (and the standard deviation is the square root of the variance).
- A value to the power of one-third means the cube root. Make sure that you have a calculator that can calculate a cube root.



Example

Entity ASD decides that it needs a minimum cash balance of \$15,000.

It estimates that it has transaction costs of \$50 for each purchase or sale of short-term investments.

Based on its measured historical observations, the standard deviation of daily cash flows is \$1,400.

The annual market interest rate on short-term investments is 8%.

Required

Calculate the upper cash limit and the return point using the Miller-Orr model.



Answer

The variance of daily cash flows = $(1,400)^2 = 1,960,000$.

The daily interest rate = $\frac{0.08}{365} = 0.000219$

Using the formula to calculate the difference between the limits

$$\text{Spread} = 3 \times \left[\frac{\frac{3}{4} \times 50 \times 1,960,000}{0.000219} \right]^{1/3}$$

$$= \$20,848$$

Lower limit (decided by management) = \$15,000

Upper limit = \$15,000 + \$20,848 = \$35,848

Return point = \$15,000 + ($\frac{1}{3} \times \$20,848$) = \$21,949.

Alternative calculation of daily interest rate

$$\text{Daily interest rate} = \sqrt[365]{(1.08)} = 0.000211$$

$$\text{Spread} = 3 \times \left[\frac{\frac{3}{4} \times 50 \times 1,960,000}{0.000211} \right]^{1/3}$$

$$= \$21,108$$

Lower limit (decided by management) = \$15,000

Upper limit = \$15,000 + \$21,108 = \$36,108



Exercise 2

Entity Green decides that it needs a minimum cash balance of \$40,000.

It estimates that it has transaction costs of \$120 for each purchase or sale of short-term investments.

Based on its measured historical observations, the standard deviation of daily cash flows is \$1,800.

The annual market interest rate on short-term investments is 7%.

Required

Using the Miller-Orr model, calculate:

- the upper cash limit, and
- the return point.

Other aspects of cash management

- Use of surplus cash: investing short term
- Ways of investing short term
- Dealing with shortfalls of cash
- Cash management in larger organisations
- Functions of a treasury department

4 Other aspects of cash management

4.1 Use of surplus cash: investing short term

Surplus cash arises when a business entity has cash that it does not need immediately for its day-to-day operations. Surpluses may be short-term (temporary).

When a surplus is identified, the entity should plan how to use it. Holding it as cash is wasteful, because cash in a business bank account earns no interest.

If the surplus is likely to be **long-term**, the cash should be invested long-term in wealth-producing assets of the business – perhaps through a plan of market expansion. Alternatively, if no suitable wealth-producing project is available, the entity should consider returning cash as dividends to its owners – the shareholders.

If the surplus is likely to be **temporary**, it would be more appropriate to invest it for the short term, and then cash in the investments when the cash is eventually needed.

When deciding on how to use temporary surplus cash, the following considerations are important:

- **Liquidity** – Short-term investments should ideally be liquid. This means that they should be convertible into cash fairly quickly, at a fair price and without difficulty. The more liquid the investment, the easier it is to convert it back into cash. Market securities can be sold immediately on the market, but at some risk of obtaining a poor price. Money in a savings account can be withdrawn without loss (except perhaps there might be some loss of interest if the money is withdrawn without providing the required minimum notice period).
- **Safety** – The level of investment risk should be acceptable. There is a risk of losing money on the investment, due to a fall in its market value. With investments such as a savings account, there would be no risk of capital loss, but the interest on the savings might be very low. On the other hand investing in shares of other companies is much more risky since share prices fluctuate.
- **Profitability** – The aim should be to earn the highest possible return on the surplus cash, consistent with the objectives of liquidity and safety.

There has to be a trade-off. The greater the liquidity and safety, then generally the lower will be the interest rate earned (profitability).

4.2 Ways of investing short term

There are various possible short-term investment options for cash.

Savings accounts and interest-earning deposits

Savings accounts. Some banks might allow a business to place short-term cash in a savings account. However, banks do not like companies to use a savings account in the same way as a normal current account, with frequent deposits and withdrawals. The bank might insist on a minimum amount of deposit and a minimum notice period for withdrawals.

If the surplus is fairly large, a bank will usually help a business customer to place surplus cash on short-term deposit in the **money markets** (interbank market). Money market rates might be higher than rates on savings accounts.

Money market investments

It is also possible to purchase some **money market investments**, such as Treasury bills and Certificates of Deposit.

Treasury bills are short-term debt instruments issued by the government. They are usually issued by the government for a period of three months (91 days) or possibly six months, and redeemed at the end of that time. They are very secure ('risk-free') since the central government owes the money. They are also very liquid, and can be sold in the market before maturity if required. However, because they are short-term, very liquid and very safe, the rate of return (yield) tends to be low.

(Note: Treasury bills are issued at a discount to their par value and are redeemed at par. For example UK 91-day Treasury bills might be issued at £99.00 and redeemed by the government at maturity for £100. During the 91-day period the bills can be sold in the market if required, and the market price should move towards £100 as the maturity date approaches.)

Certificates of Deposit issued by banks. These are certificates giving their holder the right to ownership of a deposit of cash with the bank, plus interest, at a date in the future (the maturity date for the CD). The market for CDs is liquid, and CDs can be sold easily if the cash is required before the bank deposit reaches maturity.

Short-dated government bonds. The government issues long-dated bonds ('Treasury bonds') as well as short-dated Treasury bills. When these bonds are nearing their maturity, they are an attractive short-term investment. They are as secure as Treasury bills, and possibly even more liquid.

Longer-term securities as short-term investments

Bonds traded in the bond markets. These normally offer a higher return than short-term investments, because there is greater risk for the investor. Bondholders can sell their investment in the secondary bond market if they need to convert the investment back into cash.

However, there is an investment risk. Bond prices can fall if bond yields in the market rise. Bond prices can also fall if the credit rating of the bond issuer falls. In addition, the bond market is not always liquid, so it might also be difficult to sell the bonds for a fair price when the cash is needed. (However, the domestic market for government bonds is normally very liquid. The problem with market liquidity relates more to corporate bonds and the international bond markets.)

Bonds are therefore inadvisable as a short-term investment, unless the investor is willing to accept the risk that bond prices might fall.

Equity. Investing in the shares of other companies is a high-risk investment as there is no guarantee of return of capital value. Share prices can fall as well as rise, and dividend payments are at the discretion of the directors, and usually only paid twice a year. If the shares are quoted, then there will be some liquidity as they will be tradable in the secondary market.

Investing in shares is not recommended as a short-term investment for surplus cash, because of the risk from volatility in share prices.

4.3 Dealing with shortfalls of cash

If the cash flow forecast or the cash budget indicates a shortage of cash, measures must be taken to deal with the problem. An entity must have the cash that it needs to continue in operation.

If the entity does not have short-term investments that it can sell, it will need to obtain long-term capital or short-term funds.

Long-term funding. A company can consider raising long-term funds by issuing new shares for cash.

Alternatively, an entity might be able to borrow long term, by means of issuing loan stock (bonds) or obtaining a medium-term bank loan.

Various **short-term sources of cash** might also be available.

- **Bank overdrafts** – These are very popular with small and medium-sized businesses. Obtaining a bank overdraft is usually the easiest way for a small business to obtain finance.
 - The advantage of a bank overdraft is that the borrower pays interest only on the amount of the overdraft balance.
 - However, overdrafts are expensive (the interest rate is comparatively high compared with other sources of finance). Overdrafts are also repayable to the bank on demand. The bank can ask for immediate repayment at any time

that it wishes. Overdrafts can therefore be a high-risk source of finance, especially for businesses with cash flow difficulties – in other words, the businesses that are usually in greatest need of an overdraft!

- Bank overdrafts should only be used to finance fluctuating levels of cash shortfalls. If the cash shortfall looks more permanent, other sources of finance should be used.
- **Short-term bank loans** – The main difference between a loan and a bank overdraft is that a loan is arranged for a specific period and the capital borrowed, together with the interest, is repaid according to an agreed schedule and over an agreed time period. They are not repayable on demand before maturity, provided the borrower keeps up the payments. Interest is payable on the full amount of the outstanding loan. However, the bank may demand security for a loan, for example in the form of a fixed and floating charge over the assets of the business.
- **Debt factoring** – Some business entities use the services of a debt factor. The debt factor undertakes to administer the sales receivables ledger of the client business, issuing invoices and collecting payments. In addition, the factor will be prepared to advance cash to the client business in advance of receiving payment. Typically, a factor will lend a client up to 80% of the value of outstanding trade receivables, and charge interest on the amount of the loan. However, debt factor services can be expensive.

4.4 Cash management in larger organisations

Larger businesses find it much easier than smaller businesses to raise cash when they are expecting a cash shortfall. Similarly, when they have a cash surplus, they find it easier to invest the cash.

Cash management in a large organisation is often handled by a specialist department, known as the **treasury department**. One role of the treasury department is to centralise the control of cash, to make sure that:

- cash is used as efficiently as possible
- surpluses in one part of the business (for example, in one profit centre) are used to fund shortfalls elsewhere in the business, and
- surpluses are suitably invested and mature when the cash is needed.

Making the management of cash the responsibility of a centralised treasury department has significant advantages.

- Cash is managed by specialist staff – improving cash management efficiency.
- All the cash surpluses and deficits from different bank accounts used by the entity can be ‘pooled’ together into a central bank account. This means that cash can be channelled to where it is needed, and overdraft interest charges can be minimised.
- Central control over cash lowers the total amount of cash that needs to be kept for precautionary reasons. If individual units had to hold their own ‘safety stock’ of cash, then the total amount of surplus cash would be higher (when added together) than if cash management is handled by one department.

- Putting all the cash resources into one place increases the negotiating power of the treasury department to get the best deals from the banks.

4.5 Functions of a treasury department

The central treasury department is responsible for making sure that cash is available in the right amounts, at the right time and in the right place. To do this, it must:

- produce regular cash flow forecasts to predict surpluses and shortfalls
- arrange short-term borrowing and investment when necessary
- arrange to purchase foreign currency when needed, and arrange to sell foreign currency cash receipts
- protect the business against the risk of adverse movements in foreign exchange rates, when the business has receipts and payments, or loans and investments
- deal with the entity's banks
- finance the business on a day-to-day basis, for example by arranging facilities with a bank
- advise senior management on long-term financing requirements.

Introduction to investment appraisal and capital investment decisions

Contents

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| 1 | Capital expenditure, investment appraisal and capital budgeting |
| 2 | Accounting rate of return (ARR) method |
| 3 | The payback method of capital investment appraisal |
| 4 | Relevant costs in investment decisions |

Capital expenditure, investment appraisal and capital budgeting

- Capital expenditure
- Investment appraisal
- Capital budgeting
- Features of investment projects
- Methods of investment appraisal
- The basis for making an investment decision

1 Capital expenditure, investment appraisal and capital budgeting

1.1 Capital expenditure

Capital expenditure is spending on non-current assets, such as buildings and equipment, or investing in a new business. As a result of capital expenditure, a new non-current asset appears on the statement of financial position (balance sheet), possibly as an 'investment in subsidiary'.

In contrast **revenue expenditure** refers to expenditure that does not create long-term assets, but is either written off as an expense in the income statement in the period that it is incurred, or that creates a short-term asset (such as the purchase of inventory).

Capital expenditure initiatives are often referred to as investment projects, or 'capital projects'. They can involve just a small amount of spending, but in many cases large amounts of expenditure are involved.

A distinction might possibly be made between:

- essential capital spending to replace worn-out assets and maintain operational capability
- discretionary capital expenditure on new business initiatives that are intended to develop the business make a suitable financial return on the investment.

Examination questions usually focus on discretionary capital expenditure.

1.2 Investment appraisal

Before capital expenditure projects are undertaken, they should be assessed and evaluated. As a general rule, projects should not be undertaken unless:

- they are expected to provide a suitable financial return, and
- the investment risk is acceptable.

Investment appraisal is the evaluation of proposed investment projects involving capital expenditure. The purpose of investment appraisal is to make a decision

about whether the capital expenditure is worthwhile and whether the investment project should be undertaken.

1.3 Capital budgeting

Capital expenditure by a company should provide a long-term financial return, and spending should therefore be consistent with the company's long-term corporate and financial objectives. Capital expenditure should therefore be made with the intention of implementing chosen business strategies that have been agreed by the board of directors.

Many companies have a capital budget, and capital expenditure is undertaken within the agreed budget framework and capital spending limits. For example, a company might have a five-year capital budget, setting out in broad terms its intended capital expenditure for the next five years. This budget should be reviewed and updated regularly, typically each year.

Within the long-term capital budget, there should be more detailed spending plans for the next year or two.

- Individual capital projects that are formally approved should be included within the capital budget.
- New ideas for capital projects, if they satisfy the investment appraisal criteria and are expected to provide a suitable financial return, might be approved provided that they are consistent with the capital budget and overall spending limits.

Investment appraisal and capital budgets

Investment appraisal therefore takes place within the framework of a capital budget and strategic planning. It involves

- Generating capital investment proposals in line with the company's strategic objectives.
- Forecasting relevant cash flows relating to the project
- Evaluating the projects
- Implementing projects which satisfy the company's criteria for deciding whether the project will earn a satisfactory return on investment
- Monitoring the performance of investment projects to ensure that they perform in line with expectations.

1.4 Features of investment projects

Many investment projects have the following characteristics:

- The project involves the purchase of an asset with an expected life of several years, and involves the payment of a large sum of money at the beginning of the project. Returns on the investment consist largely of net income from additional profits over the course of the project's life.

- The asset might also have a disposal value (residual value) at the end of its useful life.
- A capital project might also need an investment in working capital. Working capital also involves an investment of cash.

Alternatively a capital investment project might involve the purchase of another business, or setting up a new business venture. These projects involve an initial capital outlay, and possibly some working capital investment. Financial returns from the investment might be expected over a long period of time, perhaps indefinitely.

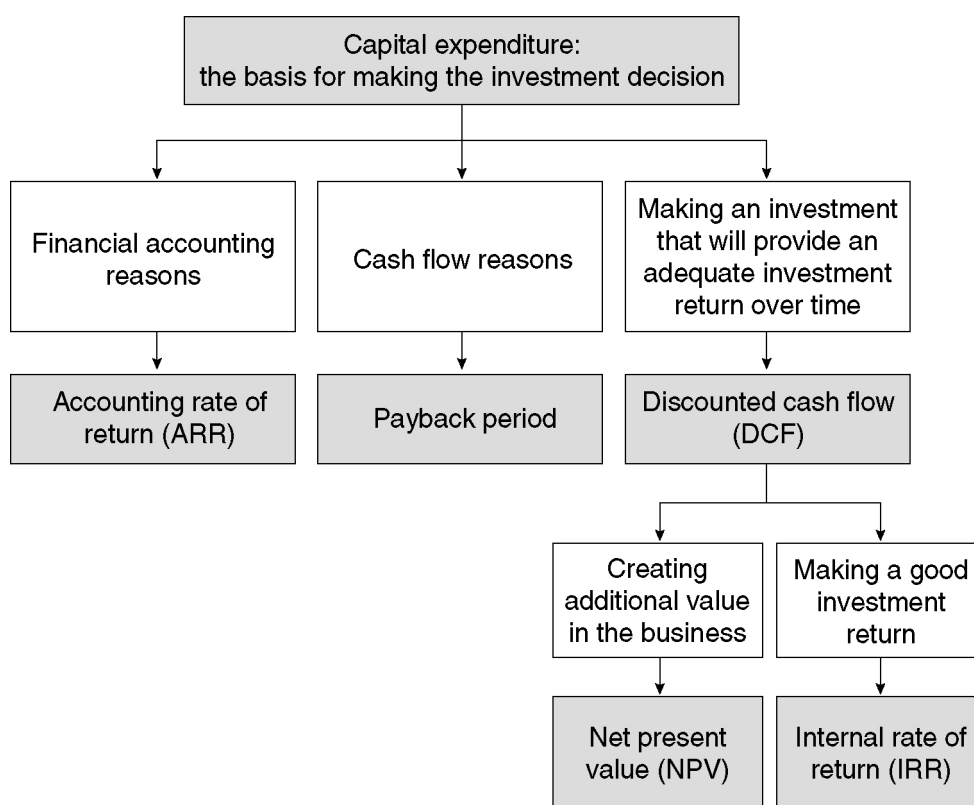
1.5 Methods of investment appraisal

There are four methods of evaluating a proposed capital expenditure project. Any or all of the methods can be used, but some methods are preferable to others, because they provide a more accurate and meaningful assessment.

The four methods of appraisal are:

- Accounting rate of return (ARR) method
- Payback method
- Discounted cash flow (DCF) methods:
 - Net present value (NPV) method
 - Internal rate of return (IRR) method

Each method of appraisal considers a different financial aspect of the proposed capital investment.



1.6 The basis for making an investment decision

When deciding whether or not to make a capital investment, management must decide on a basis for decision-making. The decision to invest or not invest will be made for **financial reasons** in most cases, although non-financial considerations could be important as well.

There are different financial reasons that might be used to make a capital investment decision. Management could consider:

- the effect the investment will have on the accounting return on capital employed, as measured by financial accounting methods. If so, they might use **accounting rate of return (ARR) /return on investment (ROI)** as the basis for making the decision
- the time it will take to recover the cash invested in the project. If so, they might use the **payback period** as the basis for the investment decision
- the expected investment returns from the project. If so, they should use **discounted cash flow (DCF)** as a basis for their decision. DCF considers both the size of expected future returns and the length of time before they are earned.

There are two different ways of using DCF as a basis for making an investment decision:

- **Net present value (NPV) approach.** With this approach, a present value is given to the expected costs of the project and the expected benefits. The value of the project is measured as the net present value (the present value of income or benefits minus the present value of costs). The project should be undertaken if it adds value. It adds value if the net present value is positive (greater than 0).
- **Internal rate of return (IRR) approach.** With this approach, the expected return on investment over the life of the project is calculated, and compared with the minimum required investment return. The project should be undertaken if its expected return (as an average percentage annual amount) exceeds the required return.

The remainder of this chapter considers the accounting rate of return (ARR) method and the payback method of appraisal

Accounting rate of return (ARR) method

- Decision rule for the ARR method
- Definition of ARR
- Advantages and disadvantages of using the ARR method

2 Accounting rate of return (ARR) method

The accounting rate of return (ARR) from an investment project is the accounting profit, usually before interest and tax, as a percentage of the capital invested. It is similar to return on capital employed (ROCE), except that whereas ROCE is a measure of financial return for a company or business as a whole, ARR measures the financial return from specific capital project.

The essential feature of ARR is that it is based on accounting profits, and the accounting value of assets employed.

2.1 Decision rule for the ARR method

The decision rule for capital investment appraisal using the ARR method is that a capital project meets the criteria for approval if its expected ARR is higher than a minimum target ARR or minimum acceptable ARR.

Alternatively the decision rule might be to approve a project if the return on capital employed (ROCE) of the company as a whole will increase as a result of undertaking the project.

2.2 Definition of ARR

If accounting rate of return (ARR) is used to decide whether or not to make a capital investment, we calculate the expected annual accounting return over the life of the project. The financial return will vary from one year to the next during the project; therefore we have to calculate an **average annual return**.

If the ARR of the project exceeds a target accounting return, the project would be undertaken. If its ARR is less than the minimum target, the project should be rejected and should not be undertaken

Unfortunately, a standard definition of accounting rate of return does not exist. There are two main definitions:

- Average annual profit as a percentage of the **average investment** in the project
- Average annual profit as a percentage of the **initial investment**.

You would normally be told which definition to apply. If in doubt, assume that capital employed is the **average** amount of capital employed over the project life.

$$\text{Capital employed} = \left[\frac{\text{Initial cost of equipment} + \text{Residual value}}{2} \right] + \text{Working capital}$$

However, you might be expected to define capital employed as the total initial investment (capital expenditure + working capital investment).

Profits will vary from one year to the next over the life of an investment project. As indicated earlier, profit is defined as the accounting profit, after depreciation but before interest and taxation. Since profits vary over the life of the project, it is normal to use the **average annual profit** to calculate ARR.

Profit is calculated using normal accounting rules, and is after deduction of depreciation on non-current assets.



Example

A company is considering a project which requires an investment of \$120,000 in machinery. The machinery will last four years after which it will have scrap value of \$20,000. The investment in additional working capital will be \$15,000.

The expected annual profits before depreciation are:

Year	
1	\$45,000
2	\$45,000
3	\$40,000
4	\$25,000

The company requires a minimum accounting rate of return of 15% from projects of this type. ARR is measured as average annual profits as a percentage of the average investment.

Should the project be undertaken?



Answer

Total project profits before depreciation = \$45,000 + \$45,000 + \$40,000 + \$25,000 = \$155,000.

Total depreciation = \$120,000 - \$20,000 = \$100,000.

Total accounting profits after depreciation = \$155,000 - \$100,000 = \$55,000.

Average annual accounting profits \$55,000/4 years = \$13,750.

Average investment = $\frac{(\$120,000 + 20,000)}{2} + \$15,000$
= \$85,000.

ARR = $(\$13,750/\$85,000) \times 100\% = 16.2\%$.

The project offers an accounting return higher than the minimum required accounting return of 15%. Therefore using ARR as the investment appraisal method, the project should be undertaken.

2.3 Advantages and disadvantages of using the ARR method

The main **advantages** of the ARR are that:

- It is fairly easy to understand. It uses concepts that are familiar to business managers, such as profits and capital employed.
- It is easy to calculate.

However, there are significant **disadvantages** with the ARR method.

- It is based on accounting profits, and not cash flows. However investments are about investing cash to obtain cash returns. Investment decisions should therefore be based on cash flows, and not accounting profits.
- Accounting profits are an unreliable measure. For example, the annual profit and the average annual investment can both be changed simply by altering the rate of depreciation and the estimated residual value.
- The ARR method ignores the timing of the accounting profits. Using the ARR method, a profit of \$10,000 in Year 1 and \$90,000 in Year 2 is just as valuable as a profit of \$90,000 in Year 1 and \$10,000 in Year 2. However, the timing of profits is significant, because the sooner the cash returns are received, the sooner they can be reinvested to increase returns even more.
- The ARR is a percentage return, relating the average profit to the size of the investment. It does not give us an absolute return. However the absolute return can be significant. For example if the ARR on an investment of \$1,000 is 50%, the average profit is \$500; whereas if the ARR on an investment of \$1 million is 20%, the average annual profit will be \$200,000. An accounting return of \$200,000 on an investment of \$1 million might be preferred to an accounting return of 50% on an investment of \$1,000.
- When using the ARR method for investment appraisal, a decision has to be made about what the minimum target ARR should be. There is no rational economic basis for setting a minimum target for ARR. Any such minimum target accounting return is a subjective target, with no economic or investment significance.



Exercise 1

A capital project would involve the purchase of an item of equipment costing £240,000. The equipment will have a useful life of six years and would generate cash flows of £66,000 each year for the first three years and £42,000 each year for the final three years.

The scrap value of the equipment is expected to be £24,000 after six years. An additional investment of £40,000 in working capital would be required.

The business currently achieves a return on capital employed, as measured from the data in its financial statements, of 10%.

Required

- (a) Calculate the ARR of the project, using the initial cost of the equipment to calculate capital employed.
- (b) Calculate the ARR of the project, using the average cost of the equipment to calculate capital employed.
- (c) Suggest whether or not the project should be undertaken, on the basis of its expected ARR.

The payback method of capital investment appraisal

- Definition of payback
- Decision rule for the payback method
- Advantages and disadvantages of the payback method

3 The payback method of capital investment appraisal

3.1 Definition of payback

Payback is measured by **cash flows, not profits**.

It is the length of time before the cash invested in a project will be recovered (paid back) from the net cash returns from the investment project.

For example, suppose that a project will involve capital expenditure of \$80,000 and the annual net cash returns from the project will be \$30,000 each year for five years. The expected payback period is:

$$\frac{\$80,000}{\$30,000} = 2.67 \text{ years.}$$

3.2 Decision rule for the payback method

Using the payback method, a maximum acceptable payback period is decided, as a matter of policy. The expected payback period for the project is calculated.

- If the expected payback is within the maximum acceptable time limit, the project is acceptable.
- If the expected payback does not happen until after the maximum acceptable time limit, the project is not acceptable.

The **time value of money** is ignored, and the total return on investment is not considered.



Example

A company requires all investment projects to pay back their initial investment within three years. It is considering a new project requiring a capital outlay of \$140,000 on plant and equipment and an investment of \$20,000 in working capital. The project is expected to earn the following net cash receipts:

Year	
1	\$40,000
2	\$50,000
3	\$90,000
4	\$25,000

Should the investment be undertaken?

a

Answer

Note that for the purpose of investment appraisal, 'now' is usually referred to as 'Year 0'.

The investment in working capital should be included as an outflow of cash at the beginning of the project. This is because when there is an increase in working capital, cash flows are lower than cash profits by the amount of the increase.

Similarly when working capital is reduced to \$0 at the end of the project, the reduction is added to cash flows because when there is a reduction in working capital, cash flows are higher than cash profits by the amount of the reduction.

Year	Cash flow	Cumulative cash position at the end of the year
	\$	\$
0	(160,000)	(160,000) (= \$140,000 + \$20,000)
1	40,000	(120,000)
2	50,000	(70,000)
3	90,000	20,000
4	465,000	65,000 cash flow = \$25,000 + \$20,000

- (a) If we assume that all cash flows occur at the end of each year, the payback period is three years.
- (b) If we assume that cash flows arise evenly over the course of each year, then the payback period is:
 $2 \text{ years} + (70,000/90,000) \text{ year}$
 $= 2.78 \text{ years} = 2 \text{ years } 9 \text{ months}.$

Note: The payback period of 2 years 9 months is calculated as follow.

(1) Payback occurs during the third year. At the beginning of year 3 the cumulative cash flow is \$(70,000). During the year there are net cash flows of \$90,000. The cumulative cash flow therefore starts to become positive, assuming even cash flows through the year, after $70,000/90,000$ of the year = 0.78 year.

(2) A decimal value for a year can be converted into months by multiplying by 12, or into days by multiplying by 365. So 0.78 years = 9 months (= 0.78×12) or 285 days (= 0.78×365).

3.3 Advantages and disadvantages of the payback method

The **advantages** of the payback method for investment appraisal are as follows:

- Simplicity – The payback is easy to calculate and understand.
- The method analyses cash flows, not accounting profits. Investments are about investing cash to earn cash returns. In this respect, the payback method is better than the ARR method.

- Payback is often used together with a DCF method, particularly by companies that have liquidity problems and do not want to tie up cash for long periods. Payback can be used to eliminate projects that will take too long to pay back. Investments that pass the payback test can then be evaluated using one of the DCF methods.

The **disadvantages** of the payback method are as follows:

- It ignores all cash flows after the payback period, and so ignores the total cash returns from the project. This is a significant weakness with the payback method.
- It ignores the timing of the cash flows during the payback period. For example, for an investment of \$100,000, cash flows of \$10,000 in Year 1 and \$90,000 in Year 2 are no different from cash flows of \$90,000 in Year 1 and \$10,000 in Year 2, because both pay back after two years. However it is clearly better to receive \$90,000 in Year 1 and \$10,000 in Year 2 than to receive \$10,000 in Year 1 and \$90,000 in Year 2.



Exercise 2

A company must choose between two investments, Project A and Project B. It cannot undertake both investments. The expected cash flows for each project are:

Year	Project A	Project B
	\$	\$
0	(80,000)	(80,000)
1	20,000	60,000
2	36,000	24,000
3	36,000	2,000
4	17,000	-

The company has a policy that:

- The maximum permissible payback period for an investment is three years.
- If a choice has to be made between two projects, the project with the earlier payback will be chosen.

Required

Calculate the payback period for each project:

- assuming that cash flows occur at that year end
- assuming that cash flows after Year 0 occur at a constant rate throughout each year

Are the projects acceptable, according to the company's payback rule?

Which project should be selected?

Do you agree that this is the most appropriate investment decision?

Relevant costs in investment decisions

- Relevant costs and decision-making
- Relevant cost of materials
- Relevant cost of existing equipment
- Relevant cost of investment in working capital
- Opportunity costs

4 Relevant costs in investment decisions

4.1 Relevant costs and decision-making

You should already be familiar with the concept that when any decision is evaluated in accounting, relevant costs should be used for the evaluation. Since the ARR method uses accounting profits and not cash flows, it is a poor investment appraisal method that should not be used for making investment decisions.

Relevant costs are used for payback method analysis and for DCF analysis. DCF analysis is described in the next chapter.

Definition of relevant costs and benefits

Relevant costs and benefits are future cash flows arising as a direct consequence of the decision under consideration.

- Relevant costs are **cash flows**. Any items of cost that are not cash flows must be ignored for the purpose of decision. For example, depreciation expenses are not cash flows and must always be ignored.
- Relevant costs are **future** cash flows. Costs that have already been incurred are not relevant to a decision that is being made now. The cost has already been incurred, whatever decision is made, and it should therefore not influence the decision. For example, a company might incur initial investigation costs of \$20,000 when looking into the possibility of making a capital investment. When deciding later whether to undertake the project, the investigation costs are irrelevant, because they have already been spent.
- Relevant costs are also **costs that will arise as a direct consequence of the decision**, even if they are future cash flows. If the costs will be incurred whatever decision is taken, they are not relevant to the decision.

Some examples of relevant costs are given below, but you should already be familiar with the concept of relevant costs from your previous studies.

4.2 Relevant costs of materials

When materials will have to be purchased for a project, because there are no existing inventories of the materials, their relevant cost is their future purchase cost.

However if the materials required for a project are already held in inventory, their relevant cost depends on circumstances.

- If the materials are in regular use, and quantities consumed for the investment project would be replaced in the normal course of trading operations, the relevant cost of the materials is their current replacement cost.
- If the materials will not be replaced if they are used for the investment project, their relevant cost is the higher of:
 - their net disposal value and
 - the net contribution that could be earned using the materials for another available use.

4.3 Relevant cost of existing equipment

When new capital equipment will have to be purchased for a project, the purchase cost of the equipment will be a part of the initial capital expenditure, and so a relevant cost.

However, if an investment project will also make use of equipment that the business already owns, the relevant cost of the equipment will be the higher of:

- the current disposal value of the equipment, and
- the present value of the cash flows that could be earned by having an alternative use for the equipment.

4.4 Relevant cost of investment in working capital

It is important that you should understand the relevance of investment in working capital for cash flows. This point has been explained previously.

Strictly speaking, an investment in working capital is not a cash flow. However, it should be treated as a cash flow, because:

- when capital investment projects are evaluated, it is usual to estimate the cash profits for each year of the project
- however, actual cash flows will differ from cash profits by the amount of the increase or decrease in working capital.

You should be familiar with this concept from cash flow statements.

- If there is an increase in working capital, cash flows from operations will be lower than the amount of cash profits. The increase in working capital can therefore be treated as a cash outflow, to adjust the cash profits to the expected cash flow for the year.
- If there is a reduction in working capital, cash flows from operations will be higher than the amount of cash profits. The reduction in working capital can

therefore be treated as a cash inflow, to adjust the cash profits to the expected cash flow for the year.



Example

A company is considering whether to invest in the production of a new product. The project would have a six-year life. Investment in working capital would be \$30,000 at the beginning of Year 1 and a further \$20,000 at the beginning of Year 2.

For the purpose of investment appraisal, it is usually assumed that a cash flow, early during a year, should be treated as a cash flow as at the end of the previous year.

The relevant cash flows for the working capital investment would therefore be as follows:

Year	\$
1 (cash outflow)	(30,000)
2 (cash outflow)	(20,000)
6 (cash inflow)	50,000

4.5 Opportunity costs

Opportunity costs are the benefits forgone by using assets or resources for one purpose, instead of using them in the most profitable alternative way. Opportunity costs are commonly measured as contribution forgone, but might also be measured as a present value (in DCF analysis).

When resources have more than one alternative use, and are in limited supply, their opportunity cost is the contribution forgone by using them for one purpose and so being unable to use them for another purpose.



Example

A company is considering an investment in a major new information system. The investment will require the use of six of the company's IT specialists for the first one year of the project. These IT specialists are each paid \$100,000 each per year. IT specialists are difficult to recruit. If the six specialists are not used on this project, they will be employed on other projects that would earn a total contribution of \$500,000.

The relevant cost of the IT specialist in Year 1 of the project would be:

	\$
Basic salaries	600,000
Contribution forgone	500,000
Total relevant cost	<u>1,100,000</u>

Discounted cash flow

Contents

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The time value of money: compounding and discounting

- The time value of money
- Compounding
- Discounting
- Discount factors
- Introduction to discounted cash flow (DCF) analysis

1 The time value of money: compounding and discounting

Discounted cash flow analysis (DCF) is a method of evaluating proposed capital investments, that:

- evaluates the expected cash flows of the investment, not accounting profits, and
- recognises the relevance of the time value of money.

1.1 The time value of money

Companies make investments in order to earn a return. They want to recover their investment, and in addition make a profit. However investments and investment returns should be measured by their cash flows, not their accounting profits. Companies that invest are no different in this respect from individuals who invest.

Money has a time value, because an investor expects a return that allows for the length of time that the money is invested. Larger cash returns should be required for investing for a longer term.



Example

If \$1,000 is invested at 10% annual interest, the investor will want a return of:

\$1,100 (= \$1,000 × 1.10¹) if it is a one-year investment, but

\$1,210 (= \$1,000 × 1.10²) if it is a two-year investment and

\$1,331 (= \$1,000 × 1.10³) if it is a three-year investment.

Investment returns can be measured by compounding or discounting.

1.2 Compounding

Compounding is used to calculate the future value of an investment, where the investment earns a compound rate of interest. If an investment is made 'now' and is expected to earn interest at r% in each time period, for example each year, the future value of the investment can be calculated as follows.

Future return = Initial investment × (1 + r)ⁿ

The term 'future value' or 'FV' means the value of an investment or cash flow at a future date. 'Present value' or 'PV' refers to value now. The above compound interest formula can therefore be stated as:

$$FV = PV \times (1 + r)^n.$$

Notes

r = the return on the investment each time period (year). This might be an actual return or a required return.

n = the number of time periods (years) covered by the investment.

r is expressed as a proportion. For example:

- if the return is 12%, $r = 0.12$
- if the return is 7%, $r = 0.07$
- if the return is 8.5%, $r = 0.085$.



Example

A company is investing \$200,000 to earn an annual return of 6% over three years. If there are no cash returns before the end of Year 3, what will be the return from the investment after three years?



Answer

$$\$200,000 \times 1.06^3 = \$238,203.$$

1.3 Discounting

Discounting is the reverse of compounding. Future cash flows from an investment can be converted to an equivalent present value amount.

$$\text{Present value of future return} = \text{Future value of return} \times [1/(1 + r)^n]$$

$$PV = FV \times [1/(1 + r)^n].$$

The present value of a future cash flow from an investment is the amount that would have to be invested now, at the investment cost of capital, to earn that future cash flow.



Example

How much would an investor need to invest now in order to have \$1,000 after 12 months, if the compound interest on the investment is 0.5% each month?



Answer

The future value of the investment return is \$1,000 after 12 months. The investment 'now' would have to be the present value of \$1,000 after 12 months, discounted at

0.5% per month.

Present value = $\$1,000 \times [1/(1.005)^{12}] = \$1,000 \times 0.942 = \$942$.



Example

An investor wants to make a return on his investments of at least 7% per year. He has been offered the chance to invest in a bond that will cost \$200,000 and will pay \$270,000 at the end of four years. If there is no investment risk with the bond, should he undertake the investment?



Answer

If the investor could invest his money at 7% per year, then in order to earn \$270,000 after four years the amount of his investment now would need to be:

$$\begin{aligned} \text{PV} &= \$270,000 \times 1/(1.07)^4 = \$270,000 \times 0.763 \\ &= \$206,010. \end{aligned}$$

He is required to invest only \$200,000 to earn \$270,000 after 4 years. This indicates that the bond will provide a return in excess of 7% per year. It can also be suggested that the bond would give the investor an immediate increase in wealth of \$6,010 because an investment costing \$200,000 is actually 'worth' \$206,010 to him.



Exercise 1

An investor has just invested a sum of money at an interest rate of 8% per year. The investment will be worth \$125,000 in five years' time.

How much has he invested?

1.4 Discount factors

A discount factor is $1/(1 + r)^n$. Future cash flows or investment values are multiplied by the appropriate discount factor to convert them into a present value.

Present value = Future cash flow \times Discount factor

The discount factor is smaller for higher values of r and higher values of n .

1.5 Introduction to discounted cash flow (DCF) analysis

Discounted cash flow is a technique for evaluating proposed investments, to decide whether they are financially worthwhile.

The expected future cash flows from the investment (cash payments and cash receipts) are all converted to a present value by discounting them at the cost of capital r . The present value of investment costs and the present value of the investment returns (cash benefits or returns) can be compared.

There are two methods of DCF:

- **Net present value (NPV) method:** the cost of capital r is the return required by the investor or company
- **Internal rate of return (IRR) method:** the cost of capital r is the actual return expected from the investment.

Net present value (NPV) method of investment appraisal

- Calculating the NPV of an investment project
- Assumptions about the timing of cash flows
- Discount tables
- Advantages and disadvantages of the NPV method

2 Net present value (NPV) method of investment appraisal

With the NPV method of investment appraisal, all the future cash flows from an investment are converted into a present value by discounting each future cash flow at the investment cost of capital. This cost of capital is the return required from the investment.

The present value of a future cash inflow from a capital project is the amount that would have to be invested now at the cost of capital to obtain that cash flow in the future. For example suppose that a project is expected to provide a cash return of \$40,000 after two years and a further \$50,000 after three years, and the company needs to make a return of 10% per year. The NPV approach to investment appraisal is to convert these expected future cash inflows into their present value equivalent.

- The present value of these future cash flows would be the amount that the company would need to invest now at 10% per year to obtain a return of \$40,000 after two years and another \$50,000 after three years.
- The present value of the expected cash flows is therefore the value to the company, in terms of 'today's value' of those cash flows in the future.

2.1 Calculating the NPV of an investment project

In NPV analysis, all future cash flows from a project are converted into a present value, so that the value of all the annual cash outflows and cash inflows can be expressed in terms of 'today's value'.

The net present value (NPV) of a project is the net difference between the present value of all the costs incurred and the present value of all the cash flow benefits (savings or revenues).

- If the present value of benefits exceeds the present value of costs, the NPV is positive.
- If the present value of benefits is less than the present value of costs, the NPV is negative.
- The NPV is 0 when the PV of benefits and the PV of costs are equal.

The **decision rule** is that, ignoring other factors such as risk and uncertainty, and non-financial considerations, a project is worthwhile financially if the NPV is positive or zero. It is not worthwhile if the NPV is negative.

The **net present value** of an investment project is also a **measure of the value of the investment**. For example, if a company invests in a project that has a NPV of \$2 million, the value of the company should increase by \$2 million.

2.2 Assumptions about the timing of cash flows

In DCF analysis, the following assumptions are made about the timing of cash flows during each year:

- All cash flows for the investment are assumed to occur at the end of the year
- If a cash flow will occur early during a particular year, it is assumed that it will occur at the end of the previous year. Therefore cash expenditure early in Year 1, for example, is assumed to occur in Year 0.

Year 0 cash flows

Cash flows at the beginning of the investment, in Year 0, are already stated at their present value.

The discount factor for a cash flow in Year 0 is $1/(1 + r)^0$.

Any value to the power of 0 is always = 1. Therefore the discount factor for Year 0 is always = 1.000, for any cost of capital.

This means that the present value of \$1 in year 0 is always \$1, for any cost of capital.



Example

A company estimates that its cost of capital is 10%. It is considering whether to invest in a project with the following cash flows and will make the decision on the basis of the net present value of the project:

Year	\$
0	(10,000)
1	6,000
2	8,000

Should the project be undertaken?



Answer

The cash flow in each year must be converted into a present value, using a discount rate of 10%. Negative cash flows have a negative present value and positive cash flows have a positive present value. The sum of the present values in each year is the net present value of the investment.

Year	Cash flow	Discount factor at 10%	Present value
	\$		\$
0	(10,000)	1	(10,000)
1	6,000	$1/(1.10)$	5,456
2	8,000	$1/(1.10)^2$	6,612
		NPV	<u>2,068</u>

The project should be accepted, ignoring other factors such as risk and uncertainty, because it has a positive NPV of \$2,068.

(Note: The figures here are rounded to the nearest \$1. It might be more appropriate to round to the nearest \$100 or even the nearest \$1,000, depending on the degree of accuracy that is required or that is appropriate, given the inevitable uncertainties in the cash flow estimates).

The positive NPV shows that in order to earn a cash return of \$6,000 after one year and \$8,000 after two years, for an investment return of 10%, the company would need to invest \$12,068 now. Instead, by investing just \$10,000 in the project, it will obtain the same returns so which is better: investing \$10,000 or investing \$12,068 in order to obtain exactly the same returns? Clearly, the answer is that it is better to invest \$10,000. The project will provide a return in excess of 10% per year.



Example

A company is considering whether to undertake an investment. The cost of capital is 10%. The initial cost of the investment would be \$50,000 and the expected annual cash flows from the project would be:

Year	Revenue	Costs	Net cash flow
	\$	\$	\$
1	40,000	30,000	10,000
2	55,000	35,000	20,000
3	82,000	40,000	42,000

Required

- Use compounding arithmetic to calculate what the investment should be worth at the end of Year 3.
- Using discounting, calculate the NPV of the project.
- Reconcile the future value of the investment (calculated by compounding) with the NPV.

a**Answer**

Compounding	\$
Investment in Year 0	(50,000)
Interest required (10%), Year 1	(5,000)
Return required, end of Year 1	(55,000)
Net cash flow, Year 1	10,000
	(45,000)
Interest required (10%), Year 2	(4,500)
Return required, end of Year 2	(49,500)
Net cash flow, Year 2	20,000
	(29,500)
Interest required (10%), Year 3	(2,950)
Return required, end of Year 3	(32,450)
Net cash flow, Year 3	42,000
Future value, end of Year 3	9,550

Discounting: NPV method

Year	Cash flow	Discount factor at 10%	Present value
	\$		\$
0	(50,000)	1.0	(50,000)
1	10,000	$1/(1.10)^1$	9,091
2	20,000	$1/(1.10)^2$	16,529
3	42,000	$1/(1.10)^3$	31,555
			+7,175
Net present value			

Reconciliation of present value and future value

$$\text{NPV} \times (1 + r)^n = \text{Future value: } \$7,175 \times (1.10)^3 = \$9,550$$

This example shows a simple capital project with an initial capital outlay in Year 0 and cash inflows for three years. The same technique can be applied to much bigger and longer capital projects, and projects with negative cash flows in years other than Year 0.

2.3 Discount tables

Discount tables are available. They take away the need to calculate the value of discount factors $[1/(1 + r)^n]$. Discount tables are included in the formula and tables sheets near the end of this study text.

Discount tables are provided in your examination, and the discount factors in the tables are rounded to three decimal places.

An extract from discount tables is shown below.

Periods (n)	Discount rates (r)									
	1%	2%	3%	4%	5%	6%	7%	8%	9%	10%
1	0.990	0.980	0.971	0.962	0.952	0.943	0.935	0.926	0.917	0.909
2	0.980	0.961	0.943	0.925	0.907	0.890	0.873	0.857	0.842	0.826
3	0.971	0.942	0.915	0.889	0.864	0.840	0.816	0.794	0.772	0.751
4	0.961	0.924	0.888	0.855	0.823	0.792	0.763	0.735	0.708	0.683
5	0.951	0.906	0.863	0.822	0.784	0.747	0.713	0.681	0.650	0.621

For example, suppose that you need to calculate the present value of \$60,000 in Year 4 if the cost of capital (discount rate) is 7%.

You could use your calculator to calculate: $\$60,000 \times 1/(1.07)^4 = \$45,774$.

Alternatively, you could use discount tables to calculate: $\$60,000 \times 0.763 = \$45,780$.

The rounding difference is insignificant.



Exercise 2

The following exercise tests your basic understanding of the NPV method and the use of discount tables. It should also demonstrate that **when the cost of capital is lower, the NPV is higher**.

A company is considering an investment in equipment costing \$70,000. Working capital of \$5,000 will also be required early in Year 1. The equipment will have a resale value of \$7,000 at the end of Year 5. The operating profits from the investment, in cash flows, will be:

Year	Cash flow
	\$
1	25,000
2	20,000
3	30,000
4	20,000
5	3,000

Required

Using discount tables for the discount factors, calculate the NPV of the project if the cost of capital is:

- 12% and
- 8%

2.4 Advantages and disadvantages of the NPV method

The **advantages** of the NPV method of investment appraisal are that:

- NPV takes account of the timing of the cash flows by calculating the present value for each cash flow at the investor's cost of capital.

- DCF is based on cash flows, not accounting profits. It is therefore much more suitable than the ARR method for investment appraisal.
- It evaluates all cash flows from the project, unlike the payback method which considers only those cash flows in the payback period.
- It gives a single figure, the NPV, which can be used to assess the value of the investment project. The NPV of a project is the amount by which the project should add to the value of the company, in terms of 'today's value'.
- The NPV method provides a decision rule which is consistent with objective of maximisation of shareholders' wealth. In theory, a company ought to increase in value by the NPV of an investment project (assuming that the NPV is positive).

The main **disadvantages** of the NPV method are:

- The time value of money and present value are concepts that are not easily understood
- There might be some uncertainty about what the appropriate cost of capital or discount rate should be for applying to any project. Cost of capital is considered in more detail in a later chapter.

Internal rate of return (IRR) method

- The investment decision rule with IRR
- Calculating the IRR of an investment project
- Advantages and disadvantages of the IRR method
- Summary: comparison of the four investment appraisal methods

3 Internal rate of return (IRR) method

The internal rate of return method (IRR method) is another method of investment appraisal using DCF.

The internal rate of return of a project is the discounted rate of return on the investment.

- It is the average annual investment return from the project
- Discounted at the IRR, the NPV of the project cash flows must come to 0.

The internal rate of return is therefore the discount rate that will give a net present value = \$0.

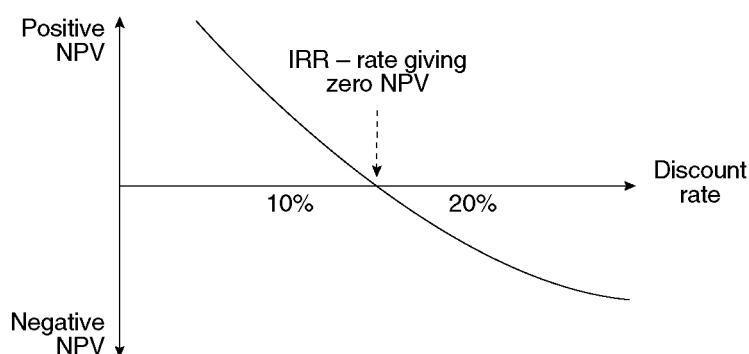
3.1 The investment decision rule with IRR

A company might establish the minimum rate of return that it wants to earn on an investment. If other factors such as non-financial considerations and risk and uncertainty are ignored:

- If a project IRR is equal to or higher than the minimum acceptable rate of return, it should be undertaken
- If the IRR is lower than the minimum required return, it should be rejected.

Since NPV and IRR are both methods of DCF analysis, the same investment decision should normally be reached using either method.

The internal rate of return is illustrated in the diagram below:



3.2 Calculating the IRR of an investment project

The IRR of a project can be calculated by inputting the project cash flows into a financial calculator. In your examination, you might be required to calculate an IRR without a financial calculator. An approximate IRR can be calculated using interpolation.

To calculate the IRR, you should begin by calculating the NPV of the project at two different discount rates.

- One of the NPVs should be positive, and the other NPV should be negative. (This is not essential. Both NPVs might be positive or both might be negative, but the estimate of the IRR will then be less reliable.)
- Ideally, the NPVs should both be close to zero, for better accuracy in the estimate of the IRR.

When the NPV for one discount rate is positive NPV and the NPV for another discount rate is negative, the IRR must be somewhere between these two discount rates.

Although in reality the graph of NPVs at various discount rates is a curved line, as shown in the diagram above. Using the interpolation method we **assume that the graph is a straight line** between the two NPVs that we have calculated. We can then use **linear interpolation** to estimate the IRR, to a reasonable level of accuracy.

The interpolation formula

If the NPV at A% is positive, + \$P

and if the NPV at B% is negative, - \$N

$$\text{IRR} = A\% + \left[\frac{P}{P+N} \times (B - A)\% \right]$$

Ignore the minus sign for the negative NPV. For example, if P = + 75 and N = - 30, then P + N = 105.



Example

A business requires a minimum expected rate of return of 12% on its investments. A proposed capital investment has the following expected cash flows.

Year	\$
0	(80,000)
1	20,000
2	36,000
3	30,000
4	17,000

Required

Calculate the NPV at a cost of capital of 10% and a cost of capital of 15%. Use these NPV figures to estimate the IRR

a**Answer**

Year	Cash flow	Discount factor at 10%	Present value at 10%	Discount factor at 15%	Present value at 15%
	\$		\$		\$
0	(80,000)	1.000	(80,000)	1,000	(80,000)
1	20,000	0.909	18,180	0.870	17,400
2	36,000	0.826	29,736	0.756	27,216
3	30,000	0.751	22,530	0.658	19,740
4	17,000	0.683	11,611	0.572	9,724
			+ 2,057		(5,920)
NPV					

The IRR is above 10% but below 15%.

Using the interpolation method:

- The NPV is + 2,057 at 10%.
- The NPV is – 5,920 at 15%.
- The NPV therefore falls by 7,977 between 10% and 15%.

The estimated IRR is: $IRR = 10\% + \left[\frac{2,057}{(2,057 + 5,920)} \times (15 - 10)\% \right]$

= 10% + 1.3%

= 11.3%

Recommendation

The project is expected to earn a DCF return below the target rate of 12%, and on financial grounds it is not a worthwhile investment.

3.3 Advantages and disadvantages of the IRR method

The main **advantages** of the IRR method of investment appraisal are:

- As a DCF appraisal method, it is based on cash flows, not accounting profits.
- Like the NPV method, it recognises the time value of money.
- It is easier to understand an investment return as a percentage return on investment than as a money value NPV in \$.
- For accept/reject decisions on individual projects, the IRR method will reach the same decision as the NPV method.

The **disadvantages** of the IRR method are:

- It is a relative measure (% on investment) not absolute measure in \$. Because it is a relative measure, it ignores the absolute size of the investment. For example, which is the better investment if the cost of capital is 10%:
 - an investment with an IRR of 15% or
 - an investment with an IRR of 20%?
- If the investments are mutually exclusive, and only one of them can be undertaken the correct answer is that it depends on the size of each of the investments. This means that the IRR method of appraisal can give an incorrect decision if it is used to make a choice between mutually exclusive projects
- Unlike the NPV method, the IRR method does not indicate by how much an investment project should add to the value of the company.

e

Example

There are two mutually exclusive projects.

Year	Project 1	Project 2
	\$	\$
	(1,000)	(10,000)
	1,200	4,600
	-	4,600
	-	4,600
IRR	20%	18%
NPV at 15%	+ \$43	+ \$503

Which is better?

a

Answer

Project 2 is better, because it has the higher NPV. Project 2 will add to value by \$503 but Project 1 will add value of just \$43.

3.4 Summary: comparison of the four investment appraisal methods

A comparison of the four investment appraisal methods is given in the table below. The **key points to note** are that:

- DCF is superior to the ARR method and payback method of investment appraisal
- It is often equally as good to use NPV or IRR
- However, NPV has two advantages over IRR
 - The NPV method indicates the value that the investment should add (if the NPV is positive) or the value that it will destroy (if the NPV is negative).
 - When there are two or more mutually exclusive projects, the NPV will always identify the project that should be selected. This is the project that will provide the highest value (NPV).

- The IRR method has the advantage of being more easily understood by non-accountants
- Another disadvantage of the IRR method is that a project might have two or more different IRRs, when some annual cash flows during the life of the project are negative. (The mathematics that demonstrate this point are not shown here.)

ARR	Payback	Discounted cash flow	
<i>Disadvantages</i>	<i>Advantages</i>	<i>Advantages</i>	
Financial profits, not cash flows	Cash flows, not accounting values	Based on investment cash flows, not accounting profit	
Balance sheet values, not cash investment cost.	Focus on recovering the cost of the investment	Recognises the time value of money	
		Recognises all cash flows, over the full life of the project	
		By far the best investment appraisal method	
		Required return is based on the organisation's cost of finance.	
	<i>Disadvantages</i>	<i>NPV</i>	<i>IRR</i>
	Choice of maximum payback period is arbitrary	Indicates the increase in the value of the company that should be expected if it were to undertake the investment.	More easily understood than NPV by a non-accountant.
	Ignores cash from the project after payback	If a choice has to be made between two (or more) mutually exclusive projects , the NPV method is more reliable than IRR.	
	Ignores the time value of money.		

Annuities and perpetuities

- Definition of an annuity
- Calculating the PV of an annuity
- Annuity discount tables
- Using annuities and annuity factors for investment appraisal
- Definition of a perpetuity
- Present value of a perpetuity

4 Annuities and perpetuities

4.1 Definition of an annuity

An annuity is a constant cash flow for a given number of time periods. A capital project might include estimated annual cash flows that are an annuity.

Examples of annuities are:

- \$30,000 each year for years 1 – 5
- \$20,000 each year for years 3 – 10
- \$500 each month for months 1 – 24.

The present value of an annuity can be calculated using annuity factors, rather than using discount factors to calculate the present value of the cash flow for each individual year.

4.2 Calculating the PV of an annuity

If you need to calculate the present value of \$50,000 per year for years 1 – 3 at a discount rate of 9%, you could calculate this as follows:

Year	Cash flow	Discount factor at 9%	Present value
	\$		\$
1	50,000	$1/(1.09) = 0.917$	45,850
2	50,000	$1/(1.09)^2 = 0.842$	42,100
3	50,000	$1/(1.09)^3 = 0.772$	38,600
		NPV	<u>126,550</u>

There is a formula for calculating the present value of an annuity. The formula is:

$$PV = \frac{A}{r} \times \left[1 - \frac{1}{(1+r)^n} \right]$$

Where:

A = the constant annual cash flow (the annuity)

r = discount rate, as a proportion

n = number of time periods

The present value of \$50,000 per year for three years at a discount rate of 9% can therefore be calculated as:

$$\frac{\$50,000}{0.09} \times \left[1 - \frac{1}{(1.09)^3} \right] = [\$50,000/0.09] \times (1 - 0.0.77218) = \$50,000 \times 0.22782$$

$$= \$126,567.$$

4.3 Annuity discount tables

Another way of calculating the PV of an annuity is to multiply the annuity by the sum of the discount factors for the years in which the cash flows occur. In the example above, the PV of \$50,000 for years 1 – 3 at a discount rate of 9% could be calculated as:

$$\$50,000 \times (0.917 + 0.842 + 0.772) = \$50,000 \times 2.531 = \$126,550.$$

The discount factors for annuities are simply the sum of the annual discount factors for each year of the annuity. Discount tables for annuities are included in the formula and tables sheets near the end of this text. These tables will be provided in your examination. An extract is shown below.

Extract from annuity tables

Periods (n)	Discount rates (r)									
	1%	2%	3%	4%	5%	6%	7%	8%	9%	10%
1	0.990	0.980	0.971	0.962	0.952	0.943	0.935	0.926	0.917	0.909
2	1.970	1.942	1.913	1.886	1.859	1.833	1.808	1.783	1.759	1.736
3	2.941	2.884	2.829	2.775	2.723	2.673	2.624	2.577	2.531	2.487
4	3.902	3.808	3.717	3.630	3.546	3.465	3.387	3.312	3.240	3.170
5	4.853	4.713	4.580	4.452	4.329	4.212	4.100	3.993	3.890	3.791

The annuity factors are for periods starting in period 1 (year 1). For example, the annuity factor for years 1 – 3 at 9%, from the table, is 2.531.



Examples

The annuity factor for years 1 – 2 at a cost of capital of 8% = 1.783 ($n = 2$, discount factor 8%). This is the sum of the discount factors at 8% for years 1, and 2 (0.926 + 0.857).

The annuity factor for years 1 – 5 at a cost of capital of 10% = 3.791 ($n = 5$, discount factor = 10%). This is the sum of the discount factors at 10% for years 1, 2, 3, 4 and 5 (0.909 + 0.826 + 0.751 + 0.683 + 0.621).

4.4 Using annuities and annuity factors for investment appraisal

Annuity discount factors can be used in DCF investment analysis, mainly to make the calculations easier and quicker.



Example

What is the present value of the cash flows for a project, if the cash flows are \$60,000 each year for years 1 – 7, and the cost of capital is 15%?



Answer

$\$60,000 \times 4.160$ (annuity factor at 15%, $n = 7$) = \$249,600.



Example

What is the present value of the following cash flows, when the cost of capital is 12%?

Year	Annual cash flow	Discount factor at 12%	Present value
	\$		\$
0	(100,000)		
1	10,000		
2	15,000		
3 – 15	20,000		
NPV			



Answer

Annuity factor at 12%, years 1 – 15 = 6.811

Annuity factor at 12%, years 1 – 2 = 1.690

Therefore annuity factor at 12%, years 3 – 15 = 6.811 – 1.690 = 5.121

Year	Annual cash flow	Discount factor at 12%	Present value
	\$		\$
0	(100,000)	1.000	(100,000)
1	10,000	0.893	8,930
2	15,000	0.797	11,955
3 – 15	20,000	5.121	102,420
NPV			<u>+23,305</u>

**Example**

A company is considering an investment of \$70,000 in a project. The project life would be five years.

What must be the minimum annual cash returns from the project to earn a return of at least 9% per annum?

**Answer**

Investment = \$70,000

Annuity factor at 9%, years 1 – 5 = 3.890

Minimum annuity required = \$17,995 (= \$70,000/3.890)

**Exercise 3**

A company is considering an investment of \$70,000 in a project. The project life would be ten years. The cash flows would be \$15,000 each year for years 1 – 5 and \$10,000 each year for years 6 – 10. The cost of capital is 8%.

What is the NPV of the project?

4.5 Definition of a perpetuity

A perpetuity is a constant annual cash flow ‘forever’, or into the long-term future.

In investment appraisal, an annuity might be assumed when a constant annual cash flow is expected for a long time into the future.

4.6 Present value of a perpetuity

The present value of a perpetuity is C/r , where:

- C is the constant annual cash flow in perpetuity
- r is the cost of capital, for example 0.08, 0.10 etcetera.

**Examples**

The present value of \$2,000 in perpetuity, starting in Year 1, given a cost of capital of 8%, is: $\$2,000/0.08 = \$25,000$.

The present value of \$5,500 in perpetuity, starting in Year 4, given a cost of capital of 11%, is calculated as follows:

- The perpetuity starts in Year 4, therefore the ‘present value’ as at the end of Year 3 = $\$5,500/0.11 = \$50,000$.

- At a discount rate of 11%, the present value (Year 0 value) of \$50,000 as at the end of Year 3
 - = \$50,000 × discount factor for Year 3 at 11%
 - = \$50,000 × 0.731
 - = \$36,550.



Exercise 4

A company is planning a long-term investment costing \$800,000. The project cash flows would be \$100,000 each year for the first five years and then \$80,000 per year in perpetuity, from Year 6 onwards. The cost of capital is 12%.

What is the NPV of this project, and should it be undertaken? (Ignore all other factors, including risk and uncertainty).

Layout of NPV calculations

- Two methods of presentation
- Workings for relevant costs

5 Layout of NPV calculations

5.1 Two methods of presentation

If you are required to present NPV calculations in the answer to an examination question, it is important that you should be able to present your calculations and workings clearly. There are two normal methods of presenting calculations, and you should try to use one of them.

The two methods of presentation are shown below, with illustrative figures.

Format 1

Year	Description of item	Cash flow	Discount factor at 10%	Present Value
		\$		\$
0	Machine	(40,000)	1.000	(40,000)
0	Working capital	(5,000)	1.000	(5,000)
1-3	Cash profits	20,000	2.487	49,740
3	Sale of machine	6,000	0.751	4,506
3	Recovery of working capital	5,000	0.751	3,755
			NPV	<u>13,001</u>

Format 2

Year	0	1	2	3
Description of item	\$	\$	\$	\$
Machine/sale of machine	(40,000)			6,000
Working capital	(5,000)			5,000
Cash receipts		50,000	50,000	50,000
Cash expenditures		(30,000)	(30,000)	(30,000)
Net cash flow	<u>(45,000)</u>	<u>20,000</u>	<u>20,000</u>	<u>31,000</u>
Discount factor at 10%	1.000	0.909	0.826	0.751
Present value	(45,000)	18,180	16,520	23,281
NPV		<u>+ 12,981</u>		

For computations with a large number of cash flow items, the second format is probably easier. This is because the discounting for each year will only need to be done once.

Note that **changes in working capital** are included as cash flows. An increase in working capital, usually at the beginning of the project in Year 0, is a cash outflow and a reduction in working capital is a cash inflow. Any working capital investment becomes \$0 at the end of the project.

5.2 Workings for relevant costs

You should also show all your workings to calculate specific cash flows. For example, you might need to show your workings to obtain the cash flows for:

- annual cash profits from a project, or
- taxation.

Where you are required to identify the relevant costs for an item, present your calculations or reasoning clearly in workings or notes. If there are sunk costs that have already been incurred or committed by an earlier decision, these are not relevant costs: it might be appropriate to tell the examiner that you have recognised the irrelevance of the sunk cost or committed cost, by making a note in your answer.



Example

A company is considering a new large project. It owns a piece of land that it bought for \$6,000 over forty years ago. This land is currently not being used but could be sold now for \$1.2 million. If it is used it could be sold in three years time for \$1.3 million.

The company will spend \$500,000 building a work processing plant for the project. The company finances the plant with a three-year bank loan at 5%. The resale value of the plant is \$50,000 at the end of year 3.

The company also will use various types of raw material. The raw material requirements for the project output of 100 tonnes of Product X are as follows:

Raw material	A	B
Current amounts in inventory (tonnes)	100	100
Cost (per tonne)	\$95	\$80
Scrap value (per tonne)	\$30	Toxic
Replacement cost (per tonne)	\$100	\$90
Used elsewhere?	Yes	No
Contribution per tonne used on other products**	\$40	\$400
(**contribution = after deduction of current replacement cost)		
Annual requirement (tonnes)	200	100

Notes

- Raw material B is toxic. No further supplies are available until the end of the first year. Material B is also being used in another product, for which 50 tonnes are required annually. This other product is being discontinued from the end of year 1.
- There are no other uses for Material B. To dispose of material B would cost the company \$25 per tonne.
- The standard cost card prepared by the management accountant shows a cost for Product X of \$450 per tonne produced. This includes a direct labour cost of \$100 per unit of Product X.
- There is spare capacity in the labour force – no extra personnel or overtime will be needed to produce the new product.

Receipts from sales will be:

Year 1	\$500,000
Year 2	\$500,000
Year 3	\$300,000

The project will last three years. Assume that all cash flows occur at the end of the relevant year.

Required

Calculate the NPV if the company has a cost of capital of 10%. Ignore taxation.

a**Answer****Notes**

- (1) **Land.** By undertaking the project, the company will forgo the immediate sale of the land, for which it could obtain \$1,200,000. This revenue forgone is an opportunity cost. However, if the project is undertaken, the land can be sold at the end of Year 3 for \$1,300,000
- (2) **Plant.** The relevant cash flows are its current cost (the \$500,000 is assumed to be a cash cost) and its eventual disposal value. The 5% financing of the plant is irrelevant and must be ignored: interest costs are implied in the cost of capital, which is 10%, not 5%.
- (3) **Labour costs** – Labour costs are irrelevant because they are not incremental cash flows. The wages or salaries will be paid whether or not the project goes ahead.
- (4) **Material A costs** – Material A is in regular use; therefore its relevant cost is its replacement cost. Annual cost = 200 tonnes × \$100 = \$20,000.
- (5) **Material B costs** – 100 tonnes are currently in inventory and no additional units can be obtained until Year 2. The choices are to use all 100 tonnes to make Product X, or to use 50 tonnes to make the other product and dispose of the remaining 50 tonnes.

The other product earns a contribution of \$400 per tonne of Material B used, and the contribution is after deducting the replacement cost of the material. The opportunity cost of using the 50 tonnes to make Product X instead of this other product in Year 1

is therefore \$490 per tonne. The total opportunity cost of lost cash flow is therefore 50 tonnes at \$490 each = \$24,500, but in Year 1 only.

However, by making Product X, the company will also avoid the need to dispose of 50 tonnes of Material B at a cost of \$25 per tonne. It is assumed that these costs would be incurred early in Year 1 (Year 0). Making and selling Product X will therefore save the company disposal costs of 50 tonnes \times \$25 = \$6,250 in Year 0.

Year	0	1	2	3
	\$	\$	\$	\$
Land	(1,200,000)			1,300,000
Plant	(500,000)			50,000
Material A		(20,000)	(20,000)	(20,000)
Material B: disposal costs saved	6,250			
Material B: cash profits forgone		(24,500)		
Material B: purchase costs			(9,000)	(9,000)
Sales	<u>500,000</u>	<u>500,000</u>	<u>300,000</u>	<u> </u>
Net cash flow	(1,193,750)	455,500	271,000	1,321,000
Discount factor at 10%	1.000	0.909	0.826	0.751
Present value	(1,193,750)	414,050	223,846	992,071

DCF: taxation and inflation

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DCF and taxation

- Taxation cash flows in investment appraisal
- Interest costs and taxation
- Timing of cash flows for taxation

1 DCF and taxation

1.1 Taxation cash flows in investment appraisal

In project appraisal, cash flows arise due to the effects of taxation. When an investment results in higher profits, there will be higher taxation. Tax cash flows should be included in DCF analysis. In DCF analysis it is normally assumed that tax is payable on the amount of cash profits in any year.

For example, if taxation on profits is 25% and a company earns \$10,000 cash profit each year from an investment, the pre-tax cash inflow is \$10,000, but there is a tax payment of \$2,500.

Similarly, if an investment results in lower profits, tax is reduced. For example, if an investment causes higher spending of \$5,000 each year and the tax on profits is 30%, there will be a cash outflow of \$5,000 but a cash benefit from a reduction in tax payments of \$1,500.

1.2 Interest costs and taxation

Interest costs are also allowable expenses for tax purposes, but interest cash flows are not included in DCF analysis. This is because the interest cost is in the cost of capital (discount rate).

In DCF analysis, an **after-tax cost of capital** is used to calculate present values. An after-tax cost of capital is a discount rate that allows for the tax relief on interest payments. This means that because interest costs are allowable for tax purposes, the cost of capital is adjusted to allow for this and is reduced accordingly.

By using an after-tax cost of capital, we are able to exclude both interest cash flows and tax relief on interest from the estimated cash flows of a project.

The cost of capital is explained in more detail in a later chapter. Briefly however, if interest on debt capital is 8% and the rate of tax on company profits is 25%, the after-tax cost of the debt capital will be $8\% \times (1 - 0.25) = 6\%$. In other words, when t is the rate of taxation as a proportion, the after-tax cost of debt capital is:
 $r(1 - t)$.

1.3 Timing of cash flows for taxation

When cash flows for taxation are included in investment appraisal, an assumption must be made about when the tax payments are made. The actual timing of tax payments depends on the tax rules that apply in the relevant country. In DCF analysis, one or other of the following assumptions is used.

- **Assumption 1.** Tax is payable in the same year as the profits to which the tax relates.
- **Assumption 2.** Tax is payable one year later ('one year in arrears'). For example, tax on the cash profits in Year 1 is payable in Year 2.

Either of these two assumptions could be correct. An examination question should specify which assumption you should use.



Example

The after-tax cost of capital is 8%. A project costing \$60,000 will be expected to earn cash profits of \$40,000 in year 1 and \$50,000 in year 2. Taxation at 30% occurs one year in arrears of the profits or losses to which they relate.

For the purpose of this exercise, assume that the cost of the project is not an allowable cost for tax purposes (i.e. capital allowances should be ignored).

Required

Calculate the NPV of the project.



Answer

Year	Investment/pre-tax cash profit	Tax at 30%	Net cash flow	Discount factor at 8%	Present value
	\$	\$	\$		\$
0	(60,000)		(60,000)	1.000	(60,000)
1	40,000		40,000	0.926	37,040
2	50,000	(12,000)	38,000	0.857	32,566
3		(15,000)	(15,000)	0.794	(11,910)
	NPV				<u>(2,304)</u>

Tax-allowable depreciation (capital allowances)

- The nature of capital allowances
- Straight-line method
- Reducing balance method
- Balancing charge or balancing allowance on disposal

2 Tax-allowable depreciation (capital allowances)

2.1 The nature of capital allowances

When a business buys a non-current asset, depreciation is charged in the financial accounts. However, depreciation in the financial accounts is not an allowable expense for tax purposes.

Instead, the tax rules provide for 'tax-allowable depreciation' or capital allowances, according to rules determined by the government.

Tax-allowable depreciation affects the cash flows from an investment, and the tax effects must be included in the project cash flows.

There are two ways of allowing depreciation for tax purposes:

- the straight-line method
- the reducing balance method.

2.2 Straight-line method

With the straight-line method of tax-allowable depreciation, the annual depreciation expense allowed for tax purposes =

$$\frac{\text{Cost of the asset minus any expected residual value}}{\text{Expected years of life}}$$



Example

An asset costs \$80,000 and has an expected economic life of four years with no residual value. If depreciation is allowed for tax purposes over four years using the straight-line method, the allowable depreciation would be \$20,000 each year.

If the rate of tax on profits is 25%, the annual reduction in tax from the capital allowance is $\$20,000 \times 25\% = \$5,000$ for four years.

		Tax written down value (TWDV) of asset	Allowance claimed	Tax saving at 25%
		\$	\$	\$
Year 0	Cost	80,000		
Year 1	Allowance claimed	(20,000)	20,000	5,000
		<u>60,000</u>		
Year 2	Allowance claimed	(20,000)	20,000	5,000
		<u>40,000</u>		
Year 3	Allowance claimed	(20,000)	20,000	5,000
		<u>20,000</u>		
Year 4	Allowance claimed	(20,000)	20,000	5,000
		<u>0</u>		

The tax cash flows (tax savings) should be treated as cash inflows in the appropriate year in the DCF analysis. In this example:

- If tax cash flows occur in the same year as that the allowance is claimed, the cash inflows of \$5,000 will occur in each of the years 1 – 4.
- If tax cash flows occur in the year following the claim for the allowance, the cash inflows of \$5,000 will occur in each of the years 2 – 5.

2.3 Reducing balance method

With the reducing balance method, the tax-allowable depreciation expense in each year is a constant percentage each year of the tax written down value (TWDV) of the asset as at the beginning of the year. The TWDV of the asset is its cost minus all accumulated capital allowances to date.



Example

An asset costs \$80,000. Tax-allowable depreciation is 25% on a reducing balance basis. Tax on profits is payable at the rate of 30%. The cash flow benefits from the tax depreciation are calculated as follows:

Year		TWDV	Tax allowable depreciation (25%)	Tax saved (30%)
		\$	\$	\$
0	Cost	80,000		
1	Allowance claimed, 25%	(20,000)	20,000	6,000
		<u>60,000</u>		
2	Allowance claimed, 25%	(15,000)	15,000	4,500
		<u>45,000</u>		
3	Allowance claimed, 25%	(11,250)	11,250	3,375
		<u>33,750</u>		

4	Allowance claimed, 25%	<u>(8,438)</u>	8,438	2,531
		25,312		
5	Allowance claimed, 25%	<u>(6,328)</u>	6,328	1,898
	TWDV, end of Year 5	<u>18,984</u>		

(Note: TWDV = the tax written-down value of the asset.)

The tax cash flows (tax savings) should be treated as cash inflows in the appropriate year in the DCF analysis – either in the same year that the allowance is claimed or one year in arrears, depending on the assumption used about the timing of tax payments.

Balancing charge or balancing allowance on disposal

When an asset reaches the end of its useful life, it will be scrapped or disposed of. An asset might also be disposed of before the end of its useful life. On disposal, there might be a balancing charge or a balancing allowance. This is the difference between:

- the written-down value of the asset for tax purposes (TWDV), and
- its disposal value (if any).

The effect of a balancing allowance or balancing charge is to ensure that over the life of the asset:

Total amount of capital allowances claimed = Cost of the asset – Residual value

Balancing allowance. If the written-down value of the asset for tax purposes is higher than the disposal value, the difference is a balancing allowance. The balancing allowance is set against taxable profits, and so it will result in a reduction in tax payments of:

Balancing allowance × Tax rate = **Cash saving**

Balancing charge. If the written-down value of the asset for tax purposes is lower than the disposal value, the difference is a balancing charge. The balancing charge is a taxable amount, and will result in an increase in tax payments of:

Balancing charge × Tax rate = **Cash payment.**

With the reducing balance method, either a balancing charge or balancing allowance should be expected at the end of the project.

The cash saving or cash payment is included in the cash flows for DCF analysis, either in the year of disposal of the asset or in the following year, depending on the assumption used about the timing of tax payments.

Note: An annual capital allowance is not claimed in the year of disposal of an asset. Instead, there is simply a balancing allowance (or a balancing charge).

e**Example**

A company is considering an investment in a non-current asset costing \$80,000. The project would generate the following cash profits:

Year	\$
1	50,000
2	40,000
3	20,000
4	10,000

The asset is eligible for tax-allowable depreciation at 25%, by the reducing balance method. It is expected to have a residual value of \$20,000 at the end of year 4, when it will be disposed of. The after-tax cost of capital is 9%. The rate of tax on profits is 30%. Taxation cash flows occur one year in arrears.

Required

Calculate the NPV of the project.

a**Answer**

The solution to the previous example shows the calculations of the tax allowance each year for depreciation. It also shows that at the beginning of year 4, the year of disposal, the written down value of the asset will be \$33,750. The disposal value of the asset at the end of year 4 is \$20,000.

No capital allowance is claimed in the year of disposal (Year 4), therefore the balancing allowance in Year 4 is calculated as follows:

	\$
TWDV at start of Year 4	33,750
Disposal value in Year 4	20,000
Balancing allowance (TWDV is higher)	<u>13,750</u>

The tax saved in Year 5 will therefore be $\$13,750 \times 30\% = \$4,125$.

The NPV of the project can now be calculated as follows. Notice that for simplicity the tax on cash profits are shown separately from the tax savings from capital allowances, instead of being combined into a single value for tax cash flows.

Year	Investment	Cash profits	Tax on profits at 30%	Tax-allowable dep'n – tax saved	Net cash flow	DCF factor at 9%	PV
	\$	\$	\$	\$	\$		\$
0	(80,000)				(80,000)	1.000	(80,000)
1		50,000		6,000	56,000	0.917	51,352
2		40,000	(15,000)	4,500	29,500	0.842	24,839
3		20,000	(12,000)	3,375	11,375	0.772	8,782
4	20,000	10,000	(6,000)	2,531	26,531	0.708	18,784
5			(3,000)	4,125	1,125	0.650	731
						NPV	<u>+ 24,488</u>

Your ability to calculate an NPV with taxation and capital allowances should improve with familiarity. The following exercise is provided to give you the opportunity to practice.



Exercise 1

A company is considering whether to invest in a new item of equipment. The equipment would cost \$120,000 and have a useful life of four years, after which it would be disposed of for \$45,000.

The equipment will reduce running costs by \$50,000 each year (before taxation). Taxation is at the rate of 30%. The equipment would attract tax-allowable depreciation of 25% each year, by the reducing balance method.

Taxation cash flows occur one year in arrears of the cost or benefit to which they relate.

The cost of capital is 11% (after tax).

Required

Calculate the NPV of the project and recommend whether the investment in the project is worthwhile.

DCF and inflation

- Inflation and long-term projects
- The normal rules for inflation in DCF analysis
- Using the real cost of capital

3 DCF and inflation

3.1 Inflation and long-term projects

When a company makes a long-term investment, there will be costs and benefits for a number of years. In all probability, the future cash flows will be affected by inflation in sales prices and inflation in costs. So far, the explanation of DCF investment appraisal has ignored inflation.

Occasions when inflation is ignored

In practice, it is common to ignore inflation when carrying out DCF analysis for investment appraisal. Inflation can be ignored if it can be assumed that:

- there will be no inflation in prices and costs, or
- it is impossible to predict what inflation will be, but the effects of inflation will be insignificant, or
- all cash flows, for benefits and costs, will have exactly the same rate of inflation.

It is certainly difficult to predict what the rate of inflation will be over the next few years, and this is probably why inflation is normally ignored for DCF analysis.

However, inflation might be a significant factor in some investments. Inflation should be taken into consideration:

- when it is likely to be significant, and
- when reasonable estimates of the future rate of inflation can be made.

3.2 The normal rules for inflation in DCF analysis

The cost of capital used in DCF analysis is normally a **'money' cost of capital**. This is a cost of capital calculated from current market returns and yields.

When estimates are made for inflation in future cash flows, the rules are as follows:

- Estimate all cash flows at their inflated amount. Since cash flows are assumed to occur at the year-end, they should be increased by the rate of inflation for the full year.

- To estimate a future cash flow at its inflated amount, you can apply the formula:

$$\text{Cash flow in year } n \text{ at inflated amount} = \\ [\text{Cash flow at current price level}] \times (1 + i)^n$$

where i is the annual rate of inflation.

- Discount the inflated cash flows at the money cost of capital, to obtain present values for cash flows in each year of the project and the NPV for the project.



Example

A company is considering an investment in an item of equipment costing \$150,000. The equipment would be used to make a product. The selling price of the product at today's prices would be \$10 per unit, and the variable cost per unit (all cash costs) would be \$6.

The project would have a four-year life, and sales are expected to be:

Year	Units of sale
1	20,000
2	40,000
3	60,000
4	20,000

At today's prices, it is expected that the equipment will be sold at the end of Year 4 for \$10,000. There will be additional fixed cash overheads of \$50,000 each year as a result of the project, at today's price levels.

The company expects prices and costs to increase due to inflation at the following annual rates:

Item	Annual inflation rate
Sales	5%
Variable costs	8%
Fixed costs	8%
Equipment disposal value	6%

The company's money cost of capital is 12%. Ignore taxation.

Required

Calculate the NPV of the project.



Answer

All the cash flows must be re-stated at their inflated amounts. An assumption needs to be made about what the cash flows will be in Year 1. Are 'today's' price levels the price levels to use in Year 1, or should the cash flows in Year 1 be increased to allow for inflation?

An examination question might tell you which assumption to use. If it does not, state your assumption in the answer. Since Year 1 cash flows relate to the end of Year 1, the appropriate assumption is usually to start inflating the cash flows in Year 1. This assumption is used here.

Item		Year 1	Year 2	Year 3	Year 4
		\$	\$	\$	\$
Revenue					
At today's prices		200,000	400,000	600,000	200,000
At inflated prices (5% per year)	A	<u>210,000</u>	<u>441,000</u>	<u>694,575</u>	<u>243,101</u>
Costs					
Variable, today's prices		120,000	240,000	360,000	120,000
Fixed, today's prices		50,000	50,000	50,000	50,000
Total, today's prices		170,000	290,000	410,000	170,000
At inflated prices (8% per year)	B	<u>183,600</u>	<u>338,256</u>	<u>516,482</u>	<u>231,283</u>
Net cash profit (A – B)		<u>26,400</u>	<u>102,744</u>	<u>178,093</u>	<u>11,818</u>
Equipment disposal (\$10,000 × (1.06) ⁴)					12,625

The NPV can now be calculated in the normal way.

Year		Cash flow	Discount factor at 12%	Present value
		\$		\$
0	Equipment	(150,000)	1.000	(150,000)
1	Cash profit	26,400	0.893	23,575
2	Cash profit	102,744	0.797	81,887
3	Cash profit	178,093	0.712	126,802
4	Cash profit	11,818	0.636	7,516
4	Disposal value	12,625	0.636	8,030
	NPV			<u>+ 97,810</u>



Exercise 2

A company is considering whether or not to invest in a five-year project. The investment will involve buying an item of machinery for \$200,000. At today's prices, the annual operating cash flows would be:

Year	Revenues	Running costs
	\$	\$
1	200,000	100,000
2	200,000	100,000
3	250,000	125,000
4	150,000	75,000
5	100,000	50,000

However, revenues are expected to go up by 7% each year due to inflation, and costs are expected to go up by 12% per year due to inflation.

The machinery is expected to have a re-sale value at the end of year 5 of \$20,000 at today's prices, but this amount is expected to rise by 5% each year due to inflation.

The cost of capital is 16%. Ignore inflation.

Required

Calculate the NPV of the investment project.

3.3 Using the real cost of capital

The cost of capital given for use in DCF analysis is normally a 'money' rate of return (also known as a **nominal rate of return**). The money rate of return should be used to discount money cash flows which have been adjusted to take into account inflation increases.

An alternative approach to DCF analysis is to discount real cash flows using a real cost of capital. Real cash flows are shown at today's prices.

Real cost and money cost

A money cost is a cost that includes an allowance for inflation. A real cost is a cost that excludes the effects of inflation. Real costs have to be expressed in terms of prices at a given date. In DCF analysis this will normally be 'today's prices'.

For example suppose that inflation for the next two years is expected to be 4% per year. If a cost at the end of Year 2 is \$1,000 at today's prices, it will be \$1,082 after allowing for inflation. In this example, \$1,000 is the real cost and \$1,082 is the money cost.

The same applies to the cost of capital. A money cost of capital is expressed in terms of current investment rates in the market, but these rates already make allowance for expectations of future rates of inflation. The real rate of return on investment is the money market rate with inflation taken out.

A real rate of return can be calculated using the relationship

$$(1 + \text{money rate}) = (1 + \text{real rate}) \times (1 + \text{inflation rate})$$

where all of the rates are expressed as proportions.



Example

If a company has a cost of capital of 12% and inflation is 5%

$$(1 + 0.12) = (1 + \text{real rate}) \times (1 + 0.05)$$

$$\text{So the real rate} = 1.12/1.05 - 1 = 6.67\%$$

Using the real rate of return for DCF analysis

Instead of calculating the NPV of a project by discounting 'money' cash flows at the money cost of capital, we can calculate the NPV using a real cost of capital applied to cash flows at today's prices.

Discounting real cash flows using a real cost of capital will give the same NPV as discounting money cash flows using the money cost of capital, where the same rate of inflation applies to all items of cash flow.



Example

A company is considering an investment in an item of equipment costing \$150,000. Contribution per unit is expected to be \$4 and sales are expected to be:

Year	Units
1	20,000
2	40,000
3	60,000
4	20,000

Fixed costs are expected to be \$50,000 at today's price levels and the equipment can be disposed of in year 4 for \$10,000 at today's price levels. The inflation rate is expected to be 6% and the money cost of capital is 15%.

Required

Calculate the NPV of the project:

- using money cash flows and the money cost of capital
- using the real value of cash flows and the real cost of capital



Answer

- Using money cash flows and a money discount rate

Item	Year 1	Year 2	Year 3	Year 4
	\$	\$	\$	\$
Contribution	80,000	160,000	240,000	80,000
Fixed costs	(50,000)	(50,000)	(50,000)	(50,000)
Disposal proceeds				10,000
Net cash flow (at today's prices)	30,000	110,000	190,000	40,000
Adjust for inflation	× 1.06	× 1.06 ²	× 1.06 ³	× 1.06 ⁴
Money cash flows	31,800	123,596	226,293	50,499
Discount at 15%	0.870	0.756	0.658	0.572
Present value	27,666	93,439	148,901	28,885

Total PV of cash flows, Years 1 – 4 = 27,666 + 93,439 + 148,901 + 28,885 = 298,891

Net present value = 298,891 – 150,000 = \$148,891

(b) Using real cash flows and a real discount rate

The real discount rate = $1.15/1.06 - 1 = 0.085 = 8.5\%$

Item	Year 1	Year 2	Year 3	Year 4
	\$	\$	\$	\$
Contribution	80,000	160,000	240,000	80,000
Fixed costs	(50,000)	(50,000)	(50,000)	(50,000)
Disposal proceeds				10,000
Net cash flow (at today's prices)	30,000	110,000	190,000	40,000
Discount at 8.5%	1/1.085	1/1.085 ²	1/1.085 ³	1/1.085 ⁴
Present value	27,650	93,440	148,753	28,863

Net present value = $298,706 - 150,000 = 148,706$

Both approaches give the same solution, with a small difference due to rounding errors.

Which method to use for DCF analysis with inflation?

When inflation is taken into consideration in investment appraisal, the normal method of analysis is to use money cash flows and the money cost of capital. This is because different items of cost or revenue are likely to have differing rates of inflation. When this happens it becomes a complex mathematical process to adjust all cash flows to a real value.

The real cost of capital and real cash flows should only be used:

- when all items are expected to have the same rate of inflation, and
- you are asked to use real costs and the real cost of capital by an examination question.

DCF: risk and uncertainty

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| 2 | Sensitivity analysis |
| 3 | Expected value of the NPV: assessment of project risk |
| 4 | Other methods of risk and uncertainty analysis |

Risk and uncertainty in capital investment appraisal

- The problem of risk and uncertainty
- Methods of assessing risk and uncertainty

1 Risk and uncertainty in capital investment appraisal

1.1 The problem of risk and uncertainty

Investment projects are long-term projects, often with a time scale of many years. When the cash flows for an investment project are estimated, the estimates might be incorrect. Estimates of cash flows might be wrong for two main reasons:

- risk in the investment, and
- uncertainty about the future.

Risk

Risk exists when the actual outcome from a project could be any of several different possibilities, and it is not possible in advance to predict which of the possible outcomes will actually occur.

The simplest example of risk is rolling a dice. When a dice is rolled, the result will be 1, 2, 3, 4, 5 or 6. These six possible outcomes are known in advance, but it is not possible in advance to know which of these possibilities will be the actual outcome. With risk assessment, it is often possible to estimate the probabilities of different outcomes. For example, we can predict that the result of rolling a dice will be 1, 2, 3, 4, 5 or 6, each with a probability of $1/6$.

Risk can often be measured and evaluated mathematically, using probability estimates for each possible future outcome.

Uncertainty

Uncertainty exists when there is insufficient information to be sure about what will happen, or what the probability of different possible outcomes might be. For example, a business might predict that sales in three years' time will be £500,000, but this might be largely guesswork, and based on best-available assumptions about sales demand and sales prices.

Uncertainty occurs due to a lack of sufficient information about what is likely to happen.

It is possible to assess the uncertainty in a project, but with less mathematical precision than for the assessment of risk.

Management should try to evaluate the risk and uncertainty, and take it into account, when making their investment decisions. In other words, investment

decisions should consider the risk and uncertainty in investment projects, as well as the expected returns and NPV.

1.2 Methods of assessing risk and uncertainty

There are several methods of analysing and assessing risk and uncertainty. In particular:

- Sensitivity analysis can be used to assess a project when there is uncertainty about future cash flows
- Probability analysis can be used to assess projects in which there is risk.

Other methods of risk and uncertainty analysis include:

- risk modelling and simulation
- risk-adjusted discount rates
- adjusted payback
- discounted payback as one of the criteria for investing in capital projects.

Sensitivity analysis

- The purpose of sensitivity analysis: assessment of project uncertainty
- Methods of sensitivity analysis
- Estimating the sensitivity of a project to changes in the cost of capital
- The usefulness of sensitivity analysis

2 Sensitivity analysis

2.1 The purpose of sensitivity analysis: assessment of project uncertainty

Sensitivity analysis is a useful but simple technique for assessing investment risk in a capital expenditure project when there is uncertainty about the estimates of future cash flows. It is recognised that estimates of cash flows could be inaccurate, or that events might occur that will make the estimates wrong.

The purpose of sensitivity analysis is to assess how the NPV of the project might be affected if cash flow estimates are worse than expected.

2.2 Methods of sensitivity analysis

There are two main methods of carrying out sensitivity analysis on a capital expenditure project.

- Sensitivity analysis can be used to calculate the effect on the NPV of a given percentage reduction in benefits or a given percentage increase in costs. For example, what would the NPV of the project be if sales volumes were 10% below estimate, or if annual running costs were 5% higher than estimate? The percentage variation in the expected cash flows should be an amount that might reasonably occur, given the uncertainty in the cash flow estimates.
- Alternatively, sensitivity analysis can be used to calculate the percentage amount by which benefits must fall below estimate or costs rise above estimate before the project NPV becomes negative. For example, by how much (in percentage terms) would sales volumes need to fall below the expected volumes, before the project NPV became negative? Or by how much (in percentage terms) would running costs need to exceed the expected amount before the NPV became negative?

There are also forms of 'stress testing', similar to sensitivity analysis, that might be used to assess the investment risk. An assessment could be made to estimate the effects of:

- of an unexpected event occurring in the future that would make the cash flow estimates for the project wrong, or
- the effect of a delay so that the expected cash inflows from the project occur later than planned.



Example

A company is considering the following project.

Year	Equipment	Income	Running costs	Net cash flow	DCF factor at 10%	PV
	\$	\$	\$	\$		\$
0	(55,000)				1.000	(55,000)
1		50,000	35,000	15,000	0.909	13,635
2		80,000	55,000	25,000	0.826	20,650
3		100,000	70,000	30,000	0.751	22,530
4		40,000	30,000	10,000	0.683	6,830
NPV						+ 8,645

Required

Estimate the sensitivity of the project to:

- income being lower than estimate, and
- running costs being higher than estimate.



Answer

We can calculate the PV of the equipment cost, the income and the running costs separately, as follows.

Method 1

We can estimate the effect on the NPV of a percentage change for the worse in each of the cash flow estimates. For example, suppose that running costs are 10% higher than estimated? The NPV would be as follows.

Year	Equipment	Income	Running costs	Net cash flow	DCF factor at 10%	PV
	\$	\$	\$	\$		\$
0	(55,000)				1.000	(55,000)
1		50,000	38,500	11,500	0.909	10,454
2		80,000	60,500	19,500	0.826	16,107
3		100,000	77,000	23,000	0.751	17,273
4		40,000	33,000	7,000	0.683	4,781
NPV						(6,385)

This analysis shows that if running costs are 10% higher than expected, the NPV will be negative and the project would fail to provide a 10% return.

Method 2

An alternative method of sensitivity analysis is to calculate by how much cash flows need to be worse than expected before the NPV becomes negative.

We can calculate the PV of the equipment cost, the income and the running costs separately, as follows. (The original cash flows are discounted here.)

Year	Equipment PV	Income PV	Running costs PV	NPV
	£	£	£	£
0	(55,000)			
1		45,450	(31,815)	
2		66,080	(45,430)	
3		75,100	(52,570)	
4		27,230	(20,490)	
PV	<u>(55,000)</u>	<u>213,950</u>	<u>(150,305)</u>	<u>+ 8,645</u>

The sensitivity of the project to errors in the estimates can now be assessed as follows.

The NPV will become negative if the PV of any cost is more than \$8,645 above estimate or if the PV of benefits is more than \$8,645 below estimate.

- **Income.** The project would cease to have a positive NPV if income is below the estimate by more than $(8,645/213,950) = 0.040$ or 4.0%.
- **Running costs.** The project would cease to have a positive NPV if running costs are above the estimate by more than $(8,645/150,305) = 0.058$ or 5.8%.
- **Equipment cost.** The project will cease to have a positive NPV if the cost of the equipment in Year 0 exceeds the estimate by more than $(8,645/55,000) = 0.157$ or 15.7%.

An assessment of risk and uncertainty could then be made on the basis of the likelihood that income will fall below estimate or running costs will increase above the estimate by more than these amounts.

2.3 Estimating the sensitivity of a project to changes in the cost of capital

The sensitivity of the project to a change in the cost of capital can be found by calculating the project IRR. This can be compared with the company's cost of capital.



Example

A company is considering the following project:

Year	Net cash flow	DCF factor at 15%	PV	DCF factor at 20%	PV
	\$		\$		\$
0	(55,000)	1.000	(55,000)	1.000	(55,000)
1	15,000	0.870	13,050	0.833	12,495
2	25,000	0.756	18,900	0.694	17,350
3	30,000	0.658	19,740	0.579	17,370
4	10,000	0.572	5,720	0.482	4,820
NPV			<u>+ 2,410</u>		<u>(2,965)</u>

$$\text{IRR} = 15\% + [2,410 / (2,410 + 2,965)] \times (20 - 15)\% = 17.2\%$$

The sensitivity of the project to changes in the cost of capital is quite small. The cost of capital is 10% but the cost of capital would have to be over 17.2% before the NPV became negative.

2.4 The usefulness of sensitivity analysis

Sensitivity analysis is useful because it directs management attention to the critical variables in the project. These are the variables where a variation in the cash flows by a fairly small amount – and certainly by an amount that might reasonably be expected, given uncertainty about the cash flows – would make the NPV negative and the project not financially viable.

- If the project is undertaken, sensitive items of cash flow should be closely monitored and action taken if they vary from plan.
- If a project NPV is particularly sensitive to an item of cost or revenue, management might decide to reject the project because of the investment risk involved.

A major problem with sensitivity analysis is that only one variable is varied at a time and it is assumed that all variables are independent of each other. In reality variables may all vary to some extent and they may be interdependent. For this reason simulation models may provide additional information when assessing risk.

Expected value of the NPV: assessment of project risk

- Definition of expected value
- Calculating and using the EV of the NPV
- Advantages and disadvantages of using expected values

3 Expected value of the NPV: assessment of project risk

3.1 Definition of expected value

An expected value is a weighted average value, calculated using probability estimates of different possible outcomes. To calculate an expected value, the probability of each possible outcome is estimated, and the mean (average) outcome is calculated.

3.2 Calculating and using the EV of the NPV

Expected value (EV) = $\sum px$

where:

p represents the probability of each outcome and

x represents the value of each particular outcome.

When expected values are used to assess the risk in capital investment appraisal, x would be the NPV for each possible outcome, and the EV would be the expected value of the project net present value (the EV of the NPV).

The **basic decision rule** is that an investment project should be undertaken if the expected value of its NPV is positive.

However, a project with a positive EV of NPV might not be undertaken if the risk involved seems too great in relation to the amount of the return expected.



Example

A company is considering an investment in a project. The project would be a five-year project, and would cost \$200,000. The actual returns from the investment are subject to uncertainty, but the following estimates have been prepared for the different possible outcomes:

Probability	NPV
	\$
0.10	(8,000)
0.30	4,000
0.40	12,000
0.20	20,000

The EV of the NPV is calculated as follows:

Probability	NPV	EV
p	x	Px
	\$	\$
0.10	(8,000)	(800)
0.30	4,000	1,200
0.40	12,000	4,800
0.20	20,000	4,000
EV of NPV		9,200

The EV of the NPV is positive, +\$9,200. The decision should therefore be to undertake the investment, provided that the risk does not seem too great. In this example there is a 10% probability that the NPV will be negative, -\$8,000. Management might therefore consider whether the investment is worth undertaking, in view of this risk.



Exercise 1

A company is considering an investment project which would involve an investment of \$1,000,000. The expected returns will depend on economic conditions over the next four years. The following estimates have been prepared. The cost of capital is 10%.

Year	Strong economy	Weak economy
	\$	\$
0	(1,000,000)	(1,000,000)
1	400,000	100,000
2	600,000	300,000
3	400,000	200,000
4	300,000	50,000
Probability	0.75	0.25

Required

Calculate the EV of the NPV of the project, and recommend whether the project should or should not be undertaken.

3.3 Advantages and disadvantages of using expected values

The **advantages** of using expected values of the NPV are as follows:

- It is a weighted average measure of all the possible outcomes. It is therefore, arguably, a more appropriate measure of return than the most likely or most probable EV of NPV.
- It provides a single figure, not a range of different figures, for making an investment decision.

The **disadvantages** of using expected values of the NPV are as follows:

- The estimates of probabilities might be subjective, and based on judgement and guesswork.
- The EV of the NPV is not a value for any of the actual possible outcomes. In other words, the EV itself will not happen. It is simply an average representing a number of different possible outcomes.
- An EV is much more reliable for estimating the average outcome from events that will happen repeatedly, many times over. A weighted average is not nearly as suitable for estimating the expected outcome for a once-only capital expenditure project.
- Most important of all, an EV does not provide any analysis of the project risk. When capital investment projects are evaluated, and a decision is made whether or not to undertake the investment, there should be a thorough analysis of the risk as well as the expected returns.

Other methods of risk and uncertainty analysis

- Risk modelling: simulation modelling
- Risk-adjusted discount rates
- Adjusted payback
- Discounted payback period

4 Other methods of risk and uncertainty analysis

4.1 Risk modelling: simulation modelling

The risk in an investment can be assessed by constructing a 'model' for the investment, and then considering possible variations in the possible outcomes.

For capital investment appraisal, a risk model might be constructed using a spreadsheet.

Having constructed the model, the risk in the investment can be assessed by testing different scenarios, such as delays in achieving the benefits from an investment, and combinations of variations in costs and benefits.

Simulation modelling

A complex risk model can be used to assess the range of possible outcomes from the investment, and to construct a probability distribution of possible outcomes, for statistical analysis. One such type of risk model is a Monte Carlo simulation model.

With a Monte Carlo simulation model, probabilities are estimated for the different values that might occur for all the uncertain variables in the model. Random numbers are assigned to these values.

For example:

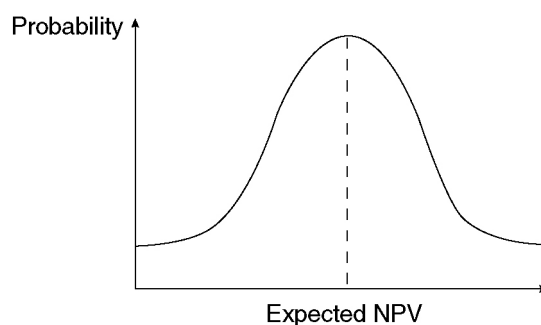
Units per year	Probability	Random numbers	Cost	Probability	Random numbers
3,000	0.15	00 – 14	\$3.00	0.20	00 – 19
4,000	0.20	15 – 34	\$3.50	0.50	20 – 69
5,000	0.30	35 – 64	\$4.00	0.30	70 – 99
6,000	0.25	65 – 89			
7,000	0.10	90 – 99			

With a complex model, a large number of different variables could be given various possible values, with associated probabilities and random number allocations.

The model is then used to produce a large number of possible outcomes and NPVs for the project. For each possible outcome, random values are given to each of the uncertain variables by generating random numbers and deciding the value in accordance with the random number generated.

If the model produces hundreds, possibly thousands, of different possible NPVs, each calculated using different values for the variables according to the random numbers generated, the different outcomes can be analysed into a probability distribution with a mean and a standard deviation.

In many cases, the probability distribution will show the characteristics of a normal statistical distribution.



Where a normal distribution is produced, the mean and standard deviation can be used to analyse the possible outcomes from the project in some detail. For example, the probability of a negative NPV can be calculated, or the minimum expected NPV at the 95% or the 99% confidence level.

Advantages of simulation

- The model can include all the possible values for each variable and their associated probabilities
- Simulation can be very useful for the analysis of large and complex investment projects.

Disadvantages of simulation

- Constructing a reliable simulation model can be complex, time-consuming and expensive. The benefits might not be worth the time and cost.
- The probability estimates for each of the variables may be highly subjective and unreliable. This will affect the reliability of the risk assessment and probability distribution derived from the model.

4.2 Risk-adjusted discount rates

Risk-adjusted discount rates might be used to evaluate projects with different risk characteristics. The broad principle is to increase the minimum required return (in other words, increase the discount rate or cost of capital) to compensate for the higher risk involved.

4.3 Adjusted payback

The minimum required payback period may be reduced in a particularly risky environment. Payback may be a good indicator of the liquidity of a project. Projects

which pay back quickly avoid the risk of trying to produce accurate revenue and cost projections far into the future.

In a fast-changing business environment it may also be important to generate liquidity in order to have funds to invest in new projects as new business opportunities continue to arise and to adopt new technology as soon as it becomes available.

4.4 Discounted payback period

Instead of using the ordinary payback to decide whether a project is acceptable, discounted payback might be used as an alternative. A maximum discounted payback period is established and projects should not be undertaken unless they pay back within this time.

A consequence of applying a discounted payback rule (and the same applies to ordinary payback) is that projects are unlikely to be accepted if they rely on cash profits in the long-term future to make a suitable financial return. Since longer-term estimates of cash flows are usually more unreliable than estimates in the shorter-term, using discounted payback as a criterion for project selection will result in the rejection of risky projects.

A discounted payback period is calculated in the same way as the 'ordinary' payback period, with the exception that the cash flows of the project are converted to their present value. The discounted payback period is the number of years before the cumulative NPV of the project reaches \$0.

Year	Annual cash flow
	\$
0	(200,000)
1	(40,000)
2	30,000
3	120,000
4	150,000
5	100,000
6	50,000

The discounted payback period is calculated as follows.

Year	Annual cash flow	Discount factor at 10%	PV of cash flow	Cumulative NPV
	\$		\$	\$
0	(200,000)	1.000	(200,000)	(200,000)
1	(40,000)	0.909	(36,360)	(236,360)
2	30,000	0.826	24,780	(211,580)
3	120,000	0.751	90,120	(121,460)
4	150,000	0.683	102,450	(19,010)
5	100,000	0.621	62,100	43,090
6	50,000	0.564	28,200	71,290
NPV			<u>+ 71,290</u>	

The discounted payback period is Year 5, and we can estimate it in years and months as:

$$4 \text{ years} + (19,010 / 62,100) \times 12 \text{ months} \\ = 4 \text{ years } 4 \text{ months.}$$

The discounted period for a capital investment is always longer than the 'ordinary' non-discounted payback period.

One criticism of the discounted payback method of project evaluation is the same as for the non-discounted payback method. It ignores the expected cash flows from the project after the payback period has been reached.

Capital investment appraisal: further aspects

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The lease versus buy decision

- The nature of the lease versus buy decision
- Making a lease versus buy decision
- The acquisition decision
- The financing decision

1 The lease versus buy decision

1.1 The nature of the lease versus buy decision

Occasionally, a company might be faced with a decision about whether or not to acquire a new non-current asset, and if the asset is acquired, whether the acquisition should be financed with a bank loan or by means of a finance lease arrangement. In capital investment appraisal, this is usually referred to as a 'lease versus buy' decision.

The lease versus buy decision involves:

- deciding whether or not to acquire the asset, and
- if the decision is to acquire it, whether to borrow the money to buy the asset or whether to obtain the asset under a finance lease arrangement.

1.2 Making a lease versus buy decision

If you are required to advise on a lease versus buy decision, the decision should be considered in two separate stages.

- The **acquisition decision** (or investment decision). The first step is to decide whether or not the asset should be acquired. This decision is based on the assumption that the asset will be purchased.
- The **financing decision**. The second stage is to make a financing decision.
 - If the decision is not to acquire the asset, this second stage is unnecessary.
 - If the decision is to acquire the asset, this stage of the decision is to select the preferred method of financing the acquisition – in other words, whether to buy the asset for cash (financed by a bank loan) or whether to lease it under a finance lease arrangement.

1.3 The acquisition decision

The acquisition decision should be reached using the normal NPV method of investment appraisal. If the project has a positive Net Present Value, the recommendation will be to acquire the asset.

The following guidelines should be followed:

- The purchase cost of the asset should be a cash outflow of the project. Typically this will be a Year 0 cash outflow, which is the purchase cost of the asset. If the purchase would be financed by a bank loan, ignore the bank loan for the purpose of the acquisition decision (and do not treat the bank loan as a year 0 cash inflow).
- The cash flows in the acquisition decision should include the expected benefits and costs from the project, such as extra cash revenues and cash expenses each year, and working capital requirements. If the asset would have a residual value at the end of its life if purchased, include the residual value as a cash flow of the project in the final year.
- The tax cash flows should be considered in full. These consist of the tax effect on tax of higher or lower annual cash profits, and also the effect on cash flows of tax-allowable depreciation (capital allowances).
- The cost of capital should be the company's normal (after-tax) cost of capital.

1.4 The financing decision

If the decision in stage 1 is that the asset should be acquired, the next stage – the financing decision – is to decide on the best method of financing for the asset.

Since the asset will be acquired, no matter what financing method is chosen, all the cash flows that will occur anyway, whatever the financing method, can now be ignored because they are not relevant to the financing decision.

The only relevant cash flows are the cash flows relating to the financing methods.

The PV of a bank loan to purchase the asset

If the asset is financed with a bank loan if purchased, the cash flows for the bank loan should be discounted to a PV of cost at the after-tax cost of borrowing.

However if we discount the cash flows of a loan (allowing for interest payments and the tax relief on interest payments) at the after-tax cost of capital, the present value of cost is always equal to the amount of the loan.

In other words, the PV of the cost of a loan to purchase the asset with a bank loan is the purchase cost of the asset (= the amount of the loan). This assumes that the discount rate is the after-tax cost of borrowing.

The PV of the option to purchase the asset with a loan is reduced by the reduction in tax payments that will occur by claiming capital allowances on the asset. The net PV of cost is therefore the amount of the loan minus the PV of the tax benefits from capital allowances.

The PV of other financing alternatives

The financing cash flows of the alternative financing method should now be discounted at the same cost of capital (the after-tax cost of the borrowing).

The preferred financing method is the one with the lower (or lowest) PV of cost.

Financing costs for a finance lease

The main financing cash flows that will need to be taken into account are as follows:

- The lease payments, which are a financing cost
- Tax relief on the lease payments, which reduce the financing cost.



Example

Crimson is considering a project requiring a new machine. The machine costs \$3 million and it would have a useful life of three years and no residual value at the end of that time.

The machine will produce cash operating surpluses of \$1.6 million each year. Tax allowable depreciation is 15% on a straight-line basis. Tax is 30% on operating cash flows and is payable one year in arrears.

Crimson has an after-tax cost of capital of 20%.

It is considering either borrowing from the bank at the pre-tax interest rate of 14% and buying the asset outright, or leasing it at a cost of \$1.3 million each year for three years, with the lease payments payable in advance at the beginning of each year.

Required

Evaluate the project. Should the asset be acquired, and if so which financing method should be used?



Answer

Stage 1: The acquisition decision (investment decision)

Year	0	1	2	3	4
	\$000	\$000	\$000	\$000	\$000
Machine cost	(3,000)				
Tax relief on machine		135	135	135	495
Operating cash flows		1,600	1,600	1,600	
Tax on operating cash flows			(480)	(480)	(480)
Net cash flows	(3,000)	1,735	1,255	1,255	15
Discount factor at 20%	1.000	0.833	0.694	0.579	0.482
PV at 20%	(3,000)	1,445	871	727	7
NPV (in \$000)					+ 50

Acquisition decision

The NPV is positive; therefore the machine should be acquired.

Workings

The tax-allowable depreciation is $15\% \times \$3,000,000 = \$450,000$ each year for years 1 – 3.

The total amount of tax allowable depreciation is therefore $3 \times \$450,000 = \$1,350,000$.

There will be a balancing allowance of $\$1,650,000$ ($\$3,000,000 - \$1,350,000$) at the end of Year 3.

It is assumed that the first tax allowance for depreciation would be claimed early in Year 1, i.e. in Year 0, resulting in a tax saving (one year later) at the end of Year 1.

The savings in tax payments will therefore be (one year in arrears):

For Years 1 – 3: $\$450,000 \times 30\% = \$135,000$.

For Year 4: $\$1,650,000 \times 30\% = \$495,000$.

Stage 2: The financing decision

There are two financing options: to buy the asset with a bank loan or to obtain the asset under a finance lease arrangement. The cash flows of these financing options should be converted into a PV of cost using the after-tax cost of borrowing.

The PV of the option to purchase the asset is a cost of $\$3,000,000$ (the purchase cost of the asset and the amount of the loan), if the cash flows are discounted at the after-tax cost of borrowing. This is different from the company's after-tax cost of capital.

The after-tax cost of borrowing is $14\% \times (1 - 30\%) = 9.8\%$.

The discount factors at a cost of capital of 9.8% are:

Year		
1	$1/(1.098) =$	0.911
2	$1/(1.098)^2 =$	0.829
3	$1/(1.098)^3 =$	0.755
4	$1/(1.098)^4 =$	0.688

(Note: Instead of using a cost of capital of 9.8%, it would be acceptable in an examination to round this figure to 10% and use discount factors from the discount tables.)

PV of leasing cost

Year	0	1	2	3
	\$000	\$000	\$000	\$000
Lease payments	(1,300)	(1,300)	(1,300)	
Tax relief on payments (30%)		390	390	390
Net cash flows	(1,300)	(910)	(910)	390
Discount factor at 9.8%	1.000	0.911	0.829	0.755
PV at 9.8%	(1,300)	(829)	(754)	294
PV of leasing cost	(2,589)			

PV of cost of purchasing

Year	0	1	2	3	4
	\$000	\$000	\$000	\$000	\$000
Machine cost	(3,000)				
Tax relief on machine		135	135	135	495
Net cash flows	(3,000)	135	135	135	495
Discount factor at 9.8%	1	0.911	0.829	0.755	0.688
PV at 9.8%	(3,000)	123	112	102	341
PV of cost of purchasing	(2,322)				

Financing decision

As the lease finance option is more expensive than the option to purchase cost, Crimson should purchase the asset and finance the purchase with a bank loan at 14%.

Asset replacement decisions

- The nature of asset replacement decisions
- The cash flows to consider
- Methods of evaluation
- Equivalent annual cost method

2 Asset replacement decisions

2.1 The nature of asset replacement decisions

An asset replacement decision involves deciding how frequently a non-current asset should be replaced, when it is in regular use, so that when the asset reaches the end of its useful life, it will be replaced by an identical asset.

In other words, this type of decision is about what is the most appropriate useful economic life of a non-current asset, and how frequently it should be replaced.

Here we are not dealing with a one-off decision about whether or not to acquire an asset. Instead we are deciding when to replace an asset we are currently using with another new asset; and then when the new asset has been used up, replacing it again with an identical asset; and so on in perpetuity. We are evaluating the cycle of replacing the machine – considering the various options for how long we should keep it before replacing it.

The **decision rule** is that the preferred replacement cycle for an asset should be the least-cost replacement cycle. This is the frequency of replacement that minimises the PV of cost.

2.2 The cash flows to consider

The cash flows that must be considered when making the asset replacement decision are:

- The capital cost (purchase cost) of the asset
- The maintenance and operating costs of the asset: these will usually increase each year as the asset gets older
- Tax relief on the running costs (which are allowable expenses for tax purposes)
- Tax relief on the asset (tax-allowable depreciation)
- The scrap value or resale value of the asset at the end of its life.

The main problem with evaluating an asset replacement decision is comparing these costs over a similar time frame. For example, how can we compare the PV of costs for asset replacement cycles of one, two, three, four and five years?

For example, you cannot simply compare the PV of cost over a two-year replacement cycle with the PV of cost over a three-year replacement cycle, because

you would be comparing costs over two years with costs over three years, which is not a fair comparison.

2.3 Methods of evaluation

A method is needed for comparing the different replacement cycles over a common period of time. There are three methods of doing this:

- the lowest common multiple method
- the finite time method
- the equivalent annual cost method: this is the method normally used.

The equivalent annual cost method is the method normally used, and the only one of these three methods that you need to know for your examination. It is the only method described here.

2.4 The equivalent annual cost method

The equivalent annual cost method of calculating the most cost-effective replacement cycle for assets is as follows:

- For each choice of replacement cycle, the PV of cost is calculated over one full replacement cycle, with the asset purchased in year 0 and disposed of at the end of the life cycle.
- This PV of cost is then converted into an equivalent annual cost or annuity. The equivalent annual cost is calculated by dividing the PV of cost of the life cycle by the annuity factor for the cost of capital, for the number of years in the life cycle.

$$\text{Equivalent annual cost for replacement every } n \text{ years} = \frac{\text{Net PV of costs over one replacement cycle}}{\text{Annuity factor for Years } 1 - n}$$

- The replacement cycle with the lowest equivalent annual cost is selected as the least-cost replacement cycle.



Example

NTN is considering its replacement policy for a particular machine, which it intends to replace every year, every two years or every three years. The machine has purchase cost of \$17,000 and a maximum useful life of three years. The following information is also relevant:

Year	Maintenance/running costs of machine	Scrap value if sold at end of year
	\$	\$
1	1,900	8,000
2	2,400	5,500
3	3,750	4,000

The cost of capital for NTN is 10%.

What is the optimum replacement cycle? Ignore taxation. Use the equivalent annual cost method.

a

Answer

Replace every year

Year		Cash flow	Discount factor at 10%	PV
		\$		\$
0	Purchase	(17,000)	1.000	(17,000)
1	Maintenance costs	(1,900)	0.909	(1,727)
1	Resale value	8,000	0.909	7,272
	PV of cost			<u>(11,455)</u>

Equivalent annual cost = PV of cost/Annuity factor at 10% for 1 year
 = \$11,455/0.909 = \$12,602.

Replace every two years

Year		Cash flow	Discount factor at 10%	PV
		\$		\$
0	Purchase	(17,000)	1.000	(17,000)
1	Maintenance costs	(1,900)	0.909	(1,727)
2	Maintenance costs	(2,400)	0.826	(1,982)
2	Resale value	5,500	0.826	4,543
	PV of cost			<u>(16,166)</u>

Equivalent annual cost = PV of cost/Annuity factor at 10% for 2 years
 = \$16,166/1.736 = \$9,312.

Replace every three years

Year		Cash flow	Discount factor at 10%	PV
		\$		\$
0	Purchase	(17,000)	1.000	(17,000)
1	Maintenance costs	(1,900)	0.909	(1,727)
2	Maintenance costs	(2,400)	0.826	(1,982)
3	Maintenance costs	(3,750)	0.751	(2,816)
1	Resale value	4,000	0.751	3,004
	PV of cost			<u>(20,521)</u>

Equivalent annual cost = PV of cost/Annuity factor at 10% for 3 years
 = \$20,521/2.487 = \$8,251.

Summary

Replace	Equivalent annual cost
	\$
Every year	12,602
Every two years	9,312
Every three years	8,251

Conclusion

The least-cost decision is to replace the asset every three years, because a three-year replacement cycle has the lowest equivalent annual cost.



Exercise 1

LONG is considering its replacement policy for an item of equipment which has a maximum useful life of four years. The machine has purchase cost of \$30,000. The following information is also relevant:

Year	Maintenance/runn ing costs of machine	Scrap value if sold at end of year
	\$	\$
1	4,000	15,000
2	5,000	10,000
3	6,500	6,000
4	8,000	1,000

The cost of capital for LONG is 12%.

What is the optimum replacement cycle? Ignore taxation.

Capital rationing decisions

- The nature of capital rationing
- Single period capital rationing: divisible projects
- Single period capital rationing: non-divisible projects

3 Capital rationing decisions

3.1 The nature of capital rationing

Capital rationing occurs where there are insufficient funds available to invest in all projects that have a positive Net Present Value. Capital is in short supply; therefore a decision has to be made about which investment projects to invest in with the capital that is available.

There are two types of capital rationing.

- **Hard capital rationing:** This occurs when the shortage of capital is imposed by external factors, such as the refusal by a bank to advance any more money or an inability to raise more capital by issuing new shares or bonds.
- **Soft capital rationing:** This occurs when the shortage of capital is imposed internally by management decision, such as setting limits to the capital budget for the year. In other words, the directors of a company might decide that in the capital budget, total capital spending must not exceed a specified amount

3.2 Single period capital rationing: divisible projects

Single period capital rationing describes a situation where the capital available for investment is in limited supply, but for one time period only (one year only). The limitation in supply is usually 'now' – in Year 0. In all other time periods, capital will be in unlimited supply.

A decision needs to be made about which projects to invest in. Projects will not be undertaken unless they have a positive NPV, but when there is capital rationing a choice must be made between alternative projects that all have a positive NPV.

The method of reaching the decision about which projects to select for investment depends on whether the investments are fully divisible, or indivisible.

Fully divisible projects

Assumption: Projects are fully divisible and therefore a part-investment can be made in a capital project leading to a partial return (proportional to the amount invested). For example suppose that an investment costing \$100,000 is fully divisible and has an expected NPV of + \$20,000. If capital is in short supply, it would be possible to invest a proportion of the \$100,000, to obtain the same proportion of the

NPV of + \$20,000. For example, it would be possible to invest only \$50,000 in the project and the expected NPV would then be + \$10,000.

Deciding which projects to invest in: When projects are fully divisible, the projects selected for investment should be those that maximise the total NPV per \$1 of capital invested (in the year of capital rationing). The technique is to calculate for each project the NPV per \$1 of capital invested (in the year of capital rationing), and to prioritise the projects for investment by ranking them in order of NPV per \$1 invested.

The ratio of NPV to capital investment is sometimes called the **profitability index**. The decision rule is therefore to invest in the projects with the highest profitability index, up to the limit of the investment capital available.

e

Example

Capital for investment is limited in Year 0 to \$5,000. There are four investment projects available with a positive NPV, but these require a total of \$10,000 for investment. All four projects are fully divisible. The investment required for each project and the project NPVs are as follows:

Project	I	II	III	IV
Investment in Year 0	\$5,000	\$2,100	\$1,400	\$1,500
NPV	\$6,250	\$4,200	\$1,540	\$1,950

Which projects should be selected for investment, in order to maximise the total NPV?

a

Answer

Rank the projects in order of profitability index (NPV per \$1 invested in the year of capital rationing).

Project	I	II	III	IV
Investment in Year 0	\$5,000	\$2,100	\$1,400	\$1,500
NPV	\$6,250	\$4,200	\$1,540	\$1,950
Profitability index	\$1.25	\$2.00	\$1.10	\$1.30
Ranking	3 rd	1 st	4 th	2 nd

The investment plan should be:

Project	Invest	NPV
	\$	\$
II	2,100	4,200
IV	1,500	1,950
	3,600	6,150
I (balance)*	1,400	1,750
Total	5,000	7,900

*The NPV earned is proportional to the investment = \$1,400 × 1.25 = \$1,750.

3.3 Single period capital rationing: non-divisible projects

When investment projects are non-divisible, the investment in a project can be either 0% or 100%, and nothing else. Part-investment is not possible.

The selection of investments should be those that offer the maximum NPV with the capital available. Finding the combination of projects that maximises NPV is a matter of trial-and-error, and testing all the possible combinations of investments that can be undertaken with the capital available.



Example

Suppose that in the previous example, all four projects are non-divisible, and that capital is limited in Year 0 to \$5,000. The possibilities would be assessed as follows:

Combination	Amount of investment		NPV
		\$	\$
I only		5,000	6,250
II, III and IV	$2,100 + 1,400 + 1,500 = 5,000$	$4,200 + 1,540 + 1,950 = 7,690$	

No other combinations of investment are possible with the amount of capital available.

The decision that would maximise NPV is to invest in Projects II, III and IV.

Sources of equity finance

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| 1 | Sources of long-term and short-term finance |
| 2 | Raising new equity externally |
| 3 | Rights issues |
| 4 | Dividend policy |

Sources of long-term and short-term finance

- Sources of finance and financial management
- Sources of short-term funds
- Sources of long-term funds
- Introduction to equity finance
- Internal sources of finance and dividend policy

1 Sources of long-term and short-term finance

1.1 Sources of finance and financial management

An important aspect of financial management is the choice of methods of financing for a company's assets. Companies use a variety of sources of finance and the aim should be to achieve an efficient capital structure that provides:

- a suitable balance between short-term and long-term funding
- adequate working capital
- a suitable balance between equity and debt capital in the long-term capital structure.

1.2 Sources of short-term funds

Sources of short-term funding are used to finance some current assets. (In some cases, companies operate with current liabilities in excess of current assets, but this is unusual.)

Most of the usual sources of short-term finance have been described in an earlier chapter on working capital. Briefly, these are:

- bank overdraft
- short-term bank loans
- suppliers (trade payables).

The main points to note about these sources of finance are as follows.

Bank overdraft

A company might arrange a bank overdraft to finance its need for cash to meet payment obligations. An overdraft facility is negotiated with a bank, which sets a limit to the amount of overdraft that is allowed. From the point of view of the bank, the company should be expected to use its overdraft facility as follows:

- The overdraft should be used to finance short-term cash deficits from operational activities. The company's bank balance ought to fluctuate regularly between deficit (overdraft) and surplus. There should not be a 'permanent'

element to the overdraft, and an overdraft should not be seen as a long-term source of funding.

- An overdraft facility is for operational requirements and paying for running costs. An overdraft should not be used to finance the purchase of long-term (non-current) assets.
- The bank normally has the right to call in an overdraft at any time, and might do so if it believes the company is not managing its finances and cash flows well.

Short-term bank loans

Short-term bank loans might be arranged for a specific purpose, for example to finance the purchase of specific items. Unlike an overdraft facility, a bank loan is for a specific period of time, and there is a repayment schedule.

Trade payables

As explained in an earlier chapter, a company should try to negotiate favourable credit terms from its suppliers. Trade credit from suppliers has no cost, and is therefore an attractive method of short-term finance. However, a company should honour its credit arrangements and pay its suppliers on time at the end of the agreed credit period. It is inappropriate for a company to increase the amount of its trade payables by taking excess credit and making payments late.

Debt factoring

Companies that use debt factors to collect their trade receivables might obtain financing for most of their trade receivables from the factor. Factoring was explained in the earlier chapter on the management of trade receivables. One of the services offered by a factor is to provide finance for up to 70% or 80% of the value of outstanding trade receivables that the factor has undertaken to collect.

Operating leases

In some cases, operating leases might be an alternative to obtaining short-term finance. Operating leases are similar to rental agreements for the use of non-current assets, although they might have a longer term. (Rental agreements are usually very short term.).

Companies that obtain the use of non-current assets with operating lease agreements avoid the need to purchase the assets and to finance these purchases with capital.

Operating leases might be used extensively by small and medium-sized business enterprises which find it difficult to obtain finance to pay for non-current asset purchases.

1.3 Sources of long-term funds

Long-term funding is required for a company's long-term assets and also to finance working capital. The main sources of long-term capital are:

- equity finance
- debt finance
- lease finance (finance leases).

Debt finance and lease finance are dealt with in the next chapter.

For some companies, long-term finance might be provided in the form of venture capital. **Venture capital** is described in the later chapter on sources of finance for small and medium-sized enterprises.

1.4 Introduction to equity finance

Equity finance is finance provided by the owners of a company – its ordinary shareholders, also called equity shareholders. (Some forms of irredeemable preference share might be regarded as equity finance, but in practice irredeemable preference shares are rare in public companies.)

New equity finance can be raised by issuing new shares for cash, or issuing new shares to acquire a subsidiary in a takeover. Methods of issuing new shares are described in the next section of this chapter.

For most companies, however, the main source of new equity finance is internal, from retained profits.

1.5 Internal sources of finance and dividend policy

When companies retain profits in the business, the increase in retained profits adds to equity reserves. The retained capital, in principle, is reinvested in the business and contributes towards further growth in profits.

Increasing long-term capital by retaining profits has several major benefits for companies.

- When new equity is raised by issuing shares, there are large expenses associated with the costs of the issue. When equity is increased through retained earnings, there are no issue costs because no new shares are issued.
- The finance is readily-available, without having to present a case to a bank or new shareholders. Shareholder approval is not required for the retention of earnings.

However there may be a limit to the amount of earnings available for retention. There are three main reasons for this.

- The company might not earn large profits. Earnings can only be retained if the company is profitable.

- Retained earnings must be used efficiently, to provide a suitable return on investment. Unless retained earnings contribute to future growth in earnings and dividends, shareholders will demand higher dividends and lower earnings retention.
- Earnings are either retained or paid out to shareholders as dividends. By retaining earnings, a company is therefore withholding dividends from its shareholders. A company might have a dividend policy, and its shareholders might have expectations about what future dividends ought to be. Earnings retention is therefore restricted by the constraints of dividend policy.

Dividend policy is considered in more detail in a later section of this chapter.

Long-term finance and working capital management

Improvements in working capital efficiency can also release cash. Efficient inventory management, collection of trade receivables and payment of trade payables can reduce the requirement for working capital. A reduction in working capital generates a one-off additional source of cash funding that can be used for investment.

Raising new equity externally

- Private companies and public companies: issuing new shares
- Methods of issuing new shares for cash
- Public offer
- Placing
- Stock market introduction
- Rights issue
- Underwriting of new share issues
- Share repurchases

2 Raising new equity externally

2.1 Private companies and public companies: issuing new shares

Companies can raise equity capital externally by issuing new shares for cash, but the opportunity to do so is much more restricted for private companies than for public companies.

Private companies and issuing shares for cash

Private companies cannot offer their shares for sale to the general investing public, and shares in private companies cannot be traded on a stock market. They can sell shares privately to investors but it is usually difficult to find investors who are willing to put cash into equity investments in private companies.

The existing owners of a company might not have enough personal capital to buy more shares in their company. Existing shareholders are therefore a limited source of new capital.

Other investors usually avoid investing in the equity of private companies because the shares are not traded on a stock exchange, and consequently they might be:

- difficult to value
- difficult to sell when the shareholder wants to cash in the investment.

Small companies and most medium-sized companies are private companies, and most are unable to raise significant amounts of new equity capital by issuing shares. They rely on retained earnings for new equity capital, but given their small size, profits are relatively small and this restricts the amount of retained profits they can reinvest in the business.

Public companies and new share issues

Public companies may offer their shares to the general public. Many public companies arrange for their shares to be traded on a stock market. The stock market

can be used both as a market for issuing new shares for cash, and also a secondary market where investors can buy or sell existing shares of the company. The existence of a secondary market and stock market trading in shares means that:

- the shares of a company have a recognisable value (their current stock market price) and
- shareholders can sell their shareholdings in the market whenever they want to cash in their shareholding.

However, before their shares can be traded on a stock exchange, a public company must:

- satisfy the regulatory authorities that the company and its shares comply with the appropriate regulatory requirements, and appropriate information about the company and its shares will be made available to investors, and
- obtain acceptance by the appropriate stock exchange for trading in the shares.

In the UK, there is a main stock market operated by the London Stock Exchange, and a secondary market for shares in smaller companies, the Alternative Investments Market or AIM. (Companies wanting to have their shares accepted for trading on AIM must meet certain regulatory requirements, but these are not as onerous as the requirements for companies on the main market.)

Electronic trading platforms for secondary market trading in shares have been developed and are capturing a substantial proportion of the total volume of secondary market trading in shares of the major companies, especially in the USA and the European Community.

Regulatory requirements

In the UK to obtain acceptance to trades shares on the main London Stock Exchange, companies must:

- apply to the regulatory authorities for the shares to be accepted onto the Official List (and companies whose shares are traded on the main market are therefore called '**listed companies**'), and
- apply to the London Stock Exchange for acceptance of the shares onto the market for trading.

Requirements in other countries with major stock markets are similar. However, since the regulations differ between countries, it should be sufficient for the purpose of your examination to be aware that a public company must comply with certain regulations and minimum standards in order to have access to one or more stock markets.

2.2 Methods of issuing new shares for cash

There are three main methods of issuing new shares for cash:

- Issuing new shares for purchase by the general investing public: this is called a **public offer**.

- Issuing new shares to a relatively small number of selected investors: this is called a **placing**
- Issuing new shares to existing shareholders in a **rights issue**.

2.3 Public offer

A public offer is an offer of new shares to the general investing public. Because of the high costs involved with a public issue, these are normally large share issues that raise a substantial amount of money from investors.

In many countries, including the UK and USA, a company whose shares are already traded on the stock market cannot make a public offer of new shares without shareholder permission (which is unlikely to be obtained, because existing shareholders would suffer a dilution in their shareholding in the company and would own a smaller proportion of the company).

Instead, companies whose shares are already traded on the stock market will use a rights issue or a placing when it wishes to issue new shares for cash.

A public offer might be used to bring the shares of a company to the stock market for the first time. The US term for this type of share issue is an **Initial Public Offering** or **IPO**. The company comes to the stock market for the first time in a 'stock market flotation'. In the UK, the terms 'prospectus issue' and 'offer for sale' are also used to describe a public offer.

The shares that are offered to investors in an IPO might be a combination of:

- new shares (issued to raise cash for the company) and
- shares already in issue that the current owners are now selling.

Only the new shares issued by the company in the IPO will provide new equity capital for the company.



Example

Stabba is a company that is being converted from private to public company status and is planning a stock market flotation with a public offer of shares.

In the flotation, the company wants to raise \$800 million in cash for investment in its businesses. Issue costs will be 5% of the total amount of capital raised. The company's investment bank advisers have suggested that a share price of \$8 to \$9 per share should be sustainable after the flotation, and a suitable issue price per share would therefore be \$8.

Required

How many new shares should be issued and sold in the public offer?

a**Answer**

Cash required after issue costs (= 95% of cash raised): \$800 million

Capital required before issue costs deducted: $\$800 \text{ million} / 0.95 = \842.1 million

Number of shares to issue to raise \$842.1 million = $\$842.1\text{m} / \$8 = 105,262,500$.

Offer for sale by tender

In a normal public offer, the issue price for the new shares is a fixed price and the new shares are offered at that price. With an offer for sale by tender, investors are invited to apply to purchase any amount of shares at a price of their own choosing. The actual issue price for the new shares is the minimum price tendered by investors that will be sufficient for all the shares in the issue to be sold. Offers for sale by tender are now very uncommon.

2.4 Placing

A placing involves the sale of a relatively small number of new shares, usually to selected investment institutions. A placing raises cash for the company when the company does not need a large amount of new capital. A placing might be made by companies whose shares are already traded on the stock exchange, but which now wishes to issue a fairly small amount of new shares.

The prior approval of existing shareholders for a placing should be obtained.

2.5 Stock exchange introduction

In a stock exchange introduction, a company brings its existing shares to the stock market for the first time, without issuing new shares and without raising any cash. The company simply obtains stock market status, so that its existing shares can be traded on the stock market.

The rules of the stock exchange might require that a minimum percentage of the shares of the company should be held by the general investing public. If so, a stock exchange introduction is only possible for a company that has already issued shares to the public but without having them traded on the stock market.

A stock market introduction is rare, but might be used by a well-established company (formerly a private company) whose shares are now held by a wide number of individuals and institutions.

When a company makes a stock market introduction, it is able at some time in the future to issue new shares for cash, should it wish to do so, through a placing or a rights issue.

2.6 Rights issue

A rights issue is a large issue of new shares to raise cash, by a company whose shares are already traded on the stock market.

Company law about rights issues varies between countries. In the UK, any company (public or private) wishing to issue new shares to obtain cash must issue them in the form of a rights issue, unless the shareholders agree in advance to waive their 'rights'. Large new share issues by existing stock market companies will therefore always take the form of a rights issue.

A rights issue involves offering the new shares to existing shareholders in proportion to their existing shareholding. For example, if a company has 8 million shares in issue already, and now wants to issue 2 million new shares to raise cash, a rights issue would involve offering the existing shareholders one new share for every four shares that they currently hold (2 million: 8 million = a 1 for 4 rights issue).

Rights issues are described in more detail in the next section.

2.7 Underwriting of new share issues

Large new issues of shares for cash are usually underwritten. When an issue is underwritten, a group of investment institutions (the underwriters) agree to buy up to a maximum stated quantity of the new shares at the issue price, if the shares are not purchased by other investors in the share issue. Each underwriter agrees to buy up to a maximum quantity of the new shares, in return for an underwriting commission (an agreed percentage of the issue value of the shares they underwrite).

The advantage of underwriting is that it ensures that there will be no unsold shares in the issue, and the company can be certain of raising the expected amount of cash.

The main disadvantage of underwriting is the cost (the underwriting commission payable by the company to the underwriters).

If a company does not want to pay to underwrite a rights issue, it might offer the new shares at a very low price compared to the market price of the existing shares. The very low price should, in theory, attract investors and ensure a successful share issue. This type of low-priced share issue is called a **deep-discounted** issue.

Both public offers and rights issues are commonly underwritten.

2.8 Share repurchases

Instead of increasing their equity capital by issuing new shares, a company might repurchase some of its equity shares and cancel them. The shares might be repurchased in the stock market, or bought back directly from some shareholders. The effect of repurchasing shares and cancelling them is to reduce the company's equity capital, with a corresponding fall in cash.

For example, suppose that a company has 200 million shares of \$1 each (par value) in issue and the shares have a market price of \$3. It might repurchase 5 million shares at this market price and cancel them. The cost of \$15 million would result in a reduction in share capital and reserves of \$15 million, and a reduction in cash of \$15 million. It would be left with 195 million shares in issue.

There two main reasons why a company might repurchase and cancel shares.

- It has more cash than it needs and the surplus cash is earning a low return. There is no foreseeable requirement for the surplus cash. Buying back and cancelling some shares will therefore increase the earnings per share for the remaining shares, and so might result in a higher share price for the remaining shares. In this situation, the company is overcapitalised and share repurchases can bring its total capital down to a more suitable level.
- Debt capital is readily-available and is cheaper than equity. A company might therefore repurchase some of its shares and cancel them, and replace the cancelled equity with debt capital, by issuing new corporate bonds or by borrowing from a bank. The result will be a capital structure with higher financial gearing.

In the mid 2000s, when debt capital was cheap and readily-available, a considerable number of companies in the USA and UK increased their gearing by repurchasing shares and raising more debt capital.

Rights issues

- The issue price
- The theoretical ex-rights price
- The shareholders' choices
- Advantages and disadvantages of rights issues

3 Rights issues

A rights issue is an issue for shares for cash, where the new shares are offered to existing shareholders in proportion to their current shareholding.

3.1 The issue price

The share price of the new shares in a rights issue should be lower than the current market price of the existing shares. Pricing the new shares in this way gives the shareholders an incentive to subscribe for them. There are no fixed rules about what the share price for a rights issue should be, but as a broad guideline the issue price for the rights issue might be about 10% - 15% below the market price of existing shares just before the rights issue.

For example if a company is planning a 1 for 3 rights issue and the market price of its shares is \$6, it might offer the new shares in the rights issue at a fixed price in the region of \$5.10 to \$5.40.

3.2 The theoretical ex-rights price

When a company announces a rights issue, the market price of the existing shares just before the new issue takes place is called the '**cum rights**' price. ('Cum rights' means 'with the rights').

The theoretical ex-rights price is what the share price ought to be, in theory, after the rights issue has taken place.

- All the shares will have the same market price after the issue.
- In theory, since the new shares will be issued at a price below the cum rights price, the theoretical price after the issue will be lower than the cum rights price.

The **theoretical ex-rights price** is simply the weighted average price of the current shares 'cum rights' and the issue price for the new shares in the rights issue.



Example

A company with 20 million shares in issue announces a 2 for 5 rights issue at a price of \$3 per share. The market price of the existing shares before the rights issue is \$3.70.

The theoretical ex-rights price can be calculated as follows.

Market value of 5 existing shares	(5 × \$3.70)	18.50
Issue price of 2 shares in the rights issue	(2 × \$3.00)	6.00
Theoretical value of 7 shares		<u>24.50</u>
Theoretical ex-rights price	(= \$24.50/7)	\$3.50

The value of rights

In theory, the holder of five shares in the company in the previous example could buy two new shares in the rights issue for \$3 each, and these two shares will be expected to rise in value to \$3.50, a gain of \$0.50 for each new share or \$1.00 in total for the five existing shares.

We can therefore say that the theoretical value of the rights is:

- \$0.50 for each new share issued, or
- \$0.20 (\$1.00/5 shares) for each current share held.

Shareholders are allowed to sell their rights to subscribe for the shares in the rights issue, and investors who buy the rights are entitled to subscribe for shares in the rights issue at the rights issue price. The most common way of stating the value of rights is the value of the rights for each existing share. In the example, the theoretical value of the shares would normally be stated as \$0.20.

3.3 The shareholders' choices

When a company announces a rights issue, the shareholders have the following choices:

- They can **take up their rights**, and buy the new shares that have been offered to them.
- They can **renounce their rights**, and sell the rights in the market. By selling rights, the shareholder is selling to another investor the right to subscribe for the new shares at the issue price.
- They can take up some rights and renounce the rest. This is a combination of the two options above.
- They can **do nothing**. If they do nothing, their existing shares will fall in value after the rights issue (perhaps from the cum rights price to the theoretical ex-rights price), and they will suffer a loss in the value of their investment. The company might try to sell the new shares to which the 'do-nothing' shareholders were entitled, and pay them any surplus receipts above the rights issue price. However, the 'do-nothing' shareholders are still likely to suffer a loss.

If a shareholder takes up his rights, in theory he will be no worse and no better off. Similarly, if a shareholder renounces his rights and sells them, he will be no better and no worse off.



Example

A company announces a 1 for 4 rights issue. The issue price is \$5 per share. The current market price per existing share is \$6.25.

The theoretical ex-rights price can be calculated as follows:

Market value of 4 existing shares	$(4 \times \$6.25)$	25.00
Issue price of 1 share in the rights issue	$(1 \times \$5.00)$	5.00
Theoretical value of 5 shares		<u>30.00</u>

Theoretical ex-rights price	$(\$30.00/5)$	\$6.00
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- If a shareholder takes up his rights, he will be required to subscribe \$5 in cash to purchase each new share. In theory, the value of his shares will rise from \$25 for every four shares he owns to \$30 for every five shares that he owns, but he has paid an additional \$5 to the company. In theory, he will therefore be neither better off nor worse off. In practice, the gain or loss on his investment will depend on what the actual share price is after the rights issue (since the actual share price might be higher or lower than the theoretical ex-rights price).
- If the shareholder renounces his rights and sells them, the theoretical value of his rights will be \$0.25 ($\$(6 - 5)/4$ shares) for each existing share. If he sells his rights at this price, he will earn \$1 for every four shares that he owns. After the rights issue, the value of his four shares will fall, in theory, from \$6.25 to \$6 each, or from \$25 to \$24 for every four shares. There will be a theoretical fall in his investment value by \$1 for every four shares held, but this is offset by the sales value of the rights. In theory, he will therefore be neither better off nor worse off.

	\$
Cum rights value of four shares $(4 \times \$6.25)$	25.00
Theoretical ex-rights value of four shares $(4 \times \$6.00)$	<u>24.00</u>
Expected fall in value of four shares	(1.00)
Sale value of rights $(4 \times \$0.25)$	<u>1.00</u>
Net gain/loss	<u>0.00</u>

3.4 Advantages and disadvantages of rights issues

Rights issues give existing shareholders the right to buy the new shares in a share issue. If an issue did not have to be a rights issue, the company would be able to offer the shares to all investors.

Advantages

The advantages of a rights issue are as follows:

- A rights issue gives shareholders the right to retain the same percentage of the company's total share capital, and so avoid a 'dilution' in the proportion of the company that he owns.
- A rights issue prevents the company from selling new shares at below the current market price to other investors.

Disadvantages

The disadvantages of a rights issue are as follows:

- The company might want to raise a large amount of cash for new investment, but the existing shareholders might be unwilling or unable to invest in the new shares.
- Shareholders can retain the same proportion of shares in the company by subscribing for new shares in the issue. There is no reason to give them preferential treatment.
- If a new share issue is offered to all investors, the issue price might be at or near the current market price, instead of at a discount to the current 'cum rights' price.

Dividend policy

- The relationship between the dividend decision and the financing decision
- Shareholder preferences
- The nature of dividend policy
- Theories of dividend policy
- Modigliani and Miller's theory of the irrelevance of dividend policy
- Practical influences on the dividend decision

4 Dividend policy

4.1 The relationship between the dividend decision and the financing decision

Total earnings are retained or paid out in dividends. Retained earnings are the surplus profits available to the company for investment after dividend has been paid. Dividends reduce equity capital.

When a company wants to raise more capital for investment, it could do so by paying no dividend at all and retaining 100% of earnings. The only external capital it then needs to raise is the amount by which its capital requirements exceed its earnings.

In practice, however, not many companies would do this. Instead, they have a dividend policy that they make known to their shareholders and try to apply in practice (subject to profits being large enough). Even when they want to raise fresh capital, they will probably continue to pay dividends.

4.2 Shareholder preferences

Some shareholders prefer to receive dividends from their equity investments. Others are not concerned about dividends and would prefer the company to reinvest all its earnings in order to pursue growth strategies that will increase the market value of the shares. Many shareholders prefer a mixture of dividends and retaining some profits for share price growth. (For many years, for example, software giant Microsoft had a policy of retaining its earnings to invest in growth, with no dividend payouts.)

Shareholders will buy and hold shares of companies that pursue a dividend policy consistent with their preferences for dividends or share price growth, and companies might try to pursue a dividend policy consistent with the preferences of most of their shareholders

4.3 The nature of dividend policy

In practice dividend policy might be stated in terms of an intention of the board of directors to increase annual dividends inline with growth in earnings per share.

When dividends increase by the same proportionate amount as the rise in EPS, it is said to maintain a constant 'payout ratio'.

Shareholders can monitor the future profit expectations of the company to predict the amount of dividends they are likely to receive in the future.

4.4 Theories of dividend policy

There are several theories about dividend policy. These theories are intended to identify the optimal amount of dividends that a company should pay to the shareholders. Three of these theories are:

- the traditional view of dividend policy
- residual theory
- Modigliani and Miller's theory of the irrelevance of dividend policy.

Traditional view of dividend policy

The traditional view of dividend policy is that the amount of dividend payments should be at a level that enables the company to maximise the value of its shares. Retaining earnings adds to earnings growth in the future, and earnings growth will enable the company to increase dividends in the future.

For example, suppose that a company pays out 40% of its earnings in dividends and retains the remaining 60% of earnings which it can reinvest in the business to earn a return of 10% per year. For every \$100 of earnings in the current year, it will pay dividends of \$40 and by reinvesting \$60 it will add to future annual earnings by 6% ($= 60\% \times 10\%$) each year. Annual earnings next year will be \$106.

Similarly if a company retains only 20% of its earnings which it can reinvest at 10%, for every \$100 of earnings in the current year, it will pay dividends of \$80 and by reinvesting \$20 it will add to future annual earnings by 2% ($= 20\% \times 10\%$) each year. Annual earnings next year will be \$102.

There is a model for the valuation of shares based on expectations of future dividend growth, known as Gordon's growth model or the dividend growth model. This model is described in a later chapter on valuation.

According to traditional theory of dividend policy, the optimal dividend policy is the dividends and retentions policy that maximises the share price using the dividend growth model to obtain a share price valuation.

Residual theory of dividend policy

The residual theory of dividend policy is that the optimal amount of dividends should be decided as follows.

- If a company has capital investment opportunities that will have a positive NPV, it should invest in them because they will add to the value of the company and its shares.
- The capital to invest in these projects should be obtained internally (from earnings) if possible.
- The amount of dividends paid by a company should be the residual amount of earnings remaining after all these available capital projects have been funded by retained earnings.
- In this way, the company will maximise its total value and the market price of its shares.

A practical problem with residual theory is that annual dividends will fluctuate, depending on the availability of worthwhile capital projects. Shareholders will therefore be unable to predict what their dividends will be.

4.5 Modigliani and Miller's theory of the irrelevance of dividend policy

Modigliani and Miller (MM) developed a theory to suggest that dividend policy is irrelevant, and the level of dividends paid out by a company does not matter. The total market value of a company will be the same regardless of whether the dividend payout ratio is 0%, 100% or any ratio in between.

Their theory was based on certain assumptions. One of these was that taxation (and the differing tax position of shareholders and companies) can be ignored. Their theory assumes a tax-free situation.

MM argued that the value of a company's shares depends on the rate of return it can earn from its business. 'Earning power' matters, but dividends do not. They argued that if a company has opportunities for investing in capital projects with a positive NPV, they can either:

- use retained earnings to finance the investment, or
- pay out earnings and dividends and obtain the equity that it needs for capital investment from the stock market.

For example if a company has earnings of \$100 million and investment opportunities costing \$100 million that have a positive NPV, it does not matter whether it pays no dividend and invests all its earnings on the capital projects, or whether it pays dividends of \$100 million and raises new equity capital of \$100 million for the capital project investments.

If the company pays out dividends and raises new equity capital, the existing shares will fall in value by the amount of the dividend payments. However this loss of value will be replaced by the new equity raised in the market, so the total value of the company's equity will be unaffected.

- Loss in value of existing shares = Amount of dividends paid
- Total value of equity before the dividend payment and equity issue = Total value of equity after the dividend payment and equity issue

Whenever shareholders want cash, it does not matter whether they obtain it in the form of dividends or by selling their shares in the market.

One initial criticism of this theory of dividend irrelevance was that some shareholders have a preference for high dividends, so dividend policy does matter. MM responded by arguing that companies often have a consistent dividend policy with a constant payout ratio. Shareholders will be attracted to holding shares in the companies whose dividend policy is consistent with their own dividend preference.

Criticisms of irrelevance theory

However, there are other criticisms of MM's theory of dividend irrelevance.

- The theory assumes that there are no costs involved in raising new equity capital, so that there is no cost difference between retaining earnings and raising new equity.
- Similarly, MM assumed that there are no costs involved in selling shares, so that shareholders should be indifferent between getting cash in the form of dividends or getting it by selling some shares.
- MM assumed that shareholders possess perfect information about the returns that will be obtained by companies from their new capital investments. Since future earnings can be predicted with confidence, MM argued that share prices would remain close to their real value. In practice, however, this is not the case. Shareholders cannot always assess the real value of their shares with confidence: this is one reason why many shareholders prefer high cash dividends instead of the prospect of bigger capital gains in the future.

4.6 Practical influences on the dividend decision

There are several practical limitations and influences on the amount of dividends paid by companies.

Investment opportunities

The amount of earnings a company wishes to retain might be affected by the number of suitable investment opportunities available to the company. If there are few investment projects available which can generate sufficient return then surplus cash should be returned to shareholders. Companies might payout as dividends any surplus cash for which they have no long-term need

Legal constraints

There might be legal restrictions on the maximum dividend payments. Companies can only pay dividends out of accumulated net realised profits. There may also be restrictions imposed by loan agreements to protect lenders.

Liquidity

Retained profit is not the same as retained cash. A company might be highly profitable but still have low levels of surplus cash. The dividends paid must not threaten a company's liquidity and dividends might be limited by the availability of cash.

Dividends as a signal to investors and shareholder expectations

A dividend which differs from shareholders expectations about dividends might send signals to the market and affect share price.

- A higher than expected dividend may signal that the board of directors are confident about the future and may lead to an increase in share price
- A lower than expected dividend may signal that the company is in financial difficulties and lead to a fall in share price.

Investors usually expect a consistent dividend policy from year to year or steady dividend growth. This can lead to pay-out ratios fluctuating as companies seek to hold a steady dividend as earnings fluctuate.

A company might also use dividend policy to send signals to the stock market about its future prospects and intentions.

4.7 Alternatives to cash dividends

There are alternatives to paying cash dividends.

Script dividends

A company that wants to retain cash for reinvestment but does not want to reduce its dividends might offer its shareholders a scrip dividend. A scrip dividend is a dividend paid in the form of new shares. Instead of receiving cash, the shareholder receives new shares.

The rules of the stock exchange might require that when a company wants to make a scrip dividend, it must offer a cash dividend alternative, so that shareholders can choose between new shares and cash.

In practice, scrip dividend have not proved popular and they are fairly uncommon.

Share repurchases

Share repurchases were mentioned in a previous section of this chapter. If a company has surplus cash and is over-capitalised, it might decide to repurchase some shares as an alternative to paying out the cash in the form of a higher dividend.

If a company chooses to pay a higher dividend, this might act as a signal to shareholders who then expect high dividends in future years too. If the cash is used for share repurchases instead of higher dividends, future dividend expectations will not be affected.

Sources of finance: debt capital

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Using debt capital

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- Debt finance and risk for the borrower
- Advantages and disadvantages of debt finance to the investor
- Finance leases

1 Using debt capital

1.1 The nature of debt finance

The term 'debt finance' is used to describe finance where:

- the borrower receives capital, either for a specific period of time (redeemable debt) or possibly in perpetuity (irredeemable debt)
- the borrower acknowledges an obligation to pay interest on the debt for as long as the debt remains outstanding, and
- the borrower agrees to repay the amount borrowed when the debt matures (reaches the end of the borrowing period).

For companies, the most common forms of debt finance are:

- borrowing from banks
- issuing debt securities.

Debt finance might be **secured** against assets of the borrower. When a debt is secured, the lender has the right to seek repayment of the outstanding debt out of the secured asset or assets, in the event that the borrower fails to make payments of interest and repayments of capital on schedule. The secured assets provide a second source of repayment if the first source fails.

When a debt is **unsecured**, the lender does not have this second source of repayment in an event of default by the borrower.

For both secured and unsecured debt, the borrower is usually required to give certain undertakings or '**covenants**' to the lender, including an undertaking to make interest payments in full and on time. The borrower will be in default for any breach of covenant, and the lenders will then have the right to take legal action against the borrower to recover the debt.

1.2 Long-term, medium-term and short-term debt finance

Debt finance can be long-term, medium-term or short-term finance. For companies:

- long-term finance is usually obtained by issuing bonds. Bonds might also be called loan stock or debentures.
- medium-term debt finance (with a maturity of up to about five or seven years) is usually in the form of bank loans, but a company might also issue bonds with a maturity of just a few years. Medium-dated bonds are often called 'notes'.
- short-term debt finance is usually in the form of a bank overdraft or similar bank facility. Large companies might be able to obtain short-term debt finance in other ways, such as:
 - by issuing short-term debt securities in the money markets as commercial paper, within a commercial paper programme
 - by arranging a 'bills acceptances' programme with a bank

Irredeemable debt

Debt capital might be irredeemable or 'permanent'. However, irredeemable debt is not common, and virtually all debt is redeemable (or possibly convertible, see below).

Committed and uncommitted funds

Most debt finance is committed, which means that the lender has undertaken to provide the finance until the agreed maturity of the debt. The borrower does not have the risk that the lender will demand immediate repayment of the debt, without notice before the agreed maturity date.

Some lending is uncommitted, which means that the lender is not obliged to lend the money, and having lent the money can demand immediate repayment at any time. A bank overdraft facility is normally uncommitted lending by the bank, and the bank has the right to demand immediate repayment at any time. A bank overdraft can therefore be a fairly risky type of borrowing for a company.

1.3 Interest payments

The frequency of interest payments varies according to the type of debt.

- For a bank loan or a bond, the interest payable is calculated on the full amount of the debt.
- For a bank overdraft (or a revolving credit with a bank), interest is charged only on the current overdraft balance.

For example, if a company has a loan of \$100,000, it will pay interest on the full amount of the loan. However, if it has a bank overdraft facility of \$100,000, it will pay interest only on the overdraft balance, typically with interest charged on a daily basis.

The interest rate on most medium-term bank loans is a **floating rate** or **variable rate**. This means that the rate of interest is adjusted for each successive payment period, according to any changes that have occurred in the interest rate since the beginning of the previous interest period. Lending to companies is at either a margin above the bank's base rate or a margin above another reference rate of interest, such as the London Inter-bank Offered Rate (LIBOR).

For example, the interest rate on a bank loan might be payable every six months at six-month LIBOR plus 1%. At the beginning of each six-monthly interest period, the interest for the period will be fixed at whatever the current six-month LIBOR rate happens to be, plus 1%.

The interest rate on most bonds and notes is at a **fixed coupon rate**. The interest payable in each interest period is a fixed amount, calculated as the fixed coupon percentage of the nominal value of the bonds. For example, if a company issues 6% bonds with interest payable every six months, the company will pay \$3 for every \$100 nominal value of bonds every six months.

1.4 Tax relief on interest

Interest costs are an allowable expense for tax purposes. This can make debt finance an attractive 'cheap' source of finance.



Example

A company borrows \$10 million at an interest cost of 5% per year. The rate of taxation is 30%.

The company will pay \$500,000 each year in interest. Its tax payments to the government will be reduced by \$150,000 ($30\% \times \$500,000$). The net cost of interest is therefore \$350,000, and the after-tax cost of debt is 3.5% ($\$350,000 / \10 million , or $5\% \times (100 - 30)$).

In comparison, dividends on shares are not an allowable cost for tax purposes. Dividends are paid out of after-tax profits.

1.5 Straight debt

The term 'straight debt' means a fixed amount of redeemable debt at a fixed rate of interest.

For example, a company might issue \$200 million of 6% bonds, with a maturity of 15 years. The company will pay interest of \$12 million each year on the bonds, for 15 years, and at the end of the 15 years, the company will redeem the bonds, usually at par value or face value, and so would return \$200 million to the bondholders.

1.6 Access to the bond markets for companies

Many companies cannot borrow by issuing bonds in the bond markets. Private companies are prohibited by law from offering bonds to the general public;

therefore if these companies want to borrow, they must seek a bank loan or find investors who are willing to invest in their bonds or loan notes.

Large public companies are able to raise capital by issuing bonds in the international bond markets, and they usually pay to have their bonds given a credit rating by one or more credit rating agencies such as Moody's and Standard & Poor's. Investment institutions are often prepared to invest in corporate bonds with a good credit rating (an 'investment grade' rating) if the return ('yield') is attractive. Bonds in the international markets are usually denominated in US dollars or euros, although there are some issues in other currencies such as yen, Swiss francs and British pounds.

Smaller public companies outside the US find it more difficult to issue bonds in the bond market, because the amount of debt they need to raise is often too small to interest major investors, and only major investors buy bonds.

There is a much larger market in the US for corporate bonds, denominated in US dollars. By offering a high fixed rate of interest, companies are often able to issue bonds even though they are not 'investment grade' (i.e. 'sub-investment grade bonds' or 'junk bonds').

The secondary market in bonds is operated by bond dealers in banks, and the liquidity of the secondary market is variable. Many investors in bonds hold them as long-term investments and do not acquire them for short-term reasons. Unlike equity share prices, bond prices are generally fairly stable and do not offer investors an opportunity for quick capital gains from buying and re-selling.

1.7 Debt finance and risk for the borrower

Although debt capital is cheap, particularly in view of the tax relief on interest payments, it can also be a risky form of finance for a company.

- Lenders have a prior right to payment, before the right of shareholders to a dividend. If a company has low profits before interest and a large amount of debt, the profits available for dividends could be very small.
- There is always a risk that the borrower will fail to meet interest payments or the repayment of debt principal on schedule. If a borrower is late with a payment, or misses a payment, there is a default on the loan. A default gives the lenders the right to take action against the borrower to recover the loan.

In comparison with providers of debt capital, equity shareholders do not have similar rights for non-payment of dividends.

Companies should therefore avoid excessive amounts of debt finance, because of the default risk. (However, there are differing views about how much debt finance is 'safe' and how high debt levels can rise before the capital structure of a company becomes too risky.)

1.8 Advantages and disadvantages of debt finance to the investor

The comments about debt finance have so far focused on the borrower. A financial manager also needs to be aware of the attractions and disadvantages of debt capital for the lender or investor.

Advantages

There are significant advantages for an investor to lend money (by purchasing bonds) rather than to invest in equity. Lending is considered safer than investing in equity:

- The loan is usually redeemable, so that the capital will be returned.
- The interest has to be paid by the company, irrespective of how well or badly it has performed.
- The debt might be legally secured on assets of the company – the debt holder can force the company to sell the assets on which the loan is secured if the company defaults. However, most bonds are unsecured.
- Debt ranks higher than equity in a winding up of a company and the liquidation of its assets. Lenders therefore have more chance of getting their investment returned, compared to the equity holders.

Main disadvantage

The main disadvantage of debt finance compared with equity finance for the investor is that:

- The returns from investing in debt bonds are fairly predictable. The interest rate is fixed. There might be some increase or decrease in the market value of bonds, if market yields on bonds change: however, the size of any such capital gain or loss is usually fairly small.
- In contrast, with equity investments, shareholders benefit when the company is successful. Dividends will probably rise in the company's annual profits growth, and there could also be substantial capital gains from increases in the share price.

1.9 Finance leases

Companies can acquire assets with leasing finance instead of buying assets with equity or debt capital. Operating leases have been referred to earlier as a means of acquiring assets for the fairly short term. Finance leases are similar to operating leases, except that the lease agreement covers most or all of the asset's expected economic life.

For financial reporting purposes, finance leases are included within liabilities (in the statement of financial position) as a form of debt finance. The main features of a finance lease arrangement are as follows:

- A company acquires a new non-current asset, such as a machine, an item of equipment, a motor vehicle, or even an aeroplane or ship.
- The purchase cost of the leased asset is paid by a lease finance company.

- The lease finance company (the lessor) and the company (the lessee) enter into a lease agreement, which covers all or most of the economic life of the asset.
- Under the terms of the lease agreement, the lessee agrees to make a number of regular fixed payments to the lessor over the term of the lease. These payments are an allowable expense for tax purposes.
- The lessee is responsible for insurance and running and maintenance costs for the asset.
- The lessor is the legal owner of the asset, and can claim the tax depreciation allowances (capital allowances). For tax purposes, the lessee can claim the full amount of each lease payment as an allowable expense.
- In law, the lessor is the owner of the asset but for practical purposes, the lessee treats the asset as if it is the owner.
- For financial reporting purposes, the principle of 'substance over form' applies. The leased asset is reported in the statement of financial position (balance sheet) of the lessee as a non-current asset. This is matched (initially) by a long-term debt obligation to the lessor, which is gradually paid off over the term of the lease.
- This means that for financial reporting purposes, lease finance is actually reported in the statement of financial position (balance sheet) as a debt obligation, and the regular lease payments are reported as a mixture of finance costs (interest) and repayment of the obligation to the lessor.



Example

A company acquires a machine under a finance lease arrangement. The purchase cost of the machine would be \$100,000. However, the company arranges to make six annual lease payments of \$19,000 over the term of the lease agreement.

In practice, the company as lessee will make the six annual lease payments and claim the tax relief. The legal owner of the machine is the lessor. In the financial accounts, the company will show the machine as a non-current asset at a cost of \$100,000, and this will be depreciated over the term of the lease. Initially, there will also be a debt of \$100,000 in the balance sheet, payable to the lessor. This will be repaid gradually over the term of the lease. For the purpose of the income statement, the lease payments are treated partly as a repayment of the lease 'debt' and partly as an interest cost on this debt.

You do not need to know the details of the financial reporting rules for lease finance. However, you need to be aware that lease finance is a source of 'debt finance' that is widely used by companies of all sizes.

Convertible bonds and bonds with warrants attached

- Convertible bonds
- Bonds with warrants attached
- Comparison of convertibles and bonds with warrants

2 Convertible bonds and bonds with warrants attached

Sometimes, companies issue bonds with an equity element included or attached. These bonds are sometimes called 'hybrid debt' securities, because they combine debt and equity features. (For financial reporting purposes, companies are required to segregate the debt from the equity element in the statement of financial position (balance sheet)).

The two main types of hybrid debt instrument are:

- convertible bonds, and
- bonds with equity warrants attached.

2.1 Convertible bonds

Convertible bonds are bonds that give their holder the right, but not the obligation, at a specified future date to convert their bonds into a specific quantity of new equity shares.

- If the bondholders choose to exercise the right, they will become shareholders in the company, but will surrender their bonds.
- If the bondholders decide not to exercise their right to convert, the bonds will be redeemed at maturity.



Example

A company might issue \$100 million of 3% convertible bonds. The bonds might be convertible into equity shares after five years, at the rate of 20 shares for each \$100 of bonds. If the shares are not converted, the company will have the right to redeem them at par immediately. Alternatively, the bonds will be redeemed after ten years.

For the first five years, the company will pay interest on the convertible bonds. After five years, the bondholders must decide whether or not to convert the bonds into shares.

- If the market value of 20 shares is higher than the market value of \$100 of the convertibles, the bondholders will exercise their right and convert the bonds into shares. They will make an immediate capital gain on their investment. For example, if the share price is \$6, the bondholders will exchange \$100 of bonds for 20 shares, and the value of their investment will rise to \$120.
- If the market value of 20 shares is lower than the market value of \$100 of the convertibles, the bondholders will not exercise their right to convert, and will

hold their bonds until they are redeemed by the company (which will be either immediately or at the end of the tenth year).

Conversion premium

When convertible bonds are first issued, the market value of the shares into which the bonds will be convertible is always less than the market value of the convertibles.

This is because convertibles are issued in the expectation that the share price will rise before the date for conversion. Investors will hope that the market value of the shares will rise by enough to make the market value of the shares into which the bonds will be convertible higher than the value of the convertible as a 'straight bond'.

The amount by which the market value of the convertible exceeds the market value of the shares into which the bonds will be convertible is called the **conversion premium**.



Example

A company issues 4% convertibles bonds at a price of \$101.50. The bonds will be convertible after six years into equity shares at the rate of 30 shares for every \$100 of bonds. The current market price of the company's shares is \$2.50.

The market price of the bonds is \$101.50 for every \$100 face value of bonds.

The conversion premium is therefore $\$101.50 - (30 \times \$2.50) = \$26$ for every \$100 of convertibles.

Advantages of convertibles

The advantages of convertibles **for companies** are as follows:

- The company can issue bonds now, and receive tax relief on the interest charges, but hope to convert the debt capital into equity in the future.
- The interest rate on convertibles is lower than the interest rate on similar straight bonds. This is because investors in the convertibles are expected to accept a lower interest rate in return for the option to convert the bonds into equities in the future.
- Occasionally, there is strong demand from investors for convertibles, and companies can respond to investors' demand by issuing convertibles in order to raise new capital.

The advantages of convertibles **for investors** are as follows:

- Investors receive a minimum annual income up to the conversion date, in the form of fixed interest.
- In addition, investors in convertibles will be able to benefit from a rise in the company's share price, and hope to make an immediate capital gain on conversion.

- Convertibles therefore combine some fixed annual income and the opportunity to benefit from a rising share price.

The risk for investors in convertibles is that the share price will not rise sufficiently to make conversion worthwhile. When this happens, it would have been better to invest in straight bonds, which would have paid higher interest.

2.2 Bonds with warrants attached

A company might issue bonds with share warrants attached.

Share warrants are a form of option, giving the holder of a warrant in a company the right, but not the obligation, to subscribe for a specified quantity of new shares in the company at a future date, at a fixed purchase price.



Example

A company might issue ten-year 4% bonds with warrants attached. Each \$1,000 of bonds might give the holder the right to subscribe for ten new shares in the company after four years, at a price of \$5.50 per share.

- If the share price is higher than \$5.50 when the date for exercising the warrants arrives, the warrant holder will exercise his right to buy new shares at \$5.50.
- If the share price is less than \$5.50 when the date for exercising the warrants arrives, the warrant holder will not exercise the warrants, and will let his rights lapse.

2.3 Comparison of convertibles and bonds with warrants

Bonds with warrants attached are similar to convertibles, and the advantages of issuing them are similar.

The main difference between bonds with warrants and convertibles is that:

- With convertibles, the right to subscribe for equity shares is included in the bond itself, and if the bonds are converted, the investor gives up the bonds in exchange for the equity shares.
- With bonds with warrants, the warrants are detachable from the bonds. The bonds are therefore redeemed at maturity, in the same way as straight bonds. The warrants are separated from the bonds, and the warrant holder either exercises the warrants to subscribe for new shares when the time to do so arrives, or lets the warrants lapse.

Since warrants are detachable from the bonds, they can be traded separately. The right to subscribe for new shares belongs to the owner of the warrants, not the bondholder. This means that an investor can buy bonds with warrants attached when the company issues them, sell the warrants in the stock market and retain the bonds.

Preference shares

- Near-debt
- Basic features of preference shares
- Types of preference shares
- Advantages and disadvantages of preference shares

3 Preference shares

3.1 Near-debt

Near-debt is a term to describe finance that is neither debt nor equity, but is closer to debt in characteristics than equity.

Various types of preference shares might be described as near-debt. They are not debt finance, but neither are they equity. In financial reporting, preference shares are more likely to be shown in the statement of financial position (balance sheet) as long-term liabilities, rather than equity, although this depends on the characteristics of the shares.

3.2 Basic features of preference shares

The basic features of preference shares are as follows:

- Most preference shares are issued with a fixed rate of annual dividend. For example, a company might issue 7% preference shares of \$1, with dividends of \$0.035 per share payable every six months (dividends of \$0.07 per \$1 share every year). If the company's annual profits rise or fall, the preference dividend remains the same.
- Preference dividends are paid out of after-tax profits. Preference dividends, like equity dividends, do not attract tax relief. This usually means that preference shares are a more expensive form of capital for companies than debt finance.
- Preference shareholders will be entitled to receive dividends out of profits before any remaining profit can be distributed to equity shareholders as equity dividends.
- If the company goes into liquidation, preference shareholders rank ahead of equity shareholders, but after providers of debt finance, in the right to payment out of the proceeds from sale of the company's assets.

Preference shares do not have any significant advantages for investors or for companies above straight debt finance. They are fairly uncommon, except perhaps in companies financed largely by venture capital.

In financial reporting, preference shares might be shown in the statement of financial position (balance sheet) as debt finance rather than equity, and preference share dividends are reported as interest costs in the income statement if the

preference shares are reported as debt. However, even if preference dividends are reported as interest costs, they do not attract tax relief.

3.3 Types of preference shares

A company might issue different classes of preference shares. Each class of preference shares might have different characteristics; for example one class of shares might pay a dividend of 5% and another might pay a dividend of 6%; one class might be redeemable preference shares and another irredeemable shares, and so on.

The different types of preference shares are summarised below.

- **Redeemable preference shares** are redeemable by the company, typically at their par value, at a specified date in the future. **Irredeemable preference shares** are perpetual shares and will not be redeemed.
- **Cumulative preference shares** are shares for which the dividend accumulates if the company fails to make a dividend payment on schedule. For example, if a company fails to make a dividend payment to its cumulative preference shareholders in one year, because it does not have enough cash for example, the unpaid dividend is added to the next year's dividend. The arrears of preference dividend must be paid before any dividend payments on equity shares can be resumed. With **non-cumulative preference shares**, unpaid dividends in any year do not accumulate, and will not be paid at a later date.
- **Participating preference shares**: These shares give their owners the right to participate, to a certain extent, in excess profits of the company when it has a good year. The dividend rate is therefore not necessarily fixed each year. For this reason, the coupon dividend rate tends to be lower than for other types of preference shares.
- **Convertible preference shares**: These are similar to convertible bonds. They give the shareholders the right to convert their shares at a future date into a fixed quantity of equity shares in the company.

3.4 Advantages and disadvantages of preference shares

The **advantages** of preference shares **for companies** are that:

- the annual dividend is fixed, and so predictable (with the possible exception of participating preference shares).
- dividends do not have to be paid unless the company can afford to pay them, and failure to pay preference dividends, unlike failure to pay interest on time, is not an event of default.

The **disadvantages** of preference shares **for companies** are that:

- dividends are not an allowable cost for tax purposes
- they are not particularly attractive to investors.

Capital structure

Contents

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| 2 | Operational gearing |
| 3 | Gearing, risk and return |

Financial gearing

- The nature of gearing
- Definition of financial gearing
- The significance of financial gearing
- Income gearing or interest gearing

1 Financial gearing

1.1 The nature of gearing

The UK term 'gearing' and the US term 'leverage' mean the same thing. They both refer to the fact that a small change in one item can lead to a much bigger change in something else. The term 'gearing' is derived from the mechanics of the motor car and the way in which a movement in a small gear wheel makes a much bigger movement in a larger gear wheel. The term 'leverage' is derived from the idea that a small amount of pressure at one end of a lever can move a much larger item at the other end of the lever.

In financial analysis, there are two types of gearing.

- Financial gearing, which is concerned with the way in which a small change in profits before interest and tax can result in larger proportional changes in earnings (profits after tax).
- Operational gearing is concerned with the way in which a small change in sales revenue results in a much greater proportional change in operating profits (profits before interest and tax).

1.2 Definition of financial gearing

The long-term capital of a company can be categorised as either equity capital or debt capital. Financial gearing measures the extent to which a company is financed by debt capital.

There are several ways of measuring the financial gearing ratio. Unless you are given an instruction or a strong hint to do something else in the examination, you should measure a financial gearing ratio as follows:

Either (A)

$$\frac{\text{Debt capital}}{\text{Equity capital}} \times 100\%$$

Or (B)

$$\frac{\text{Debt capital}}{\text{Equity capital} + \text{Debt capital}}$$

Using definition (A), a company is said to be high-g geared when debt capital exceeds equity capital, therefore the ratio exceeds 100%. With definition (B), high gearing is indicated by a ratio above 50%.

An all-equity company has a financial gearing ratio of 0%.

Gearing can be measured either by:

- Value sin the statement of financial position (balance sheet values), in which case equity is the total of equity share capital plus reserves, or
- current market values of equity and debt capital (with variable interest debt such as bank loans valued at their face value and bonds valued at their current market price).

For financial management purposes, capital gearing should normally be calculated using market values, not book values ('balance sheet values'). However if an examination question gives you information about values in the statement of financial position (balance sheet values), you should be prepared to calculate and comment on financial gearing using the 'balance sheet values' provided.



Example

Company X has 1 million \$1 ordinary shares with a current market price of \$3 each. It is also financed by \$1million of 5% bonds with a current market value of 102.00 and \$500,000 of bank loans.

What is the company's financial gearing?



Answer

MV of equity = 1 million shares \times \$3 = \$3 million

MV of debt = \$1 million \times (1.02) + \$500,000 = \$1,520,000

Gearing = $\frac{\$1,520,000}{\$3 \text{ million} + \$1,520,000} = 33.6\%$.

1.3 The significance of financial gearing

If the level of financial gearing is high, the company might have difficulties in meeting its obligations to pay interest and repay the debt capital on time. High gearing can therefore be risky, and a company should avoid excessive debt and gearing above a level that it can comfortably afford.

Another feature of financial gearing is that with higher-g geared companies, the earnings per share change rises or falls by a much larger percentage amount, in response to increases or falls in operating profit (profit before interest and tax). The following example illustrates this point.



Example

Two companies Entity A and Entity B are identical in every respect, with the exception of their capital structure. Both Entities have assets of \$1,000,000, and both have annual profits before interest and tax of \$100,000. However, Entity A is an all equity company, with 1,000,000 shares of \$1, and Entity B is a 50%-geared company, with 500,000 shares of \$1 and \$500,000 of 8% debt. The rate of taxation is 30%.

The earnings per share (EPS) of each company is calculated as follows:

	Entity A		Entity B
	\$		\$
Before interest and tax	100,000		100,000
Interest	0	(\$500,000 × 8%)	40,000
Profit before taxation	100,000		60,000
Taxation (30%)	30,000		18,000
Profit after tax	70,000		42,000
Number of shares	1,000,000		500,000
EPS	\$0.07		\$0.084

Now suppose that the profits before interest and tax increase by 50% to \$150,000. The change in EPS will be as follows.

	Entity A		Entity B
	\$		\$
Before interest and tax	150,000		150,000
Interest	0	(\$500,000 × 8%)	40,000
Profit before taxation	150,000		110,000
Taxation (30%)	45,000		33,000
Profit after tax	105,000		77,000
Number of shares	1,000,000		500,000
EPS	\$0.105		\$0.154
Increase in EPS	50%		83.3%

The percentage change in the EPS in the geared company is greater than the percentage change in EPS in the ungeared company.

This rule applies to financial gearing generally. When a company has some debt capital (i.e. has some gearing), a percentage change in profits before interest and tax results in a larger percentage change in EPS. The higher the gearing, the greater the percentage change in EPS will be.

1.4 Income gearing or interest gearing

Financial gearing is a ratio comparing the value of debt and the value of total capital or the value of equity.

Income gearing, also called interest gearing, measures annual interest charges as a percentage of profits before interest and tax. It therefore shows what percentage of profits available to cover interest payments are actually needed to make the interest payments.

A ratio of 33% or more would probably be considered very high.



Example

A company made profits before interest and tax of \$800,000. It has \$5 million of 6% debt.

The income gearing ratio, or interest gearing ratio, is

$$\frac{\$5 \text{ million} \times 6\%}{\$800,000} \times 100\% = 0.375 \text{ or } 37.5\%$$

This ratio is high, indicating that the company might have too much debt finance for the amount of profits that it is earning.

1.5 Interest cover ratio

The income gearing or interest gearing ratio is the inverse of the interest cover ratio. This ratio measures: profits before interest and tax/interest charges.

$$\text{Interest cover ratio} = \frac{\text{Profit before interest and tax}}{\text{Interest costs}}$$

As a general guide, an interest cover ratio of less than 3.0 is usually considered very low and 'risky'. In the example above, the interest cover ratio is:

$$\frac{\$800,000}{\$300,000} = 2.66 \text{ times}$$

Operational gearing

- Definition of operational gearing
- The significance of operational gearing
- Financial gearing and operational gearing

2 Operational gearing

2.1 Definition of operational gearing

Financial gearing considers the capital structure and the ratio debt capital to equity capital. Operational gearing considers the cost structure of a business operation, and the ratio of fixed costs to variable costs.

Operational (also called operating) gearing is measured in either of two ways.

Either

$$\frac{\text{Fixed costs}}{\text{Variable costs}}$$

Or

$$\frac{\% \text{ change in profits before interest and tax}}{\% \text{ change in sales revenue}}$$

2.2 Significance of operational gearing

Operational gearing is high when fixed costs are high in relation to variable costs. When operational gearing is high, a given percentage change in sales will result in a much greater change in profits before interest and tax (operating profits) than when operational gearing is low.



Example

Two companies, Entity X and Entity Y, both have annual sales of \$1,000,000 and annual operating profits before interest of \$500,000. However, their cost structures are different, as follows:

	Entity X	Entity Y
	\$	\$
Sales	1,000,000	1,000,000
Variable costs	400,000	100,000
Fixed costs	100,000	400,000
Total costs	500,000	500,000
Profit	500,000	500,000
Operational gearing	0.25	4.00

Here, operational gearing is measured as the ratio of fixed costs to variable costs.

Now suppose that annual sales increase by 50% to \$1,500,000. The operating profit will now be as follows:

	Entity X	Entity Y
	\$	\$
Sales	1,500,000	1,500,000
Variable costs	600,000	150,000
Fixed costs	100,000	400,000
Total costs	700,000	550,000
Profit	800,000	950,000
Operational gearing	0.167	2.67

For Entity X, a 50% increase in sales has resulted in a 60% increase in earnings before interest and tax, from \$500,000 to \$800,000. The operational gearing of Entity X could therefore be measured as:

$$\frac{60\%}{50\%} = 1.20$$

For Entity Y, which has much higher operational gearing a 50% increase in sales has resulted in a 90% increase in earnings before interest and tax, from \$500,000 to \$950,000.

The operational gearing of Entity Y could therefore be measured as:

$$\frac{95\%}{50\%} = 1.90$$

The greater the operating gearing:

- the greater the variability in profits as a result of a change in sales, and so
- the greater the variability in the returns to the shareholders and
- in all probability, the greater the variability in the share price.

2.3 Financial gearing and operational gearing

With high financial gearing, a percentage change in profits before interest and tax results in a greater percentage change in earnings per share. With high operational gearing, a percentage change in sales results in a greater percentage change in profits before interest and tax.

If a company has high operational gearing and high financial gearing, its earnings per share will therefore change by a much greater percentage amount for any given percentage change in annual sales. A company with volatile annual earnings is a

high-risk company, and its annual EPS could fluctuate sharply from one year to the next.



Exercise 1

Entity Green has \$2,000,000 of long-term capital, consisting of 800,000 shares worth \$800,000 and \$1,200,000 of 10% debt capital. The company has budgeted annual sales of \$800,000, and its expected total earnings and EPS are as follows:

	\$	\$
Sales	<u>800,000</u>	
Variable costs	200,000	
Fixed costs	<u>400,000</u>	
Total costs	<u>600,000</u>	
Profit before interest and tax	200,000	
Interest (\$1,200,000 × 10%)	<u>120,000</u>	
Profit before tax	80,000	
Tax at 40%	<u>32,000</u>	
Earnings	<u>48,000</u>	
Number of shares	800,000	800,000
EPS	\$0.06	

Now suppose that the budgeted sales figure is revised to \$1,000,000, an increase of 25%.

Required

- Calculate the operational gearing, measured as the ratio of the percentage increase in profit before interest and tax to the percentage increase in sales.
- Calculate the financial gearing, measured as the ratio of the percentage change in total earnings (or EPS) to the percentage increase in profit before interest and tax.
- Calculate the overall gearing, measured as the ratio of the percentage change in total earnings (or EPS) to the percentage increase in sales.
- Confirm that your answer in (c) is your answer in (a) multiplied by your answer in (b).

You can use the table above to write your answer.

This exercise should illustrate the great volatility in earnings of a company with high operational gearing and high financial gearing.

Gearing, risk and return

- Gearing and risk
- Gearing and return
- Gearing and share prices

3 Gearing, risk and return

3.1 Gearing and risk

High gearing is risky for equity investors. Risk can be defined as volatility in EPS. If an investor buys shares in a company with high operational gearing and high financial gearing, EPS will be volatile. This means that a relatively small percentage change in actual sales, above or below the expected or budgeted level, will result in a much greater percentage change, up or down, in EPS.

Risk-seeking investors might want to invest in such companies, hoping that sales will be higher than expected, and EPS much higher.

An investor looking for fairly stable and predictable annual EPS will want to avoid companies with high operational and financial gearing. They would prefer all-equity companies in which variable costs are a high proportion of total costs.

3.2 Gearing and return

To compensate them for the risk of high volatility in EPS, investors in a high-g geared company will expect a higher return on their investment than investors in a low-g geared company.

For example, suppose that an investor could invest in shares at a cost of \$10 per share, knowing for certain that the annual EPS would be \$1 or 10% every year. If the same investor could invest the same \$10 in a company with high operational and financial gearing, he would want to expect a return in excess of 10% to compensate him for the higher risk. For example, he might expect a return of 14%. Because of the high gearing, a fairly small change in annual sales above or below expectation will result in a much larger change in EPS, and the actual EPS could turn out to be far more than 14%, but could also be much less.

3.3 Gearing and share prices

Higher gearing is more risky, and investors in high-g geared companies will expect a higher return as compensation for the risk.

Gearing will also affect share prices, because share prices are linked to expected return.

There is a dividend valuation model, which states what the market price of a share ought to be assuming constant annual dividends into the future. The share price should be:

$$MV = \frac{d}{r}$$

Where:

- MV is the current market price of the share, excluding any dividend currently receivable
- d is the annual dividend
- r is the shareholders' required rate of return per year, expressed as a proportion

Higher risk, meaning that shareholders expect a higher return, results in a lower share price.



Example

Two companies, Company A and Company B, both expect to pay a dividend per share of \$0.60 to their shareholders in every year into the indefinite future. Company A has low operational and financial gearing, whereas Company B has high operational and financial gearing.

Shareholders in Company A expect the annual dividend to vary only slightly around the expected average of \$0.60 in perpetuity. Shareholders in Company B are aware that although the expected average annual dividend to be \$0.60, there could be some large variations above or below this average due to the volatility in earnings.

Shareholders in Company A expect an annual return on investment of 10% whereas shareholders in Company B expect an annual return on investment of 15%, to compensate them for the higher risk.

- The expected share price for Company A will be: $\frac{\$0.60}{0.10} = \6.00
- The expected share price for Company B will be: $\frac{\$0.60}{0.15} = \4.00

For the same annual dividend, shareholders will give a higher value to the lower-gearred, less risky investment, because the 'cost of equity' is lower. The important connection between financial gearing and 'cost of capital' is considered in more detail in later chapters.

Finance for small and medium sized entities (SMEs)

Contents

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| 1 | The characteristics of SMEs |
| 2 | The financing problem |
| 3 | Venture capital |
| 4 | Government aid |

The characteristics of SMEs

- Definition
- Relative importance

1 The characteristics of SMEs

1.1 Definition

While there is no universally-accepted definition of what constitutes a small or medium sized enterprise, they are

- private companies
- owned by a few individuals, typically a family group

The precise definition of what constitutes a SME may differ according to the industry in which the firm operates.

In the UK, the Department of Trade and Industry defines a small firm as being less than 50 employees and a medium firm as having 50-249 employees. In the EU, a small firm is defined as being an independent enterprise (i.e. not controlled by a large company), having less than 50 employees and either having turnover less than €7m or net assets (a 'balance sheet total') of less than €5m. A medium firm is also defined as an independent enterprise with employees less than 250 and either turnover of less than €40m or a 'balance sheet total' of less than €27m.

1.2 Relative importance

Of the total number of businesses in the UK and EU less than 0.5% are classified as large businesses. In the UK, small and medium enterprises account for almost 55% of employment and more than 50% of turnover. In the EU comparative figures are 66% and 54%. The majority of employment growth has come from small firms in the EU and the US.

This means that small and medium-sized enterprises make up a very large part of a national economy. For a company to grow its economy, it is therefore important that SMEs should be able to grow their businesses. To do this, they need long-term capital.

The problem of raising sufficient long-term capital to grow their business is much greater for SMEs than for larger companies.

The financing problem

- Equity finance and SMEs
- Debt finance and SMEs
- Leasing and SMEs

2 The financing problem

2.1 Equity finance and SMEs

SMEs are normally owned by a few individuals. These existing owners are often reluctant to issue new equity to new investors as this will dilute their control of the business. External investors might also be reluctant to buy shares in a SME, because of the high investment risk.

One possible source of new equity capital for a SME would be a new issue of shares to the existing owners, who would then put more of their personal wealth into their company. However the existing owners might not be willing to put more of their own money into their company. Even if they were willing to put more money into their company, they might not have enough personal wealth to meet the company's capital requirements.

If SMEs cannot raise extra equity capital by issuing new shares, retained earnings are their only source of new equity. Even in profitable small companies, it takes a long time to build up capital through retained earnings, and it might be too late to take advantage of the required investment opportunities. Opportunities for growing the business even faster might be lost.

Short-term sources of capital can be used to some extent to help a small company to grow its business, but SMEs cannot rely extensively on short-term finance. SMEs might even face difficulties in negotiating trade credit if they have not been in business long enough to build up a track record for creditworthiness. Banks are also reluctant to offer a large overdraft, unless the owner of a company is willing to provide a personal guarantee for the facility (perhaps in the form of a bank mortgage over the family home). Too much reliance on short-term finance also increases the risk of **overtrading**, which was explained in an earlier chapter.

Without additional external capital, many SMEs are unable to grow as quickly as their owners would wish. Many SMEs try to obtain finance in the form of medium-term or longer-term debt, or to acquire assets through leasing.

2.2 Debt finance and SMEs

The main source of external finance available to SMEs is bank finance. There are many problems for a SME in negotiating bank finance:

- SMEs are often limited companies or partnerships for which financial information does not have to be published to a wide audience. There may be

only limited requirements for external audit, or no legal requirement for an annual audit. The SME will have to provide the bank with sufficient financial information and also convince the bank that it has a credible business plan that should ensure its ability to repay the money it borrows.

- The SME may lack experienced management and a bank may be unwilling to trust them with its money. For example a bank might suspect that the profit forecasts provided by the management of an SME might be far too optimistic and inaccurate.
- The SME might have few assets to offer the bank as security for a loan. It is often the case that long-term loans are easier to obtain as these can be secured with mortgages against property (land and buildings) owned by the SME. The main problem arises with short and medium-term loans, for which adequate security does not exist, and this is known as the 'maturity gap'.
- The high-risk nature of investment projects by SMEs might mean that even if a bank is willing to lend money, it will require a high risk premium to be incorporated into the interest rate.

2.3 Leasing and SMEs

SMEs make extensive use of leasing as a method of obtaining long-term assets. Both operating leases and finance leases might be used. A feature of a lease is that the leasing company remains the owner of the asset. In the event that a company cannot make the scheduled lease payment, the lessor is able to take back the asset. This provides some form of security. A lessor might therefore be more willing to agree a leasing deal with an SME than a bank is willing to make a loan or offer a large bank overdraft facility.

Venture capital

- Finance and growth
- Business angel finance
- Obtaining venture capital

3 Venture capital

3.1 The nature of venture capital

SMEs will usually try to raise the finance they need from retained earnings and bank finance, and by leasing assets. Working capital requirements can be reduced by negotiating credit terms with suppliers, and possibly by factoring trade receivables and obtaining some factor finance.

For SMEs with an ambitious strategy for growth, these sources of finance are unlikely to be sufficient. In some cases it might be possible to raise new finance in the form of venture capital.

Venture capital is capital provided to a SME by one or more external investors, in the form of equity capital, preference shares or debt finance – perhaps a mixture of all three. Some investment institutions specialise in providing venture capital finance to private companies to support their growing businesses.

Venture capital investors require large returns on their investment, because of the high risks involved. They want the profits on their successful investments to cover the losses they inevitably suffer on business ventures that fail.

3.2 Business angel finance

Business angels are wealthy individuals who invest directly in small businesses, usually by purchasing new equity shares. The business angel does not get involved personally in the management of the company, but hopes to make a large return on his investment from dividends and eventually from the sale of the shares when the company has grown.

The main problems with business angel finance are as follows.

- There are not many business angels, and it is usually very difficult for a small company to identify an individual who might be willing to consider making an equity investment in the company.
- Since there are not many business angels, there is far too little business angel finance available to meet the potential demand for equity capital from small companies.

3.3 Obtaining venture capital

The term 'venture capital' is normally used to mean capital provided to a private company by specialist investment institutions, sometimes with support from banks.

Venture capitalists might be willing to provide finance to new businesses in return for an equity stake in the business. In addition to equity capital they might also agree to provide extra finance in the form of preference shares. With some venture capital arrangements, a bank might also be willing to provide loan capital as part of an overall financing package for the company.

The company will have to demonstrate to the venture capitalist organisation that it has a clear strategy and a convincing business plan. It must demonstrate that its management are experienced, have sufficient skills to make a success of the business and are committed to achieving success. Sometimes the venture capital organisation will require a representative to be on the board or will appoint an independent director.

Exit route for the venture capital investor

A venture capital organisation will not invest money in a company unless it is satisfied that there is a strategy for the company that will enable them to withdraw their investment at a profit, if the company is successful. This is known as an 'exit route' for their investment, and a venture capitalist might expect an exit route to be available after about five years or so from the time of making the investment in the company.

The exit route might be:

- A stock market listing, if the company grows quickly and is successful. When the company's shares are brought to the stock market, the venture capitalist can sell its shares.
- A 'trade sale' of the company to a larger company. A venture capitalist investor might insist that the company should be sold to a larger rival, so that they can take their profits and disinvest.
- Refinancing by another venture capital organisation. A venture capitalist might be able to transfer its investment in a company to another venture capitalist.

Problems with obtaining venture capital finance

The main problem with obtaining venture capital finance is finding a venture capital organisation that is prepared to look at the possibility of investing in the company.

The problem is particularly severe for companies that want to raise 'seed corn' finance to build up their business from a very small beginning. Venture capitalists are often reluctant to spend time and resources in looking at small ventures where the potential returns are likely to be small. They are much more likely to be interested in financing well-established medium-sized private companies, such as private companies that gain 'independence' in a management buyout. Medium-sized businesses often need new equity to enable them to build their business to a

point where a stock market flotation is possible, and the risk of business failure is lower than with smaller 'start-up' ventures.

In the UK, for example, most of the larger venture capital organisations are not prepared to consider providing finance for start-up companies or newly-established small companies, and focus instead on more well-established companies such as management buyout companies.

On the other hand there are some very large financial institutions that provide venture capital to companies on a global scale, including the provision of capital to companies in China and India. For example in April 2008 US-based private equity group Warburg Pincus announced the creation of a \$15 billion global fund for investing mainly in venture capital investments and 'growth capital' for private companies. The company announced at the time that it was looking at a five-year to seven-year time frame for its investments.

Government aid

- Loan guarantee scheme
- Enterprise investment scheme
- Venture capital trusts
- Enterprise grants
- Finance for SMEs: summary

4 Government aid

Many governments are aware of the importance for the national economy of SMEs and want to encourage SMEs to develop and grow. Some governments offer specific schemes to assist SMEs and give them access to finance either through direct financial assistance or by means of tax incentives to investors. The following are some of the schemes offered by the UK government.

4.1 Loan guarantee scheme

This was introduced in 1981 to help SMEs get bank loans even if they have insufficient security for a loan in normal commercial circumstances. The government encourages banks to lend to SMEs by guaranteeing 75% of each loan up to £100,000 for new companies and £250,000 for existing companies with the loan being guaranteed for two to ten years. In return the company pays an additional rate of interest to the government. The loan guarantee has assisted some small companies but has not been used extensively.

4.2 Enterprise Investment Scheme (EIS)

This was introduced in 1994 to encourage equity investment in small unquoted companies. It offers income tax relief at 20% on annual investments of up to £150,000 made by individuals who are not connected to the company. Capital gains made on the sale are exempt provided the shares have been held for a minimum qualifying period. The scheme therefore gives wealthy individuals a tax incentive to invest directly in unquoted companies.

4.3 Venture capital trusts

Venture capital trusts are investment trusts, approved by the tax authorities, which are established to invest in small companies. Investors put their money into a venture capital trust rather than directly into small companies, and the venture capital trust makes investments in a number of small companies. In this way investors in venture capital trusts obtain an indirect investment in a portfolio of small companies, and receive tax relief on their investment. They are exempt from income tax on their dividends and are also exempt from capital gains tax on disposal of the shares, provided they have been held for a minimum qualifying period.

4.4 Enterprise grants

The government or government agencies might award cash grants to small companies. For example in the UK an enterprise grant scheme allows SMEs to apply for a grant of 15% of their fixed costs up to a maximum of £75,000 when they are investing up to £500,000.

4.5 Finance for SMEs: summary

The success of government initiatives to assist SMEs to obtain capital to grow their business is limited. Most SMEs face serious problems with raising long-term capital, and the supply of long-term funding for small companies falls well short of the demand from SMEs for capital.

Cost of capital

Contents	
1	Relative costs of equity and debt
2	Cost of equity
3	Cost of debt capital
4	Calculating the weighted average cost of capital (WACC)
5	Cost of capital and gearing
6	Pecking order theory

Relative costs of equity and debt

- Cost of equity, cost of debt and the weighted average cost of capital (WACC)
- Average and marginal cost of capital
- Comparing the cost of equity and the cost of debt
- The creditor hierarchy

1 Relative costs of equity and debt

1.1 Cost of equity, cost of debt and the weighted average cost of capital (WACC)

The **cost of capital for investors** is the return that investors require from their investment. Companies must be able to make a sufficient return from their own capital investments to pay the returns required by their shareholders and holders of debt capital. The cost of capital for investors therefore establishes a cost of capital for companies.

- For each company there is a cost of equity. This is the return required by its shareholders, in the form of dividends or share price growth
- There is a cost for each item of debt finance. This is the yield required by the lender or bond investor
- When there are preference shares, there is also a cost of preference share capital.

The **cost of capital for a company** is the return that it must make on its investments so that it can afford to pay its investors the returns that they require.

The cost of capital for investors and the cost of capital for companies should theoretically be the same. However, they are different because of the differing tax positions of investors and companies.

- The cost of capital for investors is measured as a pre-tax cost of capital
- The cost of capital for companies recognises that interest costs are an allowable expense for tax purposes, and the cost of debt capital to a company should allow for the tax relief that companies receive on interest payments, reducing their tax payments. The cost of debt capital for companies is measured as an after-tax cost.

The **weighted average cost of capital (WACC)** is the average cost of all the sources of capital that a company uses. This average is weighted, to allow for the relative proportions of the different types of capital in the company's capital structure.

1.2 Average and marginal cost of capital

One approach to the evaluation of capital investments by companies is that all of their investment projects should be expected to provide a return equal to or in excess of the

WACC. If all their investment projects earn a return in excess of the WACC, the company will earn sufficient returns overall to meet the cost of its capital and provide its investors with the returns they require. An alternative is to use the marginal cost of capital when evaluating investment projects.

The marginal cost of capital is the cost of the next increment of capital raised by the company.

1.3 Comparing the cost of equity and the cost of debt

The cost of equity is always higher than the cost of debt capital. This is because equity investment in a company is always more risky than investment in the debt capital of the same company.

- Interest on debt capital is often fixed: bondholders for example receive a fixed amount of annual interest on their bonds. In contrast, earnings per share are volatile and can go up or down depending on changes in the company's profitability.
- Providers of debt capital have a contractual right to receive interest and the repayment of the debt principal on schedule. If the company fails to make payments on schedule, the debt capital providers can take legal action to protect their legal or contractual rights. Shareholders do not have any rights to dividend payments.
- Providers of secured debt are able to enforce their security if the company defaults on its interest payments or capital repayments.
- In the event of insolvency of the company and liquidation of its assets, providers of debt capital are entitled to payment of what they are owed by the company before the shareholders can receive any payment themselves out of the liquidated assets.

Since equity has a higher investment risk for investors, the expected returns on equity are higher than the expected returns on debt capital.

In addition, from a company's perspective, the cost of debt is also reduced by the tax relief on interest payments. This makes debt finance even lower than the cost of equity.

The effect of more debt capital, and higher financial gearing, on the WACC is considered in more detail later.

1.4 The creditor hierarchy

The creditor hierarchy refers to **the order in which proceeds are distributed in the event of a company insolvency and winding up** (liquidation of its assets).

- At the top of the hierarchy are **secured creditors** such as debenture holders and banks who are entitled to unpaid interest and the principal outstanding on any loan.
- The next are unsecured creditors, such as providers of unsecured debt capital and trade payables.

- Next are preference shareholders, if the company has any preference shares in issue. If there are several different classes of preference shares, their priority ranking for payment depends on their relative class rights.
- Ordinary shareholders are at the bottom of the hierarchy and are only entitled to repayment of capital once all debt holders and preference shareholders have been paid in full.

The further down the hierarchy a finance provider the greater the risk of loss of capital. The return required in compensation therefore increases and the cost of equity will always exceed the cost of debt and preference shares.

There is also a **priority ranking for annual income**.

- Providers of debt capital receive payment of interest out of the company's profits before interest and tax
- Preference shareholders are paid dividends out of after-tax profits. If the company is unable to pay preference dividends in any year, the unpaid dividend accumulates in the case of cumulative preference shares, and the arrears of unpaid dividends must be paid in full before dividend payments to ordinary shareholders can be resumed.
- Ordinary shareholders (equity shareholders) are paid dividends out of distributable profits at the discretion of the company's directors. For ordinary shareholders there is a risk that the dividends and share price will be adversely affected by volatile earnings, and lower-than-expected annual profits.

Cost of equity

- Methods of calculating the cost of equity
- The dividend valuation model method of estimating the cost of equity
- The dividend growth model method of estimating the cost of equity
- The CAPM method of estimating the cost of equity

2 Cost of equity

2.1 Methods of calculating the cost of equity

The cost of equity is the annual return expected by ordinary shareholders, in the form of dividends and share price growth. However, share price growth is assumed to occur when shareholder expectations are raised about future dividends. If future dividends are expected to increase, the share price will also increase over time. At any time, the share price can be explained as a present value of all future dividend expectations.

Using this assumption we can therefore say that the current value of a share is the present value of future dividends in perpetuity, discounted at the cost of equity (i.e. the return required by the providers of equity capital).

There are two methods that you need to know for estimating what the share price in a company ought to be:

- the dividend valuation model
- the dividend growth model, sometimes called the Gordon growth model.

Each of these methods for obtaining a share price valuation uses a formula that includes the cost of equity capital. The same models can therefore be used to estimate a cost of equity if the share price is known. In other words, the dividend valuation model and dividend growth model can be used either:

- to calculate an expected share price when the cost of equity is known, or
- to calculate the cost of equity when the share price is known.

Another method of estimating the cost of capital is the **capital asset pricing model or CAPM**. This is an alternative to using a dividend valuation model method, and it produces a different estimate of the cost of equity.

2.2 The dividend valuation model method of estimating the cost of equity

If it is assumed that future annual dividends are expected to remain constant into the foreseeable future, the cost of equity can be calculated by re-arranging the dividend valuation model as follows.

$$r_E = \frac{d}{MV}$$

where:

r_E is the cost of equity

d = the expected future annual dividend.

MV is the share price ex dividend.

The formula assumes that dividends are paid annually.

'Ex dividend' means that if the company will pay a dividend in the near future, the share price must be a price that excludes this dividend. For example a company might declare on 1 March that it will pay a dividend of \$0.60 per share to all holders of equity shares on 30 April, and the dividend will be paid on 31 May. Until 30 April the share price allows for the fact that a dividend of \$0.60 will be paid in the near future and the shares are said to be traded 'cum dividend' or 'with dividend'. After 30 April, if shares are sold they are traded without the entitlement to dividend, or 'ex dividend'. This is the share price to use in the cost of equity formula whenever a dividend is payable in the near future and shares are being traded cum dividend.



Example

A company's shares are currently valued at \$8.20 and the company is expected to pay an annual dividend of \$0.70 per share for the foreseeable future. The cost of equity in the company can therefore be estimated as:

$$(0.70/8.20) = 0.085 \text{ or } 8.5\%.$$



Example

A company's shares are currently valued at \$8.20 and the company is expected to pay an annual dividend of \$0.70 per share for the foreseeable future. The next annual dividend is payable in the near future and the share price of \$8.20 is a cum dividend price. The cost of equity in the company can therefore be estimated as:

$$0.70/(8.20 - 0.70) = 0.70/7.50 = 0.093 \text{ or } 9.3\%.$$

2.3 The dividend growth model method of estimating the cost of equity

If it is assumed that the annual dividend will grow at a constant percentage rate into the foreseeable future, the cost of equity can be calculated by re-arranging the dividend growth model.

$$r_E = \frac{d(1+g)}{MV} + g$$

where:

r_E is the cost of equity

d = the annual dividend for the year that has just ended

g is the annual growth rate in dividends, expressed as a proportion (4% = 0.04, 2.5% = 0.025 etc.)

$d(1 + g)$ is therefore the expected annual dividend next year

MV is the share price ex dividend.

(Note: The formula sheet in your examination uses the expression ' P_0 ' for the current market price ex dividend. ' MV ' is used here because it is probably easier to recognise and understand.)

The formula assumes that dividends are paid annually.



Example

A company's share price is \$8.20. The company has just paid an annual dividend of \$0.70 per share, and the dividend is expected to grow by 3.5% into the foreseeable future. The next annual dividend will be paid in one year's time.

The cost of equity in the company can be estimated as follows:

$$r_E = \frac{0.70(1.035)}{8.20} + 0.035$$

$$= 0.123 \text{ or } 12.3\%.$$



Example

A company's share price is \$5.00. The next annual dividend will be paid in one year's time and dividends are expected to grow by 4% per year into the foreseeable future. The next annual dividend is expected to be \$0.45 per share.

The next annual dividend = $d(1 + g)$. The cost of equity in the company can be estimated as follows:

$$r_E = \frac{0.45}{5.00} + 0.04$$

$$= 0.13 \text{ or } 13\%.$$

2.4 The CAPM method of estimating the cost of equity

Another approach to calculating the cost of equity in a company is to use the capital asset pricing model (CAPM). The CAPM is considered in more detail in the next chapter. The formula for the model:

$$R_E = R_{RF} + \beta (R_M - R_{RF})$$

Where

R_E = the cost of equity for a company's shares

R_{RF} = the risk-free rate of return: this is the return that investors receive on risk-free investments such as government bonds

R_M = the average return on market investments as a whole, excluding risk-free investments

β = the beta factor for the company's equity shares. The nature of the beta factor is explained in the next chapter.



Example

The rate of return available for investors on government bonds is 4%. The average return on market investments is 7%. The company's equity beta is 0.92.

Using the CAPM, the company's cost of equity is therefore:
 $4\% + 0.92(7 - 4)\% = 6.76\%$.



Example

A company's shares have a current market value of \$13.00. The most recent annual dividend has just been paid. This was \$1.50 per share.

Required

Estimate the cost of equity in this company in each of the following circumstances:

- The annual dividend is expected to remain \$1.50 into the foreseeable future.
- The annual dividend is expected to grow by 4% each year into the foreseeable future
- The CAPM is used, the equity beta is 1.20, the risk-free cost of capital is 5% and the expected market return is 14%.



Answer

(a) Cost of equity = $\frac{1.50}{13.00} = 0.115$ or 11.5%.

(b) Cost of equity = $\frac{1.50(1.04)}{13.00} + 0.04 = 0.16$ or 16%.

(c) Cost of equity = $5\% + 1.20(14 - 5)\% = 15.8\%$.

Cost of debt capital

- Cost of variable rate debt (floating rate debt)
- Cost of irredeemable fixed rate debt (perpetual bonds)
- Cost of redeemable fixed rate debt (redeemable fixed rate bonds)
- Cost of convertible debt
- Cost of preference shares

3 Cost of debt capital

Each item of debt finance for a company has a different cost. This is because different types of debt capital have differing risk, according to whether the debt is secured, whether it is senior or subordinated debt, and the amount of time remaining to maturity. (Note: Longer-dated debt normally has a higher cost than shorter-dated debt).

3.1 Cost of variable rate debt (floating rate debt)

The cost of debt can be calculated as either a pre-tax cost or an after-tax cost. Investors are interested in the pre-tax cost. Companies that borrow are interested in the after-tax cost of debt, for the purpose of calculating their cost of capital.

- The **pre-tax cost of variable rate debt** (also called floating rate debt), such as the cost of a bank loan, is the current interest rate payable on the debt.
- The **after-tax cost of variable rate debt** is the pre-tax cost multiplied by a factor $(1 - t)$, where t is the rate of tax on company profits.

For example, suppose that a company is currently paying interest at 6% on its bank loan of \$10 million, and the rate of tax on company profits is 25%. The pre-tax cost of the debt is 6% and the after-tax cost is $6(1 - 0.25) = 4.5\%$.

For the purpose of calculating a weighted average cost of capital (WACC, explained later), the cost of the debt would be its after-tax cost of 4.5% and its market value (for the purpose of weighting the cost of capital) would be \$10 million, which is the amount of the loan.

3.2 Cost of irredeemable fixed rate debt (perpetual bonds)

The cost of irredeemable fixed rate bonds, which might be described as perpetual bonds, is calculated as follows:

Pre-tax cost	Post-tax cost
$r_D = \frac{i}{MV}$	$r_D = \frac{i(1-t)}{MV}$

where:

r_D is the cost of the debt capital

i is the annual interest payable on each \$100 (nominal value) of the bonds.

t is the rate of tax on company profits.

MV is the market value of \$100 nominal value of bonds, excluding any interest currently payable.



Example

The coupon rate of interest on a company's irredeemable bonds ('perpetual bonds') is 6% and the market value of the bonds is 103.60. The tax rate is 25%.

- (a) The pre-tax cost of the debt is $6/103.60 = 0.058$ or 5.8%.
- (b) The after-tax cost of the bonds is $6(1 - 0.25)/103.60 = 0.043$ or 4.3%.

3.3 Cost of redeemable fixed rate debt (redeemable fixed rate bonds)

The cost of redeemable bonds is their redemption yield. This is the return, expressed as an average annual interest rate or yield, that investors in the bonds will receive between 'now' and the maturity and redemption of the bond, taking the current market value of the bonds as the investment. It is the investment yield at which the bonds are currently trading in the bond market.

This is calculated as the rate of return that equates the present value of the future cash flows payable on the bond (to maturity) with the current market value of the bond. In other words, it is the IRR of the cash flows on the bond to maturity, assuming that the current market price is a cash outflow.

A problem arises with calculating the pre-tax and the after-tax cost of redeemable bonds, because the redemption of the principal at maturity is not an allowable expense for tax purposes. The post-tax cost of redeemable debt could therefore be calculated in either of two ways. Each gives a different cost of capital:

- **Method 1.** Calculate the pre-tax cost of debt (the IRR of the cash flows ignoring debt) and then apply the factor $(1 - t)$ to reach the post-tax cost of debt
- **Method 2.** Calculate the post-tax cost of debt as the IRR of the future cash flows, allowing for tax relief on the interest payments and the absence of tax relief on the principal repayment.

If in doubt, use Method 2. However, Method 1 might be more appropriate if it is assumed that the company will replace the redeemable debt at maturity with a new issue of similar debt capital. So either Method 1 or Method 2 might be valid. Read the requirements of the question carefully, to see whether you are given any instructions about which method to use.

The cash flows for calculating the cost of redeemable debt

If Method 2 is used, the cash flows used to calculate an IRR (redemption yield) are:

- The current market value of the bond, excluding any interest payable in the near future: this is a cash outflow. The yield can be calculated for \$100 of bonds (nominal value). For example if the market price is \$101.50 (\$101.50 per \$100 nominal value of bonds), the Year 0 cash outflow is (101.50).
- The annual interest payments on the bond: these are cash inflows
- Tax relief on these annual interest payments: these are cash outflows (the opposite of the interest payments) and occur either in the same year as the interest payments or one year in arrears, depending on the assumption used about the timing of tax payments
- The redemption value of the bonds, which is often par. If the bonds are redeemable at par, the cash inflow from the redemption of the bonds will be 100.0 in the year when the bonds are redeemed.

If Method 1 is used, the tax cash flows are ignored.



Example

The current market value of a company's 7% loan stock is 96.25. Annual interest has just been paid. The bonds will be redeemed at par after four years. The rate of taxation on company profits is 30%.

Required

Calculate the after-tax cost of the bonds for the company:

- (a) assuming that these bonds will be replaced at redemption with identical bonds (i.e. using Method 1)
- (b) using the normal method of computation, Method 2.



Answer

- (a) **Method 1**

Year	Cash flow	Try 8%		Try 10%	
		Discount factor	PV	Discount factor	PV
0	Market value (96.25)	1.000	(96.25)	1.000	(96.25)
1	Interest 7.00	0.926	6.48	0.909	6.36
2	Interest 7.00	0.857	6.00	0.826	5.78
3	Interest 7.00	0.794	5.56	0.751	5.26
4	Interest 7.00	0.735	5.15	0.683	4.78
4	Redemption 100.00	0.735	73.50	0.683	68.30
	NPV		+ 0.44		(5.77)

Using interpolation, the before-tax cost of the debt is:

$$8\% + \frac{0.44}{(0.44 + 5.77)} \times (10 - 8)\% = 8.14\%$$

The after-tax cost of the debt is therefore estimated as $8.14\% \times (100 - 70)\% = 5.7\%$

(Note: deciding which cost of capital to try first. If you don't know which cost of capital to try first, calculate the average annual net cash flow as a percentage of the current market value. Here the total annual net cash inflows = $7 + 7 + 7 + 107 - 96.25 = 31.75$ which averages 7.9375 each year. As a percentage of the market value 96.25, this is 8.2%. So try 8% first).

(b) **Method 2**

It is assumed here that tax savings on interest payments occur in the same year as the interest payments.

Year	Cash flow	Try 6%		Try 5%	
		Discount factor	PV	Discount factor	PV
0	Market value (96.25)	1.000	(96.25)	1.000	(96.25)
1	Interest less tax 4.90	0.943	4.62	0.952	4.66
2	Interest less tax 4.90	0.890	4.36	0.907	4.44
3	Interest less tax 4.90	0.840	4.12	0.864	4.23
4	Interest less tax 4.90	0.792	3.88	0.823	4.03
4	Redemption 100.00	0.792	79.20	0.823	82.30
	NPV		(0.07)		+ 3.41

Using interpolation, the after-tax cost of the debt is:

$$5\% + \frac{3.41}{(3.41 + 0.07)} \times (6 - 5)\% = 5.98\%, \text{ say } 6.0\%.$$

If in doubt, use Method 2.

3.4 Cost of convertible debt

The cost of a convertible bond is the higher of:

- the cost of the bond as a straight bond that will be redeemed at maturity, and
- the IRR of the relevant cash flows assuming that the conversion of the bonds into equity will take place in the future.

The cost of capital of the bond as a straight bond is only the actual cost of the bond if the bonds are not converted into shares at the conversion date. The IRR of the

relevant cash flows is the cost of the convertible bond assuming that conversion will take place.

The relevant cash flows for calculating this yield (IRR) are:

- the current market value of the bonds (Year 0 outflow)
- annual interest on the bonds up to the time of conversion into equity (annual inflows)
- tax relief on the interest (annual outflows)
- the expected market value of the shares, at conversion date, into which the bonds can be converted.



Example

The current market value of a company's 7% convertible debenture is \$108.70. Annual interest has just been paid. The debenture will be convertible into equity shares in three years time, at a rate of 40 shares per debenture. The current ordinary share price is \$3.20 and the rate of taxation on company profits is 30%.

Required

Calculate the after-tax cost of the bonds for the company.

Year	Cash flow	Try 10%		Try 9%	
		DCF factor	PV	DCF factor	PV
0	Current market value	(108.7)	1.000	(108.7)	1.000
1- 3	Interest less tax	4.90	2.487	12.19	2.531
3	Value of shares on conversion (40 × \$3.2)	128.00	0.751	96.13	0.772
	NPV			(0.38)	+ 2.52

Using interpolation, the after-tax cost of the debt is:

$$9\% + [2.52 / (2.52 + 0.38)] \times (10 - 9)\% = 9.9\%$$

The cost of the convertibles as a straight bond is obviously less than 9.9% (since the market value is above par and the coupon is only 7%). The market therefore expects the bonds to be converted into equity, and the after-tax cost is 9.9%.



Exercise 1

A company has issued 4% convertible bonds that can be converted into shares in two years' time at the rate of 25 shares for every \$100 of bonds (nominal value). It is expected that the share price in two years' time will be \$4.25. If the bonds are not converted, they will be redeemed at par after four years. The yield required by investors in these convertibles is 6%.

What is the value of the convertible bonds?

3.5 Cost of preference shares

For **irredeemable preference shares**, the cost of capital is calculated in the same way as the cost of equity assuming a constant annual dividend, and using the dividend valuation model.

$$r = \frac{d}{MV}$$

where:

r is the cost of the preference shares

d = the expected future annual dividend

MV is the share price ex dividend.

For **redeemable preference shares**, the cost of the shares is calculated in the same way as the pre-tax cost of irredeemable debt. (Dividend payments are not subject to tax relief, therefore the cost of preference shares is calculated ignoring tax, just as the cost of equity ignores tax.)

Calculating the WACC

- Method of calculating the weighted average cost of capital (WACC)
- WACC and market values
- WACC and book values

4 Calculating the weighted average cost of capital (WACC)

4.1 Method of calculating the WACC

The weighted average cost of capital (WACC) is a weighted average of the (after-tax) cost of all the sources of capital for the company. The weightings given to each item of finance in the capital structure should be its total market value.

Source of finance	Market value	×	Cost	Market value × Cost
			r	$MV \times r$
Equity	MV_E	×	r_E	$MV_E \times r_E$
Preference shares	MV_P	×	r_P	$MV_P \times r_P$
Debt	MV_D	×	r_D	$MV_D \times r_D$
Total	ΣMV			$\Sigma MV \times r$
WACC =	$\frac{\Sigma MV \times r}{\Sigma MV}$			

The WACC for a company is found using the method shown above. If there is more than one source of debt, each with a different cost, there should be a separate line in the table for each item of debt.



Example

A company has 10 million shares each with a value of \$4.20, whose cost is 7.5%. It has \$30 million of 5% bonds with a market value of 101.00 and an after-tax cost of 3.5%. It has a bank loan of \$5 million whose after-tax cost is 3.2%. It also has 2 million 8% preference shares of \$1 whose market price is \$1.33 per share and whose cost is 6%. Calculate the WACC.

a**Answer**

Source of finance	Market value	Cost	Market value × Cost
	\$ million	r	MV × r
Equity	42.00	0.075	3.150
Preference shares	2.66	0.060	0.160
Bonds	30.30	0.035	1.061
Bank loan	5.00	0.032	0.160
	<u>79.96</u>		<u>4.531</u>

$$\text{WACC} = \frac{4.531}{79.960} = 0.05667, \text{ say } 5.7\%.$$

Formula for WACC

A formula for calculating the weighted average cost of capital is given in the formula sheet in your examination, as follows:

$$\text{WACC} = \left[\frac{V_e}{V_e + V_d} \right] K_e + \left[\frac{V_d}{V_e + V_d} \right] K_d (1 - t)$$

where

V_e is the total market value of the company's equity shares

V_d is the total market value of the company's debt

K_e is the cost of equity

K_d is the pre-tax cost of debt

t is the rate of tax on profits

This formula can only be used, however, when there is just one type of debt capital in the capital structure and the after-tax cost of debt is calculated by applying the factor $(1 - t)$ to the pre-tax cost of debt.

e**Example**

A company has 20 million shares each with a value of \$6.00, whose cost is 9%. It has debt capital with a market value of \$80 million and a before-tax cost of 6%. The rate of taxation on profits is 30%. Calculate the WACC.

a**Answer**

The after-tax cost of the debt capital is $6\% (1 - 0.30) = 4.2\%$.

Using a table for calculations:

Source of finance	Market value	Cost	Market value × Cost
	\$ million	r	MV × r
Equity	120.00	0.090	10.80
Bonds	80.00	0.042	3.36
	<u>200.00</u>		<u>14.16</u>

$$\text{WACC} = 14.16/200 = 7.08\%$$

Using the formula:

$$\begin{aligned} \text{WACC} &= \left[\frac{120}{200} \right] 9\% + \left[\frac{80}{200} \right] 6\% (1 - 0.30) \\ &= 5.4\% + 1.68\% = 7.08\% \end{aligned}$$

Both methods give the same WACC.

4.2 WACC and market values

For a company with constant annual 'cash profits', there is an important connection between WACC and market value. (Note: 'Cash profits' are cash flows generated from operations, before deducting interest costs.)

If we assume that annual cash profits are a constant amount in perpetuity, the total value of a company, equity plus debt capital, is calculated as follows:

$$\text{Total market value of the company} = \frac{\text{Annual cash profits}}{\text{WACC}}$$

From this formula, the following conclusions can be made:

- The lower the WACC, the higher the total value of the company will be (equity + debt capital), for any given amount of annual profits.
- Similarly, the higher the WACC, the lower the total value of the company.

For example, ignoring taxation, if annual cash profits are, say, \$12 million, the total market value of the company would be:

- \$100 million if the WACC is 12% (\$12 million/0.12)
- \$120 million if the WACC is 10% (\$12 million/0.10)
- \$200 million if the WACC is 6% (\$12 million/0.06).

The aim should therefore be to achieve a level of financial gearing that minimises the WACC, in order to maximise the value of the company.

Important questions in financial management are:

- For each company, is there an 'ideal' level of gearing that minimises the WACC?
- If there is, what is it?

4.3 WACC and book values

The WACC should be calculated using market values for equity, debt capital and preference shares.

The study guide to the syllabus specifies that you should also be able to calculate a WACC using balance sheet values (book values) for equity and debt. This is an unusual syllabus requirement, since WACC based on book values has no meaning and no value. The cost of equity and the cost of debt are not based on actual returns required by investors; therefore they have no obvious significance.

WACC using book values is calculated in the same way as the calculation of WACC using market values, with the following differences.

- Instead of using the market value of equity shares, take the value of equity shares plus reserves from the balance sheet.
- Instead of using the market value of debt capital, use its nominal value.
- Instead of using the cost of debt based on market values and investment yields on debt, use the 'coupon' rate (nominal rate) of interest on fixed rate debt. The current floating rate of interest should be used for variable rate debt. The cost of debt can be converted into an after tax cost, if required, using the factor $(1 - t)$.
- Instead of using the cost of equity using the CAPM or a dividend valuation model, you might be required to calculate the cost of equity as (annual dividends divided by the balance sheet value of equity capital and reserves) \times 100%.



Example

Extracts from the balance sheet of a company are shown below.

Equity and reserves	\$m
Ordinary shares of \$1	100
Reserves	500
	600
Bank loan	200
8% bonds	300
	1,100

The current rate of interest on the bank loan is 9%.
Annual dividends of \$84 million are paid to shareholders.

What is the WACC using book values? Ignore taxation.

a**Answer**

The cost of the bank loan is 9%

The cost of equity is assumed to be $84/600 = 0.14$ or 14%.

Source of finance	Book value	'Cost'	Book value × Cost
	\$ million	r	MV × r
Equity	600	0.14	84
Bank loan	200	0.09	18
Bonds	300	0.08	24
	<u>1,100</u>		<u>126</u>

WACC using book values = $126/1,100 = 0.1145$ or 11.45%.

It must be stressed, however, that a WACC based on book values is not an accurate measure of a company's WACC, because cost of capital should measure yields required by investors. Measures based on book values are not a measure of these yields, and weightings based on book values are also unreliable.

Cost of capital and gearing

- The traditional view of gearing and WACC
- The Modigliani-Miller view: ignoring corporate taxation
- The Modigliani-Miller view: allowing for corporate taxation

5 Cost of capital and gearing

For a given level of annual cash profits before interest and tax, the value of a company (equity + debt) is maximised at the level of gearing where WACC is lowest. This should also be the level of gearing that optimises the wealth of the company's equity shareholders.

The question is therefore: Is there a level of gearing where the WACC is minimised?

If WACC is minimised at a particular level of gearing a company should try to achieve a capital structure where this minimum WACC occurs.

However, there are different theories about the relationship between WACC and gearing. The three you need to know are:

- The traditional theory of WACC and gearing
- Modigliani and Miller's theory of WACC, ignoring taxation
- Modigliani and Miller's theory of WACC, allowing for taxation.

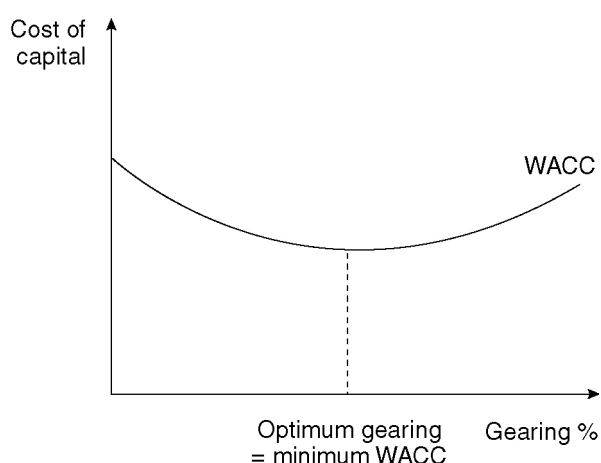
5.1 The traditional view of gearing and WACC

The traditional view of gearing is that there is an optimum level of gearing for a company, where WACC is minimised. This theory is based on the following assumptions.

- As gearing increases, the cost of equity rises. However, as gearing increases, there is also a greater proportion of debt capital in the capital structure, and the cost of debt is cheaper than the cost of equity.
- As gearing increases, WACC is therefore affected by a higher cost of equity, but a larger proportion of cheaper debt capital.
- At lower levels of gearing, as gearing increases, the effect of having more debt capital has a bigger effect on the WACC than the rising cost of equity. Consequently the WACC falls as gearing increases.
- However, after a certain level of gearing is reached, if gearing continues to increase, the increase in the cost of equity has a greater effect on WACC than the larger proportion of cheap debt capital. The WACC starts to rise.

The traditional view of gearing is therefore that an optimum level of gearing exists, where WACC is minimised and the value of the company is maximised. A graph of WACC at different levels of gearing can be drawn as a saucer-shaped or bowl-shaped curve.

Traditional view of gearing and the WACC



The greatest weakness with traditional theory is that it is based on assumptions and observation. It does not provide any guidance about how to identify or calculate:

- the level of gearing where WACC is minimised, or
- the WACC at the optimal gearing level.

5.2 The Modigliani-Miller view: ignoring corporate taxation

The traditional view of gearing and WACC was challenged by Modigliani and Miller (MM) in the 1950s. Initially, their arguments were based on the assumption that corporate taxation, and the tax relief on interest, could be ignored.

You do not need to know Modigliani and Miller's arguments in detail, only the main assumptions on which their arguments were based and the conclusions they reached.

Assumptions

MM made several assumptions in making their propositions.

- There is a perfect capital market in which investors all have the same information and also act rationally. Consequently they all share the same expectations about the future earnings of a company and also the level of its business risk.
- There is no taxation.
- Debt is risk-free and freely-available to both companies and investors.
- There are no transaction costs involved in buying or selling shares or debt capital.

It is not possible to explain properly the relevance of the assumptions about risk-free debt, its availability and the absence of transaction costs in buying and selling shares. These assumptions were used by MM to justify their views and explain how investors were indifferent to the gearing of companies because they are able to adjust their own personal gearing by borrowing and buying or selling shares.

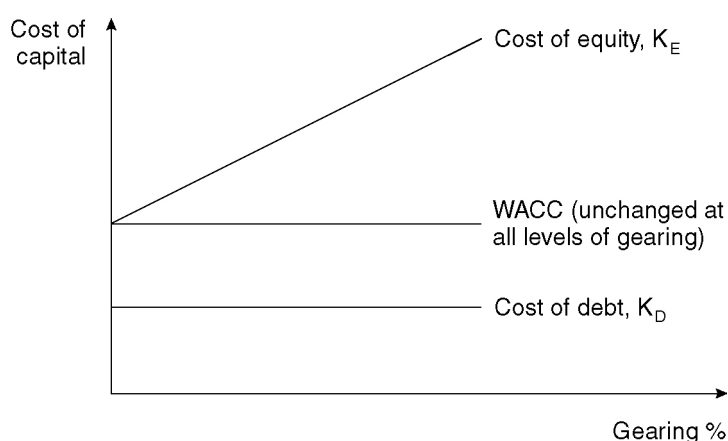
Modigliani and Miller's propositions: ignoring taxation

MM argued that if corporate taxation is ignored, an increase in financial gearing will have the following effect:

- As the level of gearing increases, there is a greater proportion of cheaper debt capital in the capital structure of the firm.
- However, the cost of equity rises as gearing increases.
- As gearing increases, the net effect of the greater proportion of cheaper debt and the higher cost of equity is that the WACC remains unchanged. The effect of the higher cost of equity is exactly equal to the offsetting effect of having a larger proportion of debt capital in the capital structure.
- **The WACC is the same at all levels of financial gearing.**
- **The total value of the company** (equity + debt capital) is therefore the same at all levels of financial gearing.

Modigliani and Miller therefore reached the conclusion that the level of gearing is irrelevant for the value of a company. There is no optimum level of gearing that a company should be trying to achieve.

Modigliani-Miller view of gearing and the WACC: no taxation



MM's theory is sometimes called the 'net operating income' approach because MM argued that, in the absence of taxation, the total market value of a company is determined by just two factors:

- The total earnings of the company (profit after interest, if tax is ignored).
- The business risk of the company, which determines the WACC. WACC is not affected by financial gearing, but it is affected by the perceived business risk of investing in the company. WACC is higher for companies with higher business risk.

Modigliani-Miller formulae: no taxation

There are three formulae for the Modigliani and Miller theory, ignoring corporate taxation. These are shown below. The letter 'U' refers to an ungeared company (all-equity company) and the letter 'G' refers to a geared company.

(1) WACC

The WACC in a geared company and the WACC in an identical but ungeared (all-equity) company are the same:

$$WACC_G = WACC_U$$

(2) Total value of the company (equity plus debt capital)

The total value of an ungeared company is equal to the total value of an identical geared company (combined value of equity + debt capital):

$$V_G = V_U$$

This total value can be calculated for a company with constant annual operating profits (profits before interest) as:

Annual operating profits/WACC.

(3) Cost of equity

The cost of equity in a geared company is higher than the cost of equity in an ungeared company, by an amount equal to:

- the difference between the cost of equity in the ungeared company and the cost of debt ($K_{EU} - K_D$)
- multiplied by the ratio of the market value of debt to the market value of equity in the geared company (D/E).

$$K_{EG} = K_{EU} + \frac{D}{E}(K_{EU} - K_D)$$

where

K_{EG} = the cost of equity in a geared company

K_{EU} = cost of equity in an ungeared company

K_D = the cost of debt in the geared company

D = the market value of debt capital in the geared company

E = the market value of equity in the geared company

**Example**

An all-equity company has a market value of \$60 million and a cost of equity of 8%. It borrows \$20 million of debt finance, costing 5%, and uses this to buy back and cancel \$20 million of equity. Tax relief on debt interest is ignored.

Required

According to Modigliani and Miller, if taxation is ignored, what would be the effect of the higher gearing on (a) the WACC (b) the total market value of the company and (c) the cost of equity in the company?

a**Answer**

According to Modigliani and Miller:

- (a) **WACC.** The WACC in the company is unchanged, at 8%.
- (b) **Total value.** The total market value of the company with gearing is identical to the market value of the company when it was all equity, at \$60 million. This now consists of \$20 million and \$40 million equity (\$60 million – \$20 million of debt)
- (c) **Cost of equity.** The cost of equity in the geared company is
- $$8\% + \left[\frac{20}{40} \times (8 - 5) \right] \% = 9.5\%$$

e**Example**

A company has \$500 million of equity capital and \$100 million of debt capital, all at current market value. The cost of equity is 14% and the cost of the debt capital is 8%.

The company is planning to raise \$100 million by issuing new shares. It will use the money to redeem all the debt capital.

Required

According to Modigliani and Miller, if the company issues new equity and redeems all its debt capital, what will be the cost of equity of the company after the debt has been redeemed? Assume that there is no corporate taxation.

a**Answer**

In the previous example, the Modigliani-Miller formulae were used to calculate a cost of equity in a geared company, given the cost of equity in the company when it is ungeared (all-equity). This example works the other way, from the cost of equity in a geared company to a cost of equity in an ungeared company. The same formulae can be used.

Using the known values for the geared company, we can calculate the cost of equity in the ungeared company after the debt has been redeemed.

$$K_{EG} = K_{EU} + \frac{D}{E}(K_{EU} - K_D)$$

$$14.0 = K_{EU} + \frac{100}{500}(K_{EU} - 8.0)$$

$$1.2 K_{EU} = 14.0 + 1.6$$

$$K_{EU} = 13.0\% (= 15.6/1.2).$$



Exercise 2

A company has \$80 million of equity capital, which costs 10% and \$20 million of debt capital that costs 5%. The company borrows \$20 million of debt finance, costing 5%, and uses this to buy back and cancel \$20 million of equity.

According to Modigliani and Miller, ignoring corporate taxation, what will be:

- the WACC of the company after the increase in gearing
- the market value of equity in the company after the increase in gearing, and the cost of equity in the company after the increase in gearing.

(**Hint:** To calculate the new cost of equity, calculate the cost of equity in an all-equity company first, and then calculate the cost of equity for the company at its new level of gearing.)

5.3 The Modigliani-Miller view: allowing for corporate taxation

Modigliani and Miller revised their arguments to allow for corporate taxation and the fact that there is tax relief on interest. You do not need to know the arguments they used to reach their conclusions, but you must know what their conclusions were.

Modigliani and Miller argued that allowing for corporate taxation and tax relief on interest, an increase in gearing will have the following effect:

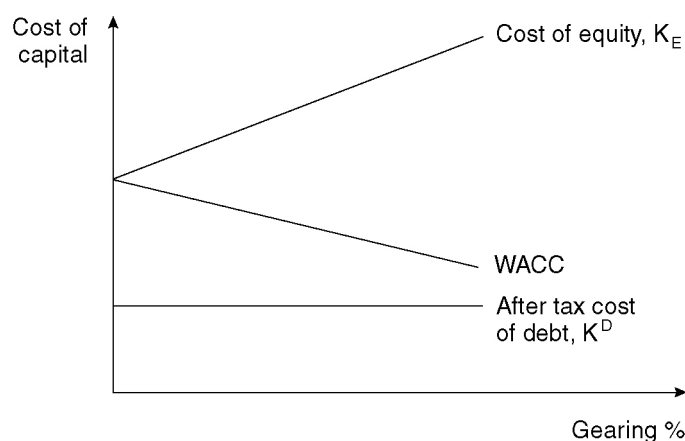
- As the level of gearing increases, there is a greater proportion of cheaper debt capital in the capital structure of the firm. However, the cost of equity rises as gearing increases.
- As gearing increases, the net effect of the greater proportion of cheaper debt and the higher cost of equity is that the WACC becomes lower. Increases in gearing therefore result in a reduction in the WACC.
- The WACC is at its lowest at the highest practicable level of gearing.
- There are practical limitations on gearing that stop it from reaching very high levels. For example, lenders will not provide more debt capital except at a much higher cost, due to the high credit risk or insolvency risk.

The conclusions that MM reached were that:

- The total value of the company is higher for a geared company than for an identical all-equity company.
- The value of a company will rise, for a given level of annual cash profits before interest and tax, as its gearing increases.
- There is an optimum level of gearing that a company should be trying to achieve. A company should be trying to make its gearing as high as possible, to the maximum practicable level, in order to maximise its value.

A graph showing the relationship between WACC and gearing, according to MM's theory with taxation, is as follows:

Modigliani-Miller view of gearing and the WACC: with taxation



Modigliani-Miller formulae: allowing for taxation

There are three formulae for the Modigliani and Miller theory, allowing for corporate taxation. These are shown below. The letter 'U' refers to an ungeared company (all-equity company) and the letter 'G' refers to a geared company.

(1) WACC

The WACC in a geared company is lower than the WACC in an all-equity company, by a factor of $1 - \frac{Dt}{(D+E)}$.

$$WACC_G = WACC_U \left[1 - \frac{Dt}{(D+E)} \right]$$

where t is the rate of taxation.

(2) Value of a company

The total value of a geared company (equity + debt) is equal to the total value of an identical ungeared company plus the value of the 'tax shield'. This is the market value of the debt in the geared company multiplied by the rate of taxation (Dt).

$$V_G = V_U + Dt$$

(3) Cost of equity

The cost of equity in a geared company is higher than the cost of equity in an ungeared company, by a factor equal to:

- the difference between the cost of equity in the ungeared company and the cost of debt, ($K_{EU} - K_D$)
- multiplied by the ratio $(1-t) \times \frac{D}{E}$.

$$K_{EG} = K_{EU} + \frac{(1-t)D}{E} (K_{EU} - K_D)$$

When making calculations for the effect of gearing on the WACC and cost of equity, when you allow for taxation, it is usually necessary to begin by calculating the effect of a change in gearing on total market value and the market value of equity. In other words, you will usually have to begin with the formula $V_G = V_U + Dt$.



Example

An all-equity company has a market value of \$60 million and a cost of equity of 8%. It borrows \$20 million of debt finance, costing 5%, and uses this to buy back and cancel \$20 million of equity. The rate of taxation on company profits is 25%.

According to Modigliani and Miller:

(a) **Market value**

The market value of the company after the increase in its gearing will be:

$$V_G = V_U + Dt$$

$$V_G = \$60 \text{ million} + (\$20 \text{ million} \times 0.25) = \$65 \text{ million.}$$

The market value of the debt capital is \$20 million; therefore the market value of the equity in the geared company is \$45 million (\$65 million – \$20 million).

(b) **WACC of the geared company**

The WACC of the company after the increase in its gearing is calculated as follows:

$$WACC_G = WACC_U \left[1 - \frac{Dt}{(D+E)} \right]$$

$$WACC_G = 8\% \left[1 - \frac{(\$20 \text{ million} \times 25\%)}{(\$65 \text{ million})} \right] = 8\% (0.9231) = 7.38\%$$

(c) **Cost of equity in the geared company**

$$K_{EG} = K_{EU} + \frac{(1-t)D}{E} (K_{EU} - K_D)$$

$$K_{EG} = 8\% + \left[20 \frac{(1-0.25)}{45} \times (8-5) \right] \% = 8\% + 1\% = 9\%$$

Check: the WACC can now be calculated as follows:

Source of finance	Market value	Cost	Market value x Cost
	\$ million	r	MV x r
Equity	45.00	0.09	4.05
Debt (after-tax cost)	20.00	0.0375	0.75
	<u>65.00</u>		<u>4.80</u>

$$WACC = \frac{4.80}{65.00} = 0.0738 \text{ or } 7.38\%$$

Pecking order theory

- Preferred sources of finance
- Ease of obtaining finance

6 Pecking order theory

6.1 Preferred sources of finance

Pecking order theory is a view about how companies seek to raise new capital that contradicts views of capital structure based on Modigliani and Miller theory or the traditional view of WACC.

Pecking order theory suggests that when companies try to raise new capital, they are not concerned with minimising the WACC. They look for cheap capital and convenient access to new capital.

Many companies have a preferred order for sources of finance as follows.

- Retained earnings
- New debt
- New equity

It therefore goes against the theory that companies have a unique combination of debt and equity which will minimise their cost of capital.

6.2 Ease of obtaining finance

The reason for the order of preference of sources of finance may be due to the ease of obtaining the finance.

- Retained earnings are easily accessible and have no issue costs. To obtain retained earnings, all a company needs to do is to be profitable and keep dividends below the total amount of earnings. Financial managers might therefore consider retained earnings to have no cost, although this is not correct.
- It is cheaper to raise debt finance than equity and it is possible to raise smaller amounts when required. Bank finance in particular is relatively quick and inexpensive to obtain, even though the bank will charge an arrangement fee for any loan that it provides.
- The cost of raising capital by issuing new shares for cash is quite high. They include for example the costs of professional fees of investment banking advisers, accountants and lawyers, underwriting fees, costs of meeting regulatory requirements and so on.

Capital asset pricing model (CAPM)

Contents

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| 1 | Risk and investments |
| 2 | Components of the capital asset pricing model (CAPM) |
| 3 | The cost of capital for capital investment appraisal |
| 4 | Project-specific discount rates |

Risk and investments

- Risk and return in investments
- What is investment risk?
- Diversification to reduce risk: building an investment portfolio
- Systematic and unsystematic risk

1 Risk and investments

1.1 Risk and return in investments

Investors invest in shares and bonds in the expectation of making a return. The return that they want from any investment could be described as:

- a return as reward for providing funds and keeping those funds invested, plus
- a return to compensate the investor for the risk.

As a basic rule, an investor will expect a higher return when the investment risk is higher.

1.2 What is investment risk?

Investors in bonds, investors in shares and companies all face investment risk.

In the case of **bonds**, the risks for the investor are as follows:

- The bond issuer may default, and fail to pay the interest on the bonds, or fail to repay the principal at maturity.
- There may be a change in market rates of interest, including interest yields on bonds. A change in yields will alter the market value of the bonds. If interest rates rise, the market value of bonds will fall, and the bond investor will suffer a loss in the value of his investment.

In the examination, you might be told to assume that debt capital is risk-free for the purpose of analysing the cost of equity. In practice however, only government debt denominated in the domestic currency of the government is risk-free.

In the case of **equity shares**, the risks for the investor are that:

- the company might go into liquidation, or,
- much more significantly, the company's profits might fluctuate, and dividends might also rise or fall from one year to the next.

For investors in equities, the biggest investment risk comes from uncertainty and change from one year to the next in annual profits and dividends. Changes in expected profits and dividends will affect the value of the shares. Bigger risk is associated with greater variability in annual earnings and dividends.

When a company invests in a new project, there will be an investment risk. This is the risk that actual returns from the investment will not be the same as the expected returns but could be higher or lower. This investment risk for companies is similar to the investment risk facing equity investors.

Some types of investment are more risky than others because of the nature of the industry and markets. For example, investments by a supermarkets group in building a new supermarket is likely to be less risky than investment by an IT company in a new type of software. This is because the IT business is inherently more risky than the supermarkets business. When business risk is higher, returns are less predictable or more volatile, and the **expected returns should be higher to compensate for the higher business risk**.

1.3 Diversification to reduce risk: building an investment portfolio

To a certain extent, an investor can reduce the investment risk – in other words, reduce the volatility of expected returns – by diversifying his investments, and holding a portfolio of different investments.

Creating a portfolio of different investments can reduce the variation of returns from the total portfolio, because if some investments provide a lower-than-expected return, others will provide a higher-than-expected return. Extremely high or low returns are therefore less likely to occur.

Similarly, a company could reduce the investment risk in its business by diversifying, and building a portfolio of different investments. However, it can be argued that there is no reason for a company to diversify its investments, because an investor can achieve all the diversification he requires by selecting a diversified portfolio of equity investments.

An investment portfolio consisting of all stock market securities (excluding risk-free securities), weighted according to the total market value of each security, is called the **market portfolio**.

1.4 Systematic and unsystematic risk

Although investors can reduce their investment risk by diversifying, not all risk can be eliminated. There will always be some investment risk that cannot be eliminated by diversification.

- When the economy is weak and in recession, returns from the market portfolio as whole are likely to fall. Diversification will not protect investors against falling returns from the market as a whole
- Similarly, when the economy is strong, returns from the market as a whole are likely to rise. Investors in all or most shares in the market will benefit from the general increase in returns.

Therefore there are two types of risk:

- **Unsystematic risk**, which is risk that is unique to individual investments or securities, that can be eliminated through diversification

- **Systematic risk, or market risk.** This is risk that cannot be diversified away, because it is risk that affects the market as a whole, and all investments in the market in the same way.

Implications of systematic and unsystematic risk for portfolio investment

The distinction between systematic risk and unsystematic risk has important implications for investment.

- Investors expect a return on their investment that is higher than the risk-free rate of return (unless they invest 100% in risk-free investments).
- The higher expected return is to compensate investors for the higher investment risk.
- By diversifying, and investing in a wide range of different securities, investors can eliminate unsystematic risk. This is because if some investments in the portfolio perform much worse than expected, others will perform much better. The good-performing and poor-performing investments 'cancel each other out'.
- In a well-diversified portfolio, the unsystematic risk is therefore zero. Investors should therefore not require any additional return to compensate them for unsystematic risk.
- The only risk for which investors should want a higher return is systematic risk. This is the risk that the market as a whole will perform worse or better than expected.

Components of the capital asset pricing model (CAPM)

- Systematic risk in securities
- The beta factor of a security
- Formula for the CAPM
- The beta factor of a small portfolio
- Alpha factor
- Asset betas, equity betas and debt betas
- Advantages and disadvantages of the CAPM

2 Components of the capital asset pricing model (CAPM)

The capital asset pricing model (CAPM) establishes a relationship between investment risk and expected return from individual securities. It can also be used to establish a relationship between investment risk and the expected return from specific capital investment projects by companies.

The CAPM was explained in the previous chapter as a model for estimating the cost of equity in a company, i.e. the returns that are required by equity investors. This section explains some of the assumptions and components of the CAPM.

2.1 Systematic risk in securities

As explained earlier, systematic risk is risk that cannot be eliminated by diversifying. Every individual security, with the exception of risk-free securities, has some systematic risk. This is the same systematic risk that applies to the market portfolio as a whole, but the amount of systematic risk for the shares in an individual company might be higher or lower than the systematic risk for the market portfolio as a whole.

Since investors can eliminate unsystematic risk through diversification and holding a portfolio of shares, their only concern should be with the systematic risk of the securities they hold in their portfolio. The return that they expect to receive should be based on their assessment of systematic risk, rather than total risk (systematic + unsystematic risk) in the security.

The CAPM assumes that investors hold diversified investment portfolios and are therefore concerned with systematic risk only and not unsystematic risk.

The systematic risk of a security can be compared with the systematic risk in the market portfolio as a whole.

- A security might have a higher systematic risk than the market portfolio. This means that when the average market return rises, due perhaps to growth in the economy, the return from the security should rise by an even larger amount.

Similarly, if the average market return falls due to deterioration in business conditions, the return from the security will fall by an even larger amount.

- A security might have a lower systematic risk than the market portfolio, so that when the average market return rises, the return from the security will rise, but by a smaller amount. Similarly, when the average market return falls, the return from the security will also fall, but by a smaller amount.

A risk-free security has no systematic risk, because returns on these securities are unaffected by changes in market conditions. The shares of every individual company, however, have some systematic risk.

2.2 The beta factor of a security

The systematic risk for an individual security is measured as a beta factor. This is a measurement of the systematic risk of the security, in relation to the systematic risk of the market portfolio as a whole.

The **beta factor for the market portfolio itself = 1.0**.

Beta factor of risk-free securities

Risk-free investments provide a predictable and secure return. They have no systematic risk.

In the real world there are no risk-free investments, but short-term government debt issued in the domestic currency can normally be regarded as very safe investments. The current yield on short-term government debt is usually taken as a risk-free return. In the UK this is the current yield on UK government Treasury bills.

Since they have no systematic risk, the **beta factor for risk-free securities = 0**.

The risk-free rate of return varies between different countries, and can go up or down. The beta factor of a risk-free security, however, is 0 at all times.

Beta factor of company securities

The formula for calculating a security's beta factor is as follows:

$$\text{Beta factor of Security S } (\beta_S) = \frac{\text{Systematic risk of Security S}}{\text{Systematic risk of the market as a whole}}$$

The 'market as a whole' is the market portfolio.

The beta factor for the shares of an individual company:

- must always be higher than the risk-free beta factor (higher than 0)
- will be less than 1.0 if its systematic risk is less than the systematic risk for the market portfolio as a whole
- will be more than 1.0 if its systematic risk is greater than the systematic risk for the market portfolio as a whole.

When the beta factor for an individual security is greater than 1, the increase or fall in its expected return (ignoring unsystematic risk) will be greater than any given increase or decrease in the return on the market portfolio as a whole (= the 'market return').

When the beta factor for a security is less than 1, the security is relatively low-risk. The expected increase or decrease in its expected return (ignoring unsystematic risk) will be less than any given increase or decrease in the market return.

Beta factors for stock market companies (quoted companies) are measured statistically from historical stock market data (using regression analysis) and are available on the internet from sources such as Datastream and the London Business School Risk Management Service.

2.3 Formula for the CAPM

The formula for the capital asset pricing model is used to calculate the expected return from a security (ignoring unsystematic risk).

$$R_S = R_{RF} + \beta_S (R_M - R_{RF})$$

where:

R_S is the expected return from a security S

R_{RF} is the risk-free rate of return

R_M is the expected market return

β_S is the beta factor for security S.

This formula is given to you in the formula sheet for the examination, but it is an important formula and you should try to learn it.

The expected return from an individual security will therefore vary up or down as the return on the market as a whole goes up or down. The size of the increase or fall in the expected return will depend on:

- the size of the change in the returns from the market as a whole, and
- the beta factor of the individual security.



Example

The risk-free rate of return is 4% and the return on the market portfolio is 8.5%. What is the expected return from shares in companies X and Y if:

- the beta factor for company X shares is 1.25
- the beta factor for company Y shares is 0.90?

a**Answer**

Company X: $R_S = 4\% + 1.25 (8.5 - 4)\% = 9.625\%$

Company Y: $R_S = 4\% + 0.90 (8.5 - 4)\% = 8.05\%$.

The market premium

If an investor invests in a portfolio of risk-free assets, he will receive the risk-free rate of return, which is the interest yield on those risk-free assets.

To compensate an investor for investing in the market portfolio, the expected return must be higher than on risk-free investments. The **market premium** is the difference between the expected return on the market portfolio and a portfolio of risk-free investments.

$$\text{Market premium} = R_M - R_{RF}$$

where:

R_M is the market rate of return (the expected return on the market portfolio)

R_{RF} is the risk-free rate of return.

If you look again at the CAPM formula, you will see that the market premium is an element in the formula for the CAPM. The return required from shares in any company by an investor who holds a diversified portfolio should consist of:

- the return on risk-free securities
- plus a premium for the systematic investment risk: this premium is the market premium multiplied by the beta factor for the particular security.

In the UK, the market premium historically has normally been within the range of about 3.5% to 5%.

2.4 The beta factor of a small portfolio

A portfolio of investments containing just a few securities will not be fully representative of the market portfolio, and its systematic risk will therefore be different from the systematic risk for the market as a whole.

The relationship between the systematic risk of a small portfolio and the systematic risk of the market as a whole can be measured as a beta factor for the portfolio.

A beta factor for a portfolio is the weighted average value of the beta factors of all the individual securities in the portfolio. The weighting allows for the relative proportions of each security in the portfolio.



Example

A portfolio contains five securities. The proportions of each security in the portfolio and the beta factor of each security are as follows:

Security	Proportion of the portfolio	Beta factor of the security
1	10%	1.20
2	25%	0.90
3	15%	0.96
4	30%	1.15
5	20%	1.06

The beta factor for the portfolio is calculated as follows:

Security	Proportion of the portfolio	Beta factor of the security	
	p	β	$p\beta$
1	10%	1.20	0.120
2	25%	0.90	0.225
3	15%	0.96	0.144
4	30%	1.15	0.345
5	20%	1.06	0.212
Beta factor for the portfolio			<u>1.046</u>

2.5 Alpha factor

The beta factor for shares is a measure of systematic risk and it ignores variations in the equity returns caused by unsystematic risk factors. When shares yield more or less than their expected return (based on the CAPM), the difference is an abnormal return. This abnormal return might be referred to as the alpha factor. The alpha factor for a security is simply the balancing figure in the following formula:

$$R_S = R_{RF} + \beta_S (R_M - R_{RF}) + \alpha_S$$



Example

The return on shares of company A is 11%, but its normal beta factor is 1.10. The risk-free rate of return is 5% and the market rate of return is 8%.

There is an abnormal return on the shares:

$$11\% = 5\% + 1.10 (8 - 5)\% + \alpha$$

$$\alpha = 2.7\%.$$



Example

An investor tries to buy shares or bonds for his portfolio that provide a positive abnormal return. He is considering two shares and two bonds for adding to his portfolio.

The required return on shares is measured by the Capital Asset Pricing Model (CAPM). The required return for bonds is measured using a model similar to the CAPM, except that the 'beta' for a bond is measured as the ratio of the duration of the bond in years to the duration of the bond market as a whole.

The following information is available:

Shares	Expected actual return (%)	Standard deviation of returns	Correlation coefficient of returns with the market
Equity market	11.0	12	1.00
Company X	9.5	14	0.92
Company Y	12.0	17	0.83

Bonds	Duration (years)	Coupon (%)	Redemption yield (%)
Bond market	6.0	-	6.2
Bond P	5.0	7	6.4
Bond Q	8.5	6	6.5

The risk-free rate of return is 5%.

Required:

Identify which of these investments currently offers a positive abnormal return.



Answer

The first step is to calculate beta factors for the shares and the similar factors for the bonds.

For shares, the beta factor is calculated as the correlation coefficient multiplied by the standard deviation of returns for the share, divided by the standard deviation of market returns.

Security	Beta factor
Share X	$(0.92 \times 14)/12$ 1.073
Share Y	$(0.83 \times 17)/12$ 1.176
Bond P	$(5.0/6.0)$ 0.833
Bond Q	$(8.5/6.0)$ 1.417

We can now calculate the required return for each security (using the CAPM) and compare it with the expected actual returns. The difference is the abnormal return. For bonds, the redemption yield should be used as the measure of return.

Security		Required return	Actual expected return	Abnormal return
		%	%	%
Share X	$5\% + 1.073(11 - 5)\%$	11.44	9.50	- 1.94
Share Y	$5\% + 1.176(11 - 5)\%$	12.06	12.00	- 0.06
Bond P	$5\% + 0.833(6.2 - 5)\%$	6.00	6.40	+ 0.40
Bond Q	$5\% + 1.417(6.2 - 5)\%$	6.70	6.50	- 0.20

Only bond P offers a positive abnormal return. If the investor makes investment decisions on the basis of abnormal returns, he will invest in this bond and add it to his portfolio. (However, the abnormal return could be eliminated by a rise in the price of the bond.)

2.6 Asset betas, equity betas and debt betas

Asset beta

When a company has no debt capital and is ungeared, its beta factor reflects the business risk of its business operations. The beta factor is higher for ungeared companies with higher business risk.

The beta factor for a company's business operations is called its asset beta.

If the company continues with the same business operations, its business risk will not change and its asset beta remains constant.

Equity beta and debt beta

When a company takes on debt capital and its gearing increases, there is financial risk as well as business risk. The cost of equity increases to compensate equity investors for the financial risk. The 'equity beta' a company is the beta factor of its equity capital, that allows for both business risk and financial risk.

- The equity beta in an ungeared company is lower than the equity beta in a geared company because there is no financial risk in an ungeared company.
- The equity beta in an ungeared company is equal to the asset beta: it allows for business risk only, with no financial risk.
- The equity beta in a geared company is therefore higher than the company's asset beta.

Debt capital also has a beta factor (a 'debt beta'), although this is much lower than the equity beta.

Formula for asset beta, equity beta and debt beta

There is a formula for the relationship between a company's asset beta, equity beta and debt beta.

$$\beta_A = \beta_{EG} \times \frac{E}{E + D(1-t)} + \beta_D \times \frac{D(1-t)}{E + D(1-t)}$$

where:

β_A = the company's asset beta: this is the same as the equity beta for an ungeared (all-equity) company

β_{EG} = the beta factor of equity in the company: if the company has debt capital, this 'equity beta' is the 'geared beta' for the company's equity capital

β_D = the beta factor for the debt capital in the company

D = the market value of debt in the company

E = the market value of equity in the company

This formula is included in the formula sheet that you will be given in your examination, except that the formula sheet uses the term V_e instead of E and V_d instead of D.

Assumption that the debt beta is 0

It is often assumed that the beta factor of debt capital in a company is very small and it is therefore possible to assume that is actually 0. In other words, it is often assumed that a company's debt capital is risk-free.

If it is assumed that corporate debt is risk-free, this formula simplifies to:

$$\beta_A = \beta_{EG} \times \frac{E}{E + D(1-t)}$$

If we assume that debt is risk-free, the asset beta of a company is lower than the equity beta factor by a factor of $\frac{E}{[E + D(1-t)]}$

You should see from the formula that if the company is ungeared and is all-equity financed, the asset beta and the equity beta are the same, because $D = 0$.



Example

Plassid Company has an equity beta of 1.25. The beta factor of its debt capital is 0.05.

The total market value of the shares of Plassid is \$600 million and the total market value of its debt capital is \$200 million. The rate of corporate taxation is 30%.

Required:

- Calculate the asset beta of the company.
- Re-calculate the asset beta of Plassid assuming that the debt capital is risk-free.

a**Answer**

$$\begin{aligned}
 (a) \quad \beta_A &= 1.25 \times \frac{600}{600 + 200(1 - 0.30)} + 0.05 \times \frac{200(1 - 0.30)}{600 + 200(1 - 0.30)} \\
 &= (1.25 \times 600/740) + 0.05 \times 140/740 \\
 &= 1.0135 + 0.0095 = 1.023
 \end{aligned}$$

(b) If the debt capital is risk-free, the asset beta is 1.0135 (see workings above).

It is often assumed that debt capital is risk-free because the estimate of the asset beta is not affected significantly by this simplifying assumption.

Relevance of asset beta

The asset beta is a beta factor that reflects the business risk of a particular business operation. It can be used to estimate a cost of equity capital for a specific capital investment project and so a project specific discount rate for use with DCF analysis. This is explained in a later section.

2.7 Advantages and disadvantages of the CAPM

The CAPM is based on some simplifying assumptions. For example, the CAPM assumes:

- A perfect capital market, in which all investors have access to all available information about the financial markets
- Uniformity of investor expectations
- All forecasts (expectations) are made in the context of just one time period.

In spite of these simplifying assumptions, the CAPM appears to be reliable in practice. The advantages and disadvantages of the CAPM are summarised in the following table.

Advantages of CAPM	Weaknesses of CAPM
It provides a measurable relationship between risk and return.	It can be difficult to estimate statistically reliable values for the risk-free rate and market rate of return, and the beta factor for a security.
It can be used to estimate the cost of capital for securities, notably equity shares.	It focuses on systematic risk only and ignores unsystematic risk. Unsystematic risk is significant for an investor who does not have a well-diversified portfolio.
It can be adapted to establishing a required (risk-adjusted) DCF return on capital investments by a company.	It makes no distinction between the ways in which a security provides its return (for example dividends or share price increase).

The cost of capital for capital investment appraisal

- CAPM and the WACC
- The beta factor of a security
- Formula for the CAPM
- The beta factor of a small portfolio
- Alpha factor
- Advantages and disadvantages of the CAPM

3 The cost of capital for capital investment appraisal

3.1 CAPM and the WACC

The capital asset pricing model can be used to calculate a cost of equity for any company. It can also be used to calculate a cost of capital for corporate debt, but this is less likely to feature in your examination. The cost of equity calculated using the CAPM can then be used in the calculation of the company's weighted average cost of capital.

The CAPM probably provides a more reliable estimate of the cost of equity than the dividend valuation model or the dividend growth model, because:

- The CAPM ignores volatility in returns caused by unsystematic risk factors, which should not affect the cost of equity for well-diversified investors
- the beta factor for each company is measured statistically from historical stock market data.

In your examination you might be required to calculate a cost of equity using the CAPM and then use your cost of equity to calculate a WACC.

3.2 Company value and cost of capital

The previous chapter explained how the cost of capital can be calculated from expected returns (dividends or interest) and the market value of securities. It is also possible, using the same mathematical method, to calculate what the market value of shares or bonds ought to be, given expectations of future returns (dividends and interest) and the cost of capital. One basic rule is that for a given size of expected future returns, the total value of a company is higher when the cost of capital is lower.

By making simplifying assumptions of constant annual operating profits, and paying out all earnings as dividends each year, we can state a formula linking the total value of a company to its WACC:

$$\text{Total market value (debt + equity)} = \frac{\text{Annual profits before interest}}{\text{WACC}}$$

There is a direct relationship between expected future returns for investors, the cost of capital and the total market value of a company.

A similar concept is applied in investment appraisal and DCF analysis of capital projects. There is a relationship between:

- (a) the future cash flows that a capital investment project will be expected to provide
- (b) the cost of capital, and
- (c) the value that the future cash flows will create.

With investment appraisal using DCF analysis, the expected future cash flows (cash profits) from a capital investment project are discounted at a cost of capital. The total value of the company should increase if the project has a positive NPV when the cash flows are discounted at the appropriate cost of capital. The expected increase in the value of the company should be the amount of the NPV.

The appropriate cost of capital for calculating the NPV should be a cost of capital that represents the investment risk of the project and the returns that the project must earn to meet the requirements of the providers of the capital.

3.3 Average and marginal cost of capital

The marginal cost of capital of a capital investment project is the additional minimum return that the project must provide to meet the requirements of the providers of the capital. The cost of the additional capital required for a new capital investment project can be defined as the **marginal cost of capital**. There will be an increase in the total value of the company from investing in a project only if its NPV is positive when its cash flows are discounted at the marginal cost of the capital.

The **average cost of capital** is the cost of capital of all existing capital, debt and equity. This is represented by the WACC.

Capital investments should be discounted at their marginal cost of capital, but are usually discounted at the company's WACC.

This is because it is generally assumed that the effect of an individual project on the company's marginal cost of capital is not significant; therefore all investment projects can be evaluated using DCF analysis and the WACC, on the assumption that the WACC will be unchanged by investing in the new project.

In some cases, however, this assumption is not valid. The marginal cost of capital is not the WACC in cases where:

- The capital structure will change because the project is a large project that will be financed mainly by either debt or equity capital, and the change in capital structure will alter the WACC. If the WACC changes, the marginal cost of capital and the WACC will not be the same.
- A new capital project might have completely different business risk characteristics from the normal business operations of the company. If the business risk for a project is completely different, the required return from the

project will also be different. In such cases, the CAPM might be used to establish a suitable marginal cost of capital for capital investment appraisal of the specific project.

3.4 Using the CAPM for capital investment appraisal

Some types of capital investment projects are more risky than others because the business risk is greater. For example, the systematic risk of investing in the manufacture of cars may be higher than the systematic risk of investing in a retailing business. Investing in the construction of residential houses might be less risky than investing in the construction of office blocks. Similarly, the risk of investing in one country may be higher than the risk of investing in another country, due to differences in the business environment or economic conditions.

Since different types of business operation have different business risk, the asset betas of each type of business operation are also different.

When there are significant differences in business risk between different capital investment projects, it follows that the required return from particular investments should be adjusted to allow for differences in systematic risk.

If a beta factor for a particular project can be established, a risk-adjusted cost of capital can be applied to the project. This risk-adjusted cost of capital should then be used to calculate the project NPV.

The calculation of a project-specific discount rate is explained in the next section.

Project-specific discount rates

- The need for project-specific discount rates
- Proxy companies and proxy betas
- Using proxy betas to estimate an asset beta
- Using an asset beta to calculate an equity beta: re-gearing the asset beta
- Summary of the steps for calculating a project-specific discount rate

4 Project-specific discount rates

4.1 The need for project-specific discount rates

A specific discount rate should be used for DCF appraisal of capital projects where either:

- the business risk of the new project is different from the business risk of the company's other business operations, or
- the financial risk will be different because financing the project will involve a major change in the company's capital structure.

For examination purposes, the syllabus focuses on obtaining a cost of capital for specific projects where the business risk will be significantly different.

4.2 Proxy companies and proxy betas

To calculate a suitable cost of capital to use in DCF analysis for a specific project where business risk is different from the company's normal business operations, the first step is to estimate the business risk.

The business risk of a business operation or capital investment project can be measured by the asset beta for that type of business.

An estimate of the asset beta can be obtained from the beta factors of quoted companies that operate in the same industry and markets. For example if a house-building company is considering a project to construct a new road bridge, for which the business risk will be very different, it can estimate an asset beta for a bridge-building project by obtaining the beta factors of quoted companies in the bridge-building industry.

These companies that operate in the relevant industry and markets are called 'proxy companies' and the beta factors of their shares are called 'proxy equity betas'.

It is assumed that the business risk within the proxy equity betas of these proxy companies is similar to the business risk in the new capital investment project that the company is considering.

4.3 Using proxy betas to estimate an asset beta

For each of the proxy companies selected, an asset beta can be calculated using the asset beta formula. In your examination you might be told to assume that debt capital in the proxy companies is risk-free; therefore the asset beta for each company can be calculated using the formula:

$$\beta_A = \beta_{EG} \times \frac{E}{E + D(1-t)}$$

The asset betas for the proxy companies will not be exactly the same, but they should be similar.

An asset beta for the capital investment project might therefore be estimated as the average of the asset betas of the proxy companies. For example if three proxy companies have been selected and their asset betas are 1.14, 1.20 and 1.22, an estimate of a suitable asset beta would be $(1.14 + 1.20 + 1.23)/3 = 1.19$.

4.4 Using an asset beta to calculate an equity beta: re-gearing the asset beta

An asset beta measures business risk but not financial risk. If a company is geared, or intends to finance a project with a mixture of equity and debt capital, the equity beta for the project will be higher than the asset beta.

The asset beta should therefore be re-gearred, and converted into an equity beta, using the asset beta formula and data about the capital structure of the company.

For examination purposes it will normally be assumed that the company's debt capital is risk-free, therefore the equity beta is calculated as:

$$\beta_{EG} = \beta_A \div \frac{E}{E + D(1-t)}$$

Having calculated an equity beta, the CAPM can be used to calculate a cost of equity for the project.

- This cost of equity can then be used to calculate a weighted average cost of capital for the project, allowing for the capital structure of the company.
- Alternatively, an examination question might instruct you to assume that the project-specific cost of equity you calculate should be used as the discount rate (cost of capital) for capital investment appraisal of the project.

4.5 Summary of the steps for calculating a project-specific discount rate

The steps for calculating a project-specific discount rate for a project with different business risk can be summarised as follows.

- 1 Identify some proxy companies.
- 2 For each of these proxy companies, obtain the available market data about their capital structure and beta factors.

- 3 For each proxy company, convert the available data in to an asset beta, using the asset beta formula.
- 4 Calculate an average asset beta from the asset betas of the proxy companies.
- 5 Convert this asset beta into a 'geared equity' beta for the company, using available data about its capital structure. You will normally be told to assume that the debt capital of the company is risk-free.
- 6 This geared equity beta should be used to calculate a cost of equity for the project, using the CAPM.
- 7 Either this cost of equity can then be used in the calculation of a weighted average cost of capital for the project, or you will be instructed to use the cost of equity as the cost of capital for DCF analysis of the capital investment project.

e

Example

An all-equity company operates in an industry where its beta factor is 0.90. It is considering whether to invest in a completely different industry. In this other industry, the average debt/equity ratio is 40% and the average beta factor is 1.25. The risk-free rate of return is 4% and the average market return is 7%. If the company does invest in this other industry, it will remain all-equity financed. The rate of taxation is 30%. Assume that debt is risk-free.

Required

What cost of capital should be used to evaluate the proposed investment?

a

Answer

The appropriate discount rate should be one that applies to the industry in which the investment will be made. We know that the 'geared beta' in this industry is 1.25, with a debt: equity ratio of 0.40. We can calculate the asset beta for the industry as:

$$\beta_A = 1.25 \times \frac{60}{[60 + 40(1 - 0.30)]} = 1.25 \times \frac{60}{88} = 0.85$$

Since the company will be all-equity financed, the cost of equity to apply to the project is therefore:

$$4\% + 0.85(7 - 4)\% = 6.55\%.$$

e

Example

A company is planning to invest in a project in a new industry where it has not invested before. The asset beta for the project has been estimated as 1.35. The project will be financed two-thirds by equity capital and one-third by debt capital. The rate of taxation on company profits is 30%.

Assume that the debt capital is risk-free.

The risk-free rate of return is 3% and the market return is 8%.

What cost of equity should be used to calculate the marginal cost of capital for this project?

a

Answer

The asset beta of 1.35 allows for business risk only and assumes that the project will be all-equity financed. The asset beta can be converted into a 'geared beta' for the equity capital as follows:

$$1.35 = \beta_{EG} \times \frac{2}{2 + 1(1 - 0.30)}$$

$$\beta_{EG} = (1.35 \times 2.70) / 2 = 1.8225.$$

The beta factor for the equity finance can be used to obtain a cost of capital for the equity, using the CAPM.

$$r = 3\% + 1.8225(8 - 3)\% = 12.1125\%, \text{ say } 12\%.$$

Since the debt capital is risk-free, its pre-tax cost is 3%. The cost of capital for the project, financed two-thirds by equity and one-third by debt, is:

$$[2/3 \times 12\%] + [1/3 \times 3\% \times (1 - 0.30)] = 8.7\%.$$

e

Example

A company is considering whether to invest in a new capital project where the business risk will be significantly different from its normal business operations. The company is financed 80% by equity capital and 20% by debt capital.

It has identified three companies in the same industry as the proposed capital investment and has obtained the following information about them:

- (1) Company 1 has an equity beta of 1.05 and is financed 30% by debt capital and 70% by equity.
- (2) Company 2 has an equity beta of 1.24 and is financed 50% by debt capital and 50% by equity.
- (3) Company 3 has an equity beta of 1.15 and is financed 40% by debt capital and 60% by equity.

The risk-free rate of return is 5% and the market rate of return is 8%. Tax on company profits is at the rate of 30%. Assume that the debt capital in each company is risk-free.

Required:

Calculate a project-specific discount rate for the project, assuming that this is:

- the project-specific cost of equity for the project, or
- the weighted average of the project-specific equity cost and the company's cost of debt capital.

a**Answer**

Asset betas can be calculated for each proxy company as follows:

Company 1

$$\beta_A = 1.05 \times \frac{70}{[70 + 30(1 - 0.30)]} = 1.05 \times \frac{70}{91} = 0.81$$

Company 2

$$\beta_A = 1.24 \times \frac{50}{[50 + 50(1 - 0.30)]} = 1.24 \times \frac{50}{85} = 0.73$$

Company 3

$$\beta_A = 1.15 \times \frac{60}{[60 + 40(1 - 0.30)]} = 1.15 \times \frac{60}{88} = 0.78$$

The average of these asset betas is $(0.81 + 0.73 + 0.78)/3 = 0.77$.

The asset beta for the capital project is 0.77. This should now be re-gearred to obtain an equity beta for the project.

$$0.77 = \beta_{EG} \times \frac{80}{[80 + 20(1 - 0.30)]}$$

$$\beta_{EG} = 0.77 [80 + 20(1 - 0.30)]/80$$

$$\beta_{EG} = 0.77 \times 94/80 = 0.90.$$

The project-specific cost of equity is now calculated using the CAPM:

$$K_E = 5\% + 0.90 (8 - 5)\% = 7.7\%$$

- If the **project-specific discount rate** is taken to be the project-specific cost of equity, the discount rate for the project should be 7.7%.
- If the **project-specific discount rate** is taken to be a weighted average cost of capital, this is calculated as follows:

Source of finance	Market value	After-tax cost	
			r MV × r
Equity	80%	0.077	0.0616
Debt capital: cost = $(5\% \times (1 - 0.30))$	20%	0.035	0.0070
			0.0686

The project-specific cost of capital would now be 6.86%, say 6.9%.

Summary: using the CAPM to obtain a project-specific discount rate

The WACC is often used as the cost of capital in capital expenditure appraisal because it is assumed that individual projects will not significantly affect the WACC. The WACC is therefore an acceptable measure of the marginal cost of capital.

A different situation arises when a new project will significantly affect the capital gearing or have significantly different business risk. In these cases, an appropriate cost of equity capital can be estimated using the asset beta formula, and assuming a risk-free cost of debt capital. The CAPM can therefore be used to obtain a project-specific discount rate.

Business valuations

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Nature and purpose of business valuations

- Reasons for business valuation
- Valuation models

1 Nature and purpose of business valuations

1.1 Reasons for business valuation

This chapter describes various techniques for calculating a value for the shares of a company, or the value of an entire company (equity plus debt). There are several reasons why a valuation might be required.

Quoted companies. Quoted companies already have a share price valuation: this is the current market price of the shares. The main reason for making a business valuation for a quoted company is when there is a takeover bid. In a takeover bid, the bidder always offers more for the shares in the target company than their current market price. A valuation might be made by the bidder in order to establish a fair price or a maximum price that he will bid for the shares in the target company. The valuation placed on a target company by the bidder can vary substantially, depending on the plans that the bidder has for the target company after the takeover has been completed.

Unquoted companies. For unquoted companies, a business valuation may be carried out for any of the following reasons:

- The company might be converted into a public limited company with the intention of launching it on to the stock market. When a company comes to the stock market for the first time, an issue price for the shares has to be decided.
- When shares in an unquoted company are sold privately, the buyer and seller have to agree a price. The buyer has to decide the minimum price he is willing to accept and the seller has to decide the maximum price he is willing to pay.
- When there is a merger involving unquoted companies, a valuation is needed as a basis for deciding on the terms of the merger.
- When a shareholder in an unquoted company dies, a valuation is needed for the purpose of establishing the tax liability on his estate.

1.2 Valuation models

There are two broad approaches to valuing companies.

- Income-based valuation models which focus on the future earnings or cash flows of the company.
- Asset-based valuation models which focus on the value of the company's assets.

There are many different techniques within these two broad approaches and they lead to different valuations of the business.

All the valuation methods described in this chapter have a **rational basis**. This means that there is logic to the valuation, and the valuation is obtained through objective analysis and assessment.

Income based valuation models

- P/E ratio method
- Earnings yield method

2 Income based valuation methods

2.1 P/E ratio method

A price/earnings ratio or P/E ratio is the ratio of the market value of a share to the annual earnings per share. For every company whose shares are traded on a stock market, there is a P/E ratio. For private companies (companies whose shares are not traded on a stock market) a suitable P/E ratio can be selected and used to derive a valuation for the shares.

A simple method of estimating a value for a company in the absence of a stock market value is:

Value = EPS × Estimated P/E ratio.

- The EPS might be the EPS in the previous year, an average EPS for a number of recent years or a forecast of EPS in a future year
- The P/E ratio is selected as a ratio that seems appropriate or suitable. The selected ratio might be based on the average P/E ratio of a number of similar companies whose shares are traded on a stock market, for which a current P/E ratio is therefore available.



Example

The EPS of a private company, ABC Company, was \$1.50 last year and is expected to rise to \$1.80 next year. Similar companies whose shares are quoted on the stock market have P/E ratios ranging from 10.0 to 15.6. The average P/E ratio of these companies is 12.5.

A valuation of the company might be to take the prospective EPS and apply the average P/E ratio for similar companies:

Valuation = $\$1.80 \times 12.5 = \22.50 per share.

An alternative evaluation might be to take the actual EPS last year and apply the lowest P/E ratio of any other similar stock market company, reduced by, say, 10% to allow for the fact that ABC Company is a private company and does not have a stock market quotation.

Valuation = $\$1.80 \times (90\% \times 10) = \16.20 .

Here, a P/E ratio of 9 (= 90% × 10) has been used in the valuation.

Another valuation might be to use the EPS for last year and a P/E ratio of 9. This would give a share value of $\$1.50 \times 9 = \13.50 .

From this example, it might be apparent that the P/E ratio valuation method has a number of weaknesses:

- It is based on subjective opinions about what EPS figure and what P/E ratio figure to use.
- It is not an objective or scientific valuation method.
- It is based on accounting measures (EPS) and not cash flows. However, the value of an investment such as an investment in shares ought to be derived from the cash that the investment is expected to provide to the investor (shareholder).

However, the P/E ratio valuation method is commonly used as one approach to valuation for:

- the valuation of a private company seeking a stock market listing for the first time
- the valuation of a company for the purpose of making a takeover bid.

The main advantage of a P/E ratio valuation is its simplicity. By taking the annual earnings of the company (profits after tax) and multiplying this by a P/E ratio that seems 'appropriate', an estimated valuation for the company's shares is obtained. This provides a useful benchmark valuation for negotiations in a takeover, or for discussing the flotation price for shares with the company's investment bank advisers.

2.2 Earnings yield method

With the earnings yield method of valuation, a company's shares are valued using its annual earnings and a suitable earnings yield.

$$\text{Earnings yield \%} = \frac{\text{Annual earnings}}{\text{Market value of shares}}$$

Using the earnings yield method of valuation, this formula is adapted as follows:

$$\text{Market value of shares} = \frac{\text{Annual earnings}}{\text{Earnings yield \%}}$$

A suitable earnings yield for a private company might be similar to the earnings yield on shares in similar quoted companies.

It might be more appropriate to select an earnings yield that is higher than the earnings yield for similar quoted companies, to allow for the higher risk of investing in private companies.

The earnings yield method of valuation is essentially a variation of the P/E ratio method of valuation and is subject to the same criticisms.



Example

The earnings of Kickstart, a private company, were \$450,000 last year.

Stock market companies in the same industry provide an earnings yield of about 9% to their shareholders.

Using the earnings yield method of valuation, suggest a suitable valuation for the equity shares in Kickstart.



Answer

If an appropriate earnings yield for Kickstart is 9%, the valuation of its equity would be:

$$\$450,000/9\% = \$5,000,000.$$

However since Kickstart is a private company, a higher earnings yield should possibly be used for the valuation. If an appropriate earnings yield for Kickstart is 10%, say, the valuation of its equity would be:

$$\$450,000/10\% = \$4,500,000.$$

The valuation depends on arbitrary assumptions about a suitable earnings yield to apply, as well as assumptions about expected annual earnings.

Dividend valuation models

- Dividend valuation model: constant annual dividends
- Dividend valuation method: constant rate of growth in annual dividends
- Retained earnings: the earnings retention valuation model

3 Dividend valuation models

3.1 Dividend valuation model: constant annual dividends

The dividend valuation model is a more objective and cash-based approach to the valuation of shares. Like the P/E ratio method and earnings yield method, it is an income-based valuation method. However the valuation is based on expected future dividends rather than on total earnings.

The basic assumption with the dividend valuation models is that the value of shares to shareholders is the value of all the future dividends that they expect to receive from those shares in the future.

If the fair value of a share represents the value of all expected future dividends, this value can be estimated by discounting expected future dividends to a present value at the shareholders' cost of capital. All expected **future dividends 'in perpetuity'** are therefore discounted to a present value at the **cost of equity capital**.

Without going into the mathematics to prove the valuation model, it can be shown that if it is assumed that the company will pay a **constant annual dividend** every year into the foreseeable future, the present value of those dividends, and so the value of the shares, is:

$$P_0 = \frac{D}{r_e}$$

where:

P_0 = the current value of the share **ex dividend**. A share price ex dividend is a price that excludes the value of the annual dividend in the current year.

D = the amount of the annual cash dividend.

r_e = the shareholders' cost of capital expressed as a proportion (so 9% = 0.09, etc).

This valuation model assumes that the dividend is paid annually, and that the current year's dividend has just been paid. This is the assumption that is commonly used in examination questions. For an 'exact' valuation using this model, it should be assumed **the next dividend is payable in one year's time**.

If the annual dividend in the current year has not yet been paid, but will soon be paid, the value of the share is its value 'cum dividend'. You might be asked to suggest a cum dividend valuation, where an annual dividend will be paid in the near future. If so, you should estimate the ex dividend price using the dividend

valuation model, and then add the current dividend to arrive at a cum dividend valuation.



Example

A company is expected to pay an annual dividend of \$0.48 per share into the foreseeable future and the shareholders' cost of capital is 12%. The most recent annual dividend has just been paid.

Required:

- Using the dividend valuation model, suggest what the value of the shares should be.
- Show how this valuation would change if the expected annual dividend in future years is \$0.54.
- Show how this valuation would change if the expected annual dividend in future years is \$0.48 but the cost of equity capital is 12.5%



Answer

- Using the dividend valuation model, the value of the share (ex dividend) ought to be $\$0.48/0.12 = \4.00 .
- If expectations about future annual dividends change from \$0.48 per share to \$0.54 per share, the valuation of the share will be \$4.50 ($\$0.54/0.12$). This is a higher valuation than in (a) because the annual dividend is higher.
- If future annual dividends are expected to be \$0.48 per share, but the shareholders' cost of capital changes to 12.5%, the valuation of the share will fall to \$3.84 ($\$0.48/0.125$). This is a lower valuation than in (a) because the cost of equity is higher.

The dividend valuation model therefore provides an explanation of how the value of shares will rise or fall when there are changes in either:

- the expected annual dividend, or
- the shareholders' required rate of return (the equity cost of capital).

3.2 Dividend valuation method: constant rate of growth in annual dividends

An alternative assumption in the dividend valuation model is that the annual dividend will grow in the future. A simplifying assumption is that the dividends will grow at a constant annual percentage rate.

Again, without going into the mathematics to prove the valuation model, it can be shown that if it is assumed that the company will pay an annual dividend that grows by a constant percentage amount every year into the foreseeable future, the present value of those dividends, and so the value of the shares, is:

$$P_0 = \frac{D_0(1+g)}{(r_e - g)}$$

where:

P_0 is the current value of the share ex dividend

D_0 is the current annual dividend (that has recently been paid or will be paid in the very near future)

g is the expected annual growth rate in dividends expressed as a proportion (3% = 0.03 etc)

$D_0(1 + g)$ is therefore the expected annual dividend next year, in Year 1. This is sometimes written as D_1

r_e is the shareholders' cost of capital expressed as a proportion (so 9% = 0.09, etc)

This is the valuation of the share ex dividend. Note that this valuation formula is based on the assumptions that:

- the dividend is paid annually, and
- the dividend for the current year has just been paid.

This formula is provided to you in your examination, in the formula sheet. However it is a formula that you should try to learn.



Example

A company has just paid an annual dividend of \$0.48. Dividends are expected to grow by 4% each year into the foreseeable future. The shareholders' cost of capital is 12%.

Using the dividend valuation model, the expected value of the share (ex dividend) is:

$$P_0 = \frac{0.48(1.04)}{0.12 - 0.04} = \$6.24$$

If there is no expected growth in annual dividends, and the company is expected to pay a constant annual dividend in the future, the share valuation would have been \$4.00 (see the earlier example). Because the annual dividend is expected to increase every year, the valuation is much higher.

Using the dividend growth model, the valuation of shares changes with:

- changes in expected future dividends (for example, changes in the expected annual growth rate in dividends), or
- changes in the shareholders' required rate of return (the equity cost of capital).



Example

In the previous example, if the expected growth rate in annual dividends falls from 4% to 3%, the valuation of the shares will fall to:

$$P_0 = \frac{\$0.48 (1.03)}{(0.12 - 0.03)} = \$5.49$$

This is a lower valuation, because future dividends are expected to be lower.

An examination question might test your understanding of the dividend growth model by asking you to calculate the annual growth rate g , given an annual dividend and the current market price of the shares.



Example

The share price of ABC Company is currently \$4.00. The cost of equity capital is 12%. The annual dividend has just been paid. It is expected that the annual dividend next year will be \$0.20 per share and that annual dividends will then grow at a constant annual rate into the foreseeable future.

Required:

- Calculate the expected annual growth rate in dividends from next year onwards.
- Suppose that the stock market now receives new and unexpected information about the company that makes investors re-assess the future annual dividends. Investors now expect that the annual dividend next year will be 10% lower than previously expected, and that annual growth in dividends in subsequent years will be only 4%. Calculate the price that should now be expected for shares in ABC Company.



Answer

- Let the annual growth rate in dividends be g .

$$4.00 = \frac{0.20}{0.12 - g}$$

$$4.0 (0.12 - g) = 0.20$$

$$0.48 - 4g = 0.20$$

$$4g = 0.28$$

$$g = 0.07 \text{ or } 7\%.$$

- The annual dividend next year is now expected to be \$0.18.

$$P = \frac{0.18}{0.12 - 0.04}$$

$$0.8 P = 0.18$$

$$P = 2.25.$$

The share price should fall to \$2.25.



Example

A company has just paid an annual dividend of \$0.63. This dividend is expected to remain constant for two more years, but from Year 3 it is expected to grow by 3% each year into the foreseeable future. The cost of shareholders' funds is 10%.

What should be the current market value of the company's shares?



Answer

The dividend valuation model and the dividend growth model calculate the present value of all expected future dividends by discounting them at the cost of equity capital. A valuation can be obtained in this example using discount tables.

When dividend growth begins in Year 1, we can obtain a Year 0 valuation using the dividend growth model. In this example, we know that dividend growth is expected to begin in Year 3. We can therefore obtain a Year 2 valuation using the dividend valuation model.

The expected value of the share (ex dividend) **at the end of Year 2** can be calculated using the dividend growth model as follows:

$$P_2 = \frac{0.63 (1.03)}{0.10 - 0.03} = \$9.27$$

The expected current value of the share is:

- this valuation at the end of Year 2 discounted to a Year 0 value,
- plus the present value of the expected dividends at the end of Year 1 and Year 2.

Year		Dividend/future valuation	Discount factor at 10%	Current valuation
		\$		\$
1	Dividend	0.63	0.909	0.57
2	Dividend	0.63	0.826	0.52
2	End of Year 2 value	9.27	0.826	7.66
	Share value			<u>8.75</u>

3.3 Retained earnings: the earnings retention valuation model

Dividend growth can be achieved by retaining some profits (retained earnings) for reinvestment in the business. Reinvested earnings should provide extra profits in the future, so that higher dividends can be paid. When a company retains a proportion of its earnings each year, the expected annual future growth rate in dividends can be estimated using the formula:

$$g = br$$

where:

g = annual growth rate in dividends in perpetuity

b = proportion of earnings retained (for reinvestment in the business)

r = the cost of equity capital, which is also assumed to be the rate of return that the company will make on its investments of retained earnings.

The dividend growth model can therefore be restated as follows. (This is sometimes called the Gordon growth model as well as the earnings retention valuation model.)

$$P_0 = \frac{D_0(1 + br)}{(r_e - br)}$$



Example

A company has just achieved annual earnings per share of \$0.50, of which 40% has been paid in dividends and 60% has been reinvested as retained earnings. The company is expected to retain 60% of its earnings every year and pay out the rest as dividends. The cost of equity capital is 8%.

The current annual dividend is $40\% \times \$0.50 = \0.20 .

The anticipated annual growth in dividends = $br = 60\% \times 8\% = 4.8\%$ or 0.048.

Using the dividend growth model, the expected value per share is:

$$P_0 = \frac{0.20(1.048)}{0.08 - 0.048} = \$6.55$$

Cash flow valuation method

- Discounted cash flow basis
- Discounting estimated free cash flows and shareholder value analysis
- Measuring free cash flow

4 Cash flow valuation method

4.1 Discounted cash flow basis

A discounted cash flow basis might be used when a takeover of a company is under consideration, to value either (1) the company in total (equity and debt capital) or (2) the company's equity shares only.

The basic assumptions in a DCF-based valuation are as follows.

- The acquisition of the target company is a form of capital investment by the company making the acquisition.
- Like any other capital investment, it can be evaluated by DCF, using the NPV method.
- After the target company is acquired, its cash flows will come under the control of the company making the acquisition.
- A maximum valuation for the target company can therefore be obtained by estimating the future cash flows from acquiring the company, and discounting these to a present value at a suitable cost of capital (perhaps the acquiring company's WACC).

Study the following example carefully.



Example

Ruffin Company is considering the acquisition of 100% of Tread, a private company. It is expected that if the takeover bid is successful, it will be necessary to invest \$6 million immediately in capital equipment which will qualify for capital allowances at an annual rate of 25% by the straight-line method. This equipment will have no expected residual value.

It is expected that annual cash profits of the acquired company would be \$1 million in the first year, rising to \$2 million in the second year, \$3 million in the third year and \$4 million in the fourth and subsequent years.

Taxation is 30% and is payable in the same year as the profits to which they relate. The cost of capital for evaluating the acquisition is 14%.

Required

What is the maximum price that Ruffin Company should offer to acquire the whole of Tread?

a**Answer****Workings****Capital allowances on the equipment purchased**

Year	Tax WDV	Allowance claimed	Tax benefit (30%)
	\$	\$	\$
0 (Cost)	600,000		
1	(150,000)	150,000	45,000
2	(150,000)	150,000	45,000
3	(150,000)	150,000	45,000
4	(150,000)	150,000	45,000

Annual cash flows

Year	Capital equipment	Cash profits less tax at 30%	Tax benefit from capital allowances	Net cash flow
	\$	\$	\$	\$
0	(6,000,000)			(6,000,000)
1		700,000	45,000	745,000
2		1,400,000	45,000	1,445,000
3		2,100,000	45,000	2,145,000
4		2,800,000	45,000	2,845,000
5 onwards		2,800,000		2,800,000

The cash flows from Year 5 onwards in perpetuity are \$2,800,000 per year. These can be converted into a Year 4 value by discounting them at the cost of capital 14%.

Year 4 value of \$2,800,000 per year in perpetuity from Year 5 onwards
 $= \$2,800,000 / 0.14 = \$20,000,000$

DCF valuation

The maximum amount at which Tread should be valued is calculated as follows:

Year	Net cash flow/ valuation	Discount factor at 14%	Present value
	\$		\$
0	(6,000,000)	1.000	(6,000,000)
1	745,000	0.877	653,365
2	1,445,000	0.769	1,111,205
3	2,145,000	0.675	1,447,875
4	2,845,000	0.592	1,684,240
5 onwards	20,000,000	0.592	11,840,000
NPV			<u>10,736,685</u>

The maximum that should be offered for the entire capital of Tread is about \$10.737 million, say \$10.5 million.

4.2 Discounting estimated free cash flows and shareholder value analysis

In the previous example, the expected annual cash flows from the acquisition of the target company were given. How are they estimated?

One way of estimating the cash profits or cash flows from a major acquisition is to estimate the **free cash flows** of the target company and discount these to a present value. Free cash flow is the annual cash flow after paying for all essential expenditures.

This method makes the following assumptions:

- **Free cash flow** can be defined in a variety of different, although similar ways. One definition is that free cash flow in each year is the total earnings before interest, tax, depreciation and amortisation, less essential payments of interest, tax and purchases of replacement capital expenditure. Another definition of free cash flow is explained later.
- The annual free cash flows that a company is expected to earn in perpetuity can be discounted to a present value, using the **company's weighted average cost of capital (WACC)** as the discount rate.
- This discounted value of future free cash flows gives a total valuation for the company's equity capital (shares) plus its debt capital.
- The fair value of the company's shares is therefore the present value of these free cash flows minus the current market value of the company's debt. This is known as shareholder value and the approach is sometimes known as **shareholder value analysis (SVA)**.

Note that free cash flow is based on annual operating **cash flows**, **not** annual operating **profit**.

Shareholder value analysis

Shareholder value analysis estimates a value for the equity capital of a company by:

- Calculating the present value of all future annual free cash flows to obtain a valuation for the entire company, and then
- Deducting the value of the company's debt capital.

Value of shares

= PV of expected free cash flows (as defined) minus Market value of debt capital



Example

A company is expected to have an operating cash flow of \$6 million every year before interest and taxation, and taxation payments are expected to be \$1.5 million each year. Capital expenditure is expected to be \$2 million each year. The weighted

average cost of capital of the company is 8% (after tax). The current market value of the company's debt is \$7 million.

Using the SVA method, the fair value of the company's shares is estimated as follows:

- Annual free cash flow = $\$(6 - 1.5 - 2) = \2.5 million
- If this free cash flow is expected every year in perpetuity, the PV of the free cash flows is $\frac{\$2.5 \text{ million}}{0.08} = \31.25 million
- This is a valuation for the company's share capital plus debt capital.
- The estimated fair value of the company's shares is obtained by deducting the market value of the debt capital:
= $\$31.25 \text{ million} - \$7 \text{ million} = \$24.25 \text{ million}$.

4.3 Measuring free cash flow

Free cash flow can be defined as the amount of cash that is available for management to use in any way they want (at their discretion), after all essential payments have been made. Essential payments include payments of taxation on profits, and should also include payments for the purchase of essential replacement non-current assets.

However, there is no standard measurement of free cash flow. If an examination question does not give a definition of free cash flow, you should choose a definition and state your definition in your answer.

The example below uses one definition of free cash flow, but others might be used.



Example

A company measures its free cash flow as follows:

		\$
	EBIT (1 - t)	X
Plus	Depreciation	(X)
Plus or minus	Changes in working capital	X or (X)
Minus	Expenditure on non-current assets	(X)
Equals	Free cash flow	X

where:

EBIT = earnings before interest and tax

t = the tax rate as a percentage.

The financial results for the year just ended are as follows:

	\$
Profit before interest and tax	1,500,000
Interest	600,000
	900,000
Tax (30%)	270,000
	630,000

There was an increase of \$50,000 in working capital during the year and expenditure on fixed assets (non-current assets) was \$250,000. The depreciation charge for the year was \$180,000.

The company's cost of capital is 11%. It expects free cash flow to increase by 6% each year for the foreseeable future.

Required

Estimate a total value for the company.

a

Answer

	\$
EBIT	1,500,000
Tax at 30%	450,000
	1,050,000
Depreciation	180,000
Increase in working capital	(50,000)
Expenditure on non-current assets	(250,000)
	930,000

Using the growth model valuation formula, an estimate of the total value of the company is:

$$\begin{aligned}
 P &= \frac{930,000 (1.06)}{(0.11 - 0.06)} \\
 &= \$19,716,000.
 \end{aligned}$$

Asset based valuation models

- Net asset value ('balance sheet basis', taken from the statement of financial position)
- Net asset value (net realisable value)
- Net asset value (replacement value)

5 Asset based valuation models

Asset based valuation models use the net tangible assets of a business as a valuation. Different figures arise from the different valuation placed on the business assets and liabilities.

5.1 Net asset value ('balance sheet basis', taken from the statement of financial position)

This approach uses the book values for assets and liabilities. These figures are readily-available from the accounts ledgers of the company. However, non-current assets might be stated at historical cost less accumulated depreciation, and this might bear no resemblance to a company's current value.

Some important intangible assets such as internal goodwill and the value of the company's human capital (e.g. the skills of its employees) are ignored because they are not included in the balance sheet. At best this method will provide the minimum value of a target company.

5.2 Net asset value (net realisable value)

This method may be used when the assets of the company are valuable, and their current disposable value might be worth more than the expected future dividends or earnings that the company will provide from using the assets. This valuation may be appropriate if the intention is for the business to be liquidated and the assets sold.

A company can never be worth less than its break-up value.



Example

A company has assets that have been valued at \$20 million. This valuation is based on the current disposal value of the assets. The company has \$4 million of liabilities. It has share capital of 200,000 shares of \$0.25 each.

A valuation of the shares based on the net asset value of the company would be:

$$\frac{\$(20 \text{ million} - 4 \text{ million})}{200,000 \text{ shares}} = \$80 \text{ per share.}$$

5.3 Net asset value (replacement value)

Replacement value measures the value of net assets at their cost of acquisition on the open market. Whilst this is likely to be a more accurate cost than book values it will still undervalue the company as intangible assets will be excluded. In addition it will be very difficult to identify and value individual assets and liabilities.

All asset-based valuation methods can be criticised, because unless there is an intention to sell off all or some of a company's assets, the value of a business comes from the expected returns it will generate, not the reported value of its assets.

The valuation of debt and preference shares

- Valuation of debt securities: the basic principle
- Valuation of irredeemable fixed rate debt
- Valuation of redeemable fixed rate debt
- Valuation of convertible bonds

6 The valuation of debt and preference shares

6.1 Valuation of debt securities: the basic principle

The valuation of debt capital is based on the same basic principle as the valuation of shares using the dividend valuation model or dividend growth model.

The value of debt securities (bonds) is the present value of all future interest payments and the repayment of the debt principal, discounted at the cost of the debt.

Taxation is ignored in the valuation, because the personal tax positions of investors differ. The valuation is obtained by discounting interest payments and the eventual redemption value of the bonds at the pre-tax cost of the bonds.

Since the future investment income from fixed-rate bonds (interest and repayment of the principal) are known amounts, not estimates, the valuation model for bonds is more exact than the dividend valuation model for shares.

For fixed rate bonds, the present value of all future interest payments and the repayment of the debt principal is therefore calculated using DCF to obtain a present value of future cash flows from the bond.

Cost of debt securities and the valuation of debt securities

The earlier chapter on cost of capital explained how the cost of debt capital can be calculated from the future cash flows from the bond and the market value of the bond.

Here we are calculating the market value of a bond from the future cash flows from the bond and the (before-tax) cost of capital.

6.2 Valuation of irredeemable fixed rate debt

The value of irredeemable fixed rate debt is the present value of interest payments in perpetuity. The valuation model for irredeemable debt is similar to the dividend valuation model with constant annual dividends.

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

where:

i = amount of the regular fixed interest payment and

r_d is the interest yield (before tax) required by the bond investor.

By convention, bonds are usually valued at an amount per \$100 or €100 or £100 nominal value of the bonds.



Example

A 7% bond, denominated in euros, pays interest annually. The interest yield required by the bond investors is 8%.

The value of the bonds (ex interest) is therefore $€100 \times (7\%/8\%) = €87.50$ per €100 nominal value of the bonds.



Example

A 10% irredeemable bond, denominated in dollars, pays interest **every six months**. The interest yield required by investors in the bonds is 8% **per annum**. What is the market value of these bonds?



Answer

If the annual cost of debt is 8%, the six-month cost of debt will be about 4%.

$$\text{Valuation} = \frac{\text{Six-monthly interest}}{\text{Six-monthly cost of debt}} = \frac{5 \text{ cents}}{0.04}$$

$$= 125.00$$

6.3 Valuation of redeemable fixed rate debt

The value of redeemable fixed rate debt is the present value of all future interest payments on the bond to maturity, plus the present value of the principal repayment at maturity, discounted at the interest yield on the bond.



Example

A dollar-denominated 6% bond pays interest annually, and has three years remaining to maturity. It will be redeemed at par. The interest yield required by the bond investors is 5% per annum. An annual interest payment has just been made.

The value of the bond is calculated as follows, for each \$100 nominal value of the bonds.

Year		Amount	Discount factor at 5%	Present value
		\$		\$
1	Interest	6	0.952	5.71
2	Interest	6	0.907	5.44
3	Interest and debt principal	106	0.864	91.58
	Bond value			<u>102.73</u>

The bond will have a market value of 102.73 and at this price investors in the bonds will receive an average annual return of 5% if they hold the bonds until maturity.

6.4 Valuation of convertible bonds

The market value of a convertible bond is the higher of:

- the value of the bond as a straight bond that will be redeemed at maturity, and
- the present value of future interest payments up to the time that the bonds can be converted into shares, plus the present value of the expected market value of the shares into which the bonds can be converted.

A convertible should therefore be valued by each of these methods, and its value will be the higher of these two valuations.



Example

A company has issued some 4% dollar-denominated convertible bonds. These are convertible into shares of the company in four years' time at the rate of 25 shares for every \$100 bonds. Interest on the bonds is payable annually, and the current year interest has just been paid.

The current market price of the company's shares is \$4.60, and shareholders expect annual dividends to grow by 5% per year into the foreseeable future. The dividend is paid annually and a dividend for the current year has just been paid.

The convertible bondholders require an annual return of 6% per year on their investment.

What is the current price of the convertible bonds likely to be?



Answer

The current price of the convertible bond will be the higher value of the bond as a straight redeemable bond redeemable in four years' time and the value of a bond that will be converted into shares in four years' time.

The current share price is \$4.60, but if dividends are expected to rise by 5% per year into the foreseeable future, the share price will also be expected to rise at the same rate. The expected share price in four years' time is therefore: $\$4.60 \times (1.05)^4 = \5.59 .

Value of the convertible as a straight bond

Year	Amount	Discount factor at 6%	Present value
	\$		\$
1 - 4 Interest	4	3.465	13.86
4 Redemption value	100	0.792	79.20
Value as straight bond			<u>93.06</u>

Value of the convertible if shares are converted

Year	Amount	Discount factor at 6%	Present value
	\$		\$
1 - 4 Interest	4.00	3.465	13.86
4 Value of shares (25 × \$5.59)	139.75	0.792	110.68
Value			<u>124.54</u>

The convertibles should have a current price of about \$124.54.

(Note: In this example, by comparing the cash flows of the convertible as a straight bond and the convertible if the bonds are converted into shares, it should be obvious which has the higher present value. In this example, it should therefore be unnecessary to calculate the PV of the convertible as a straight bond.)

Efficient market hypothesis (EMH)

- The efficiency of capital markets and fair prices
- The nature of capital market efficiency
- The purpose of the efficient market hypothesis (EMH)
- Weak form efficiency
- Semi-strong form efficiency
- Strong form efficiency
- Implications of strong capital market efficiency
- Factors that may have an impact on the market value of shares

7 Efficient market hypothesis (EMH)

7.1 The efficiency of capital markets and fair prices

Investors in securities such as shares and convertible bonds want to be confident that the price they pay for their securities is a fair price. In order for market prices to be fair, it is important that the stock market should be able to process the relevant available information about companies and that investors should have immediate access to this information and act on it when making decisions about buying and selling shares.

The efficient markets hypothesis provides a rational explanation of how share prices change in organised stock markets. The hypothesis is based on the assumption that share prices change in a logical and consistent way, in response to new information that becomes available to investors. The **speed** with which share prices change depends on how quickly new information reaches investors, and this varies with the **efficiency** of the market.

7.2 The nature of capital market efficiency

There are four types of capital market efficiency:

- **Operational efficiency.** A capital market is efficient operationally when transaction costs for buying and selling shares are low, and do not discourage investors from taking decisions to buy or sell.
- **Informational efficiency.** A capital market is efficient 'informationally' when available information about companies is processed and made available to investors.
- **Pricing efficiency.** A market has pricing efficiency when investors react quickly to new information that is made available in the market, so that current share prices are a fair reflection of all this information. For pricing efficiency to exist, a capital market must also be operationally and informationally efficient.

- **Allocational efficiency.** When there is allocational efficiency in a capital market, available investment funds are allocated to their most productive use. Allocational efficiency arises from pricing efficiency.

Research into stock market efficiency focuses on pricing efficiency.

Efficiency therefore refers to the speed with which information is made available to the market, and the response of market prices to this information. In an efficient market, all investors are reasonably well informed at the same time about new developments that might affect market prices, so that some investors with 'insider knowledge' cannot exploit their knowledge to make profits at the expense of other investors.

If all relevant information is made available to all investors at the same time, all investors are able to make decisions at the same time about buying or selling investment, and about whether current prices are too high or too low.

Although the concept of market efficiency applies to all financial markets, it is probably most easily understood in the context of equity shares and the equity markets.

7.3 The purpose of the efficient market hypothesis (EMH)

The efficient market hypothesis (EMH) is a theory of market efficiency, based on research into share price behaviour in stock markets. The purpose of this research is to establish the extent to which capital markets show pricing efficiency.

According to this theory there are three possible levels or 'forms' of market efficiency:

- weak form efficiency
- semi-strong form efficiency, and
- strong form efficiency.

Each financial market can be categorised as being weak form, semi-strong form or strong form efficient.

In equities markets, the way in which share prices move in response to available information varies according to the efficiency of the market.

7.4 Weak form efficiency

The efficient markets hypothesis states that when a market has weak form efficiency, share prices respond to the publication of historical information, such as the previous year's financial statements.

When the market displays a weak form, it also means that the current share price embodies all the historical information that is known about the company and its shares, including information about share price movements in the past. Until the

next publication of more historical information about the company, there is no other information about the company that will affect the share price in any obvious way.

The weak form suggests that the current price reflects all past prices and that past prices and upward or downward trends in the share price cannot be used to predict whether the price will go up or down in the future. Share prices do rise and fall, with supply and demand in the market, but the next price movement is equally likely to be up as down.

Random walk theory (versus Chartism)

A weak form of stock market efficiency is consistent with the **random walk theory**. This is the theory that share prices move up and down randomly over time, in response to the arrival of favourable or unfavourable information on the market.

Random walk theory is opposed to the view that future share price movements can be predicted from patterns of share price movements in the past, since patterns repeat themselves, and historical trends can be used to predict future trends. Some stock market analysts believe that they can predict future movements in share prices from recognisable patterns of share price movement. These analysts are sometimes called **chartists**, because recognisable patterns of share price movements can be illustrated by graphs or charts of share prices over a period of time. Chartism does not have a rational justification.

7.5 Semi-strong form efficiency

When a market has semi-strong form efficiency, current share prices reflect all publicly-available information about the company and its prospects, in addition to historical information. For example, share prices might respond to a new announcement by a company about its trading prospects for the remainder of the year. Similarly, the share price might also respond to an announcement that the company is seeking to make a new acquisition, or a major new investment.

If a market displays semi-strong form efficiency, share prices should move when new information becomes available to the public, but not before. For example, if a company is planning a major acquisition, the share price should not be affected by unconfirmed rumours in the market. However, the share price will react to the official announcement of a takeover bid by a company.

It also means that individuals who have access to information that has not yet been made public (**'inside information'**) will be able to buy or sell the shares in advance of the information becoming public, and make a large personal profit. This is because the inside information will indicate whether the share price is likely to go up or down, and the individual can buy or sell accordingly.

Using inside information to make a personal profit from trading in shares is called insider dealing, which is illegal in countries with well-established stock markets.

7.6 Strong form efficiency

When a market has strong form efficiency, current share prices reflect **all** relevant information about the company as soon as it comes into existence, even if it has not been made publicly-available. In other words, the share price reflects all inside information as well as publicly-available information. The market is so efficient that all information is immediately transmitted throughout the market instantly, and all investors have access to this same information.

If the stock market has strong form efficiency, it is impossible for individuals to profit from insider trading, because there is no inside knowledge that the market has not already found out about.

In practice, research suggests that most markets have weak form efficiency, but some well-developed markets such as the New York Stock Exchange and London Stock Exchange are semi-strong form efficient.



Example

A company decides to undertake a major capital investment. The investment will be in a five-year project, and over the course of the five years, the company's directors believe that the net profits will add \$125 million to the value of the company's shares.

The company made the decision to invest on 1st October Year 1, and the first year of profits from the investment will be Year 2. It announces the investment and the expected benefits to the stock market on 1st December. It is assumed that the stock market investors believe the company's estimate that the project will add \$125 million to share values.

- If the stock market has strong form efficiency, the company's share price should go up on 1st October, as soon as the decision to invest is made. The total increase in share value should be \$125 million.
- If the stock market has semi-strong form efficiency, the share price should go up on 1st December, when the investment and its expected benefits are announced to the market and so become public information. (Between 1st October and 1st December, the information is 'inside information').
- If the stock market displays weak form efficiency, the share price will not be affected by the announcement on 1st December Year 1. The share price will eventually respond, after each of the next five years, when the actual historical profits of the company, including the profits from the new investment, are announced.

7.7 Implications of strong capital market efficiency

There are several theoretical implications of market efficiency. If a capital market has strong efficiency:

- Share prices will be fair at all times and reflect all information about a company. This means that there is no 'good time' or 'bad time' to try issuing new shares or bonds.
- Companies will gain no benefit from trying to manipulate their financial results and present their performance and financial position in a favourable light. In a market with strong-form efficiency, investors will see through the pretence and will understand the true financial position of the company.
- For investors there will never be any 'bargains' in the stock market, where share prices are under-valued. Similarly there will be no over-priced shares that clever investors will sell before a share price fall.
- If the capital market has strong form efficiency, if a company invests in any new capital project with a positive net present value, the share price should respond by going up to reflect the increase in the value of the company represented by the project NPV.

7.8 Factors that may have an impact on the market value of shares

In practice, research suggests that most markets have either weak form or semi-strong form efficiency. Factors which may impact on the efficiency of the market include:

- The marketability and liquidity of shares. The greater the volume of shares traded the more opportunity there is to reflect new information in the share price.
- Availability of information. Not all information can be available to all investors at the same time. Shares which are traded more by professional dealers are more likely to reflect full information as they can afford to pay for better monitoring systems and may have better access to early information.
- Pricing anomalies. Share prices may be affected by investor behaviour at the end of the tax year.

Behavioural finance

- Definitions and explanations of behavioural finance
- Concepts in behavioural finance

8 Behavioural finance

The efficient markets hypothesis and the methods of share valuation described earlier are based on an assumption that every investor is a 'rational economic man'. There is a logical and rational explanation for the valuation of financial assets, and these valuations should be their actual market value in an efficient market.

The assumption of rational behaviour and logical economic valuation has been challenged on the grounds that this is not what happens in the real world. Actual share prices and share price movements cannot be explained entirely or consistently by rational behaviour of investors.

It can be argued that other factors affect share prices and share price movements. In particular, market prices are affected by human psychology and the oddities of human behaviour.

For example, stock market 'bubbles' (often followed by a stock market 'crash') have shown beyond doubt that investors do not act in a rational way all the time, and behavioural factors are clearly important.

8.1 Definitions and explanations of behavioural finance

Behavioural finance is closely linked to behavioural economics. It is the study of how psychology affects the behaviour of human investors (as distinct from computer investment models) and the effect that human behaviour has on financial markets and asset values.

Behavioural finance can explain both **why and how** markets might not be efficient (and why share prices might differ from what they perhaps ought logically to be). However, it cannot be used to predict share price movements.

Some definitions and explanations of behavioural finance are set out below.

- 'Behavioural finance is the study of the influence of psychology on the behaviour of financial practitioners and the subsequent effect on markets' (Sewell, 2005).
- 'Behavioural finance is the study of how psychology affects financial decision making and financial markets' (Shefrin, 2001).
- 'Behavioural economics combines the twin disciplines of psychology and economics to explain why and how people make seemingly irrational or illogical decisions when they spend, invest, save and borrow money' (Belsky and Gilovich, 1999).

- 'For most economists it is an article of faith that financial markets reach rational aggregate outcomes, despite the irrational behaviour of some participants, since sophisticated players stand ready to capitalise on mistakes of the naïve.... Yet financial markets have been subject to speculative fads, from Dutch tulip mania to junk bonds and to occasional dramatic losses in value such as occurred in October 1987, that are hard to interpret as rational.... Psychology can help to explain such aberrant macrophenomena' (Patel, Zeckhauser and Hendricks, 1991).

Supporters of the arguments of behavioural finance accept that many investors in the financial markets do act in a rational way, and seek to maximise returns. If investors identify shares or bonds in the market that are clearly over-valued or under-valued, they will sell or buy them until the market price changes to the point where the price anomaly no longer exists. This is called **arbitrage**. However it is argued that whereas some investors might make rational investment decisions, the actions of other investors can be more influential on market prices.

- Psychology can explain why many investors do not behave in a totally rational way.
- There are 'limits to arbitrage'. The actions of rational investors cannot offset the illogical effect on asset prices that are caused by less rational investors.

8.2 Concepts in behavioural finance

The recent origins of behavioural economics date back to the 1950s, but the origin of behavioural finance can probably be traced to an article by De Bondt and Thaler in 1985 'Does the Stock Market Over-react?' De Bondt and Thaler demonstrated that investors **over-react** systematically to unexpected and dramatic news.

There are many different behavioural or psychological concepts in behavioural finance. Some of these are explained below.

- **Loss aversion.** There is a noticeable lack of symmetry between decisions to buy and decisions to sell investment assets. Investors are often unwilling to sell shares when they would make a nominal loss on the sale. Loss aversion is also evident in the reluctance of house owners to reduce the selling price of their house, even in a period of weak demand from home buyers.
- **Under-reaction and over-reaction.** Share price movements are often characterised by under-reaction to new events or new information, followed by over-reaction.
- There is sometimes a '**herd instinct**' and investors simply do the same as other investors – and buy or sell shares – without considering the logic of what they are doing.
- **Status quo bias.** When there is uncertainty in the stock market about which shares should be 'winners' and which should be 'losers', there may be a bias towards the status quo, and share prices of both 'winners' and 'losers' might remain stable when they ought logically to move up or down.
- There is also evidence that people often prefer to **invest in what is familiar** to them, rather than using the rational principles of portfolio theory in their investment selection.

Some of these concepts might seem familiar to you, and you might agree that investors are likely to behave in illogical ways.

However, there are limitations to the value of behavioural finance.

- Behavioural finance can explain why investors might act irrationally and why share prices move higher or lower than should be expected on rational economic grounds. However, concepts of behavioural finance cannot be used to predict what share prices will be, or how they will move. It does not therefore provide a reliable basis for making investment decisions.
- It might also be argued that irrational behaviour affects share prices in the short term, but essentially investors are likely to act in a way they consider rational, in order to maximise their investment returns. In spite of the effects of psychology and irrational behaviour on share prices, the logical methods of share price valuation are probably the most reliable methods of valuation we can use.

Foreign exchange risk

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The nature of foreign exchange risk

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1 The nature of foreign exchange risk

1.1 The need for foreign exchange

Many companies make foreign exchange transactions with their banks. The need for foreign exchange arises from international trade and international investment.

- A company buying goods from another country might be required to pay in a foreign currency, such as the domestic currency of the supplier. It must therefore obtain the foreign currency to make the payment.
- A company selling goods abroad might price the goods in the buyer's domestic currency, or in another currency such as US dollars. When the customer pays in the foreign currency, the company might sell the currency received in exchange for its own domestic currency
- A company investing abroad might need to obtain foreign currency to acquire or to make the investment.

Many foreign currencies can be bought and sold freely in the foreign exchange markets (FX markets), which are operated world-wide by banks.

1.2 Exchange rates and volatility

When currencies can be bought and sold in the FX markets, banks quote exchange rates at which they will deal. Exchange rates are quoted as a number of units of one currency (the variable currency) in exchange for one unit of the other currency (the base currency). For example, the sterling/US dollar exchange rate (GBP/USD) might be 1.9850, meaning that each £1 can be exchanged for US\$1.9850 in the market.

Experience has shown that exchange rates can be very volatile. Volatility means that exchange rates can move up or down by large amounts, within a fairly short period of time.

- A notable example in recent years has been the euro/US dollar exchange rate. Since the euro was created in 1999, when its value was about EUR 1 = \$1.20, the exchange rate has ranged between about EUR 1 = \$0.80 to about EUR 1 = \$1.60.
- The exchange rate between the British pound and the US dollar has also been volatile, ranging in fairly recent times between about US\$1 to £1 to over US\$2 to £1.

Exchange rate volatility creates foreign exchange risk (also called currency risk and FX risk) for anyone involved in buying, selling, borrowing or investing foreign currency.

1.3 Types of foreign currency risk

Foreign currency risk can be classified into three types:

- Translation risk
- Transaction risk
- Economic risk

Translation risk

Translation risk arises in international companies with foreign subsidiaries. Income statements and statements of financial position (balance sheets) will be denominated in the local currency of the subsidiary and, on consolidation, will be translated into the currency of the holding company. On translation of financial statements from one currency to another, losses or gains arise due to exchange rate movements.

Translation risk is therefore the risk of losses (or gains) arising on the translation of the financial statements of a foreign subsidiary into the currency of the parent company, for the purpose of preparing consolidated accounts.

Transaction risk

Transaction risk is the foreign exchange risk that arises in transactions between two parties:

- where the normal transaction currency of each party is different, and
- when the transaction involves a **future receipt/payment** between the two parties.

Transaction risk is the risk that, for any future transaction in a foreign currency, the amount received or paid in domestic currency might be different from the amount originally expected because of movements in the exchange rate between the date of the initial transaction and the date of settlement (payment/receipt).

For example, transaction risk will arise when a UK company buys goods from a Chinese supplier when the price is in US dollars, and payment is required three months after the date of the purchase.

- For the UK buyer, there is a risk that the US dollar will increase in value against the British pound in the three months before settlement is required. If the dollar strengthens in value, the cost in pounds of obtaining the dollars to pay the supplier will be higher than originally expected.

- For the Chinese supplier, there is a risk that the US dollar will fall in value against the Chinese renminbi in the three months before settlement. If the dollar falls in value, the dollar receipts will learn less in renminbi than originally expected when the sale was made.

Volatile exchange rates increase transaction risk. Transaction risk can disrupt international trade, and make businesses more reluctant to trade internationally, because losses arising from adverse movements in an exchange rate reduce the profit on sales transactions, or increase costs of purchases. The transaction loss might even offset the amount of normal trading profit.



Example

A German company sells goods to a US buyer for US\$280,000 when the exchange rate is €1 = \$1.4000. The US buyer is allowed three months' credit, and when the German company eventually receives the US dollars three months later, and exchanges them for euros, the exchange rate has moved to €1 = \$1.6000.

The original expectation would have been that the sale proceeds in euros would be €200,000 ($\$280,000/1.4000$). However, during the time that it was exposed to the currency risk, the exchange rate has moved in an adverse direction, and the actual receipts are only €175,000 ($\$280,000/1.6000$). The 'FX loss' has been €25,000.

This example illustrates several points about transaction risk.

- Currency risk arises from exposure to the consequences of a rise or fall in an exchange rate. Here, the German company was exposed to the risk of a fall in the value of the US dollar.
- Transaction risk arises only when the settlement of the transaction (and receipt/payment) will occur at a **future** date.
- An exposure lasts for a period of time. Here, the exposure lasts from when the goods were sold on credit until the time that the customer eventually pays.
- Currency risk is a two-way risk, and exposure to risk can lead to either losses or gain from movements in an exchange rate. In this example, the exchange rate could have moved the other way. For example, if the exchange rate after three months had been €1 = \$1.25, the German company would have received €224,000, which is €24,000 more than it would have expected at the time of the sale. There would have been an 'FX gain' of €24,000.
- Trading profits for companies engaged in foreign trade can be significantly affected by currency movements. When exchange rates are volatile and unpredictable, the gain or loss on currency exchange could possibly be even bigger than the expected gross profit from the transaction.

Economic risk

Economic risk refers to the long-term movement in exchange rates caused by changes in the competitiveness of a country.

For example, over the long term the euro might increase in value against the US dollar. If this happens, goods produced and paid for in US dollars will become cheaper relative to goods produced and paid for in euros. US companies will therefore become more competitive in terms of price, relative to companies in the eurozone, because of the exchange rate movement.

Economic risk, in the context of foreign exchange, is therefore the risk that a company might choose to locate its operations in a country whose currency gains in value over time against the currencies of its competitors in world markets. The consequence of an increase in the value of the domestic currency is a loss of competitiveness.

Summary: currency risks

Translation risk does not affect the cash flows of a group of companies. It is a risk of non-cash ('paper') losses or gains in preparing consolidated financial statements.

Transaction risk does affect cash flows, because movements in exchange rates affect the amount of cash received in domestic currency, or the amount paid in domestic currency, for at least one of the two parties to the transaction.

Economic risk is a strategic risk, affecting the competitiveness of a business entity over the longer term

1.4 Government measures to stabilise exchange rates

A government might try to stabilise the exchange rate for its currency. In the past, some governments were able to manage the exchange rate by dealing on the foreign exchange markets, using their official reserves of foreign exchange to either buy or sell domestic currency. By creating demand or supply for its currency in the markets, the government would try to move the exchange rate up or down against major currencies such as the dollar. However, the foreign exchange markets are now so large, due to the enormous scale of international trade and investment, that very few countries are in a position to manage the exchange rate effectively in this way. (Countries such as China might be an exception.)

The most effective way for a government to manage its exchange rate today, if it wished to do so, would be to increase or reduce domestic interest rates on its currency. Raising or reducing interest rates should affect the demand for the currency from investors. For example, raising the interest rate should attract more investment into the currency, and by increasing demand for the currency, the foreign exchange value of the currency should increase.

1.5 Causes of exchange rate fluctuations

There are several approaches to explaining the causes of exchange rate fluctuations

- supply and demand
- purchasing power parity theory
- interest rate parity theory.

Supply and demand

Exchange rates are determined by supply and demand in the foreign exchange markets.

For example, the value of the British pound against other currencies is determined by supply and demand for the pound.

- The demand for pounds comes from buyers of British exports, who are required to pay in pounds. Pounds are also bought by British exporters who receive payments in foreign currencies and want to exchange their currency receipts into pounds.
- Demand for pounds is also created by flows of investment capital and savings. Foreign investors wishing to purchase investments in the UK must buy pounds to pay for their investments. UK investors selling their foreign investments might exchange their sale receipts (in a foreign currency) into pounds.

The supply of pounds comes from individuals and organisations who want to sell pounds in exchange for a foreign currency.

- UK buyers of foreign goods who must pay in a foreign currency will sell pounds and buy the currency they need to make the payment.
- Foreign investors who sell their UK investments and receive payment in sterling will want to sell the pounds in exchange for another currency. UK investors buying investments abroad must buy currency (and sell pounds) to pay for the investments.

A balance of trade deficit might affect the exchange rate. This is the difference between the value of a country's exports of goods and services and the cost of its imports. As a general rule if a country has a large balance of trade deficit, its currency is likely to depreciate in value because supply of its currency from international trading operations (e.g. from importers who need to pay in foreign currency) exceeds the demand (e.g. from foreign buyers of exported goods).

Supply and demand for currencies explain the continual fluctuations in currency values.

However, there are other theories that explain the underlying reasons for exchange rate movements, especially over the longer term, and an advantage of these other theories – purchasing power parity theory and interest rate parity theory – is that they can be used to make estimates of what exchange rates will be in the future.

1.6 Introduction to purchasing power parity theory

Purchasing power parity theory (PPP theory) attempts to explain changes in an exchange rate by the relative rate of price inflation in each country. The theory is based on the assumption that the exchange rate will adjust to enable the same amount of goods to be purchased in any country with a given amount of money.

For example suppose that at the beginning of a year, a basket of goods would cost £100 in the UK and the same basket of goods would cost \$200 in the USA. During the year, price inflation is 5% in the UK and 2% in the USA.

At the end of the year the basket of goods would cost £105 in the UK and \$204 in the USA, but the same amount of goods could be purchased with equivalent amounts of each currency. This means that the exchange rate must be $£105 = \$204$, or $£1 = \$1.9429$.

PPP theory therefore predicts that if inflation is higher in one country than in another, its exchange rate value will fall so as to restore purchasing power parity.

In reality, an exchange rate does not change in the way predicted by PPP theory because other factors apart from price inflation affect the rate, especially in the short term. It might be argued, however, that PPP theory provides a useful guide to the likely direction and extent of exchange rate movements over a longer period of time.

1.7 International Fisher effect: the Fisher formula

The economist Irving Fisher gave his name to the so-called Fisher effect and international Fisher effect.

The Fisher effect is simply that the real rate of return on an investment is the nominal rate of return adjusted for the rate of inflation:

$$(1 + nr) = (1 + rr)(1 + i)$$

Where

nr = nominal rate of interest

rr = real rate of interest

i = rate of inflation

So if the nominal rate of inflation is 4% per year and the rate of inflation is 2.5%, the real rate of return is:

$$(1.04/1.025) - 1 = 0.0146 = 1.46\%$$

Fisher argued that investors in all countries expect the same real rate of return, after allowing for inflation, and the difference in interest rates between two countries could be explained by differences in the rates of inflation in those countries. This is the so-called international Fisher effect.

From this argument, it is possible to derive interest rate parity theory.

1.8 Introduction to interest rate parity theory

Interest rate parity theory is based on the assumption that exchange rates will adjust to eliminate differences in interest rates between countries. For example, suppose that the current exchange rate between the British pound and the US dollar is $£1 = \$2$, and interest rates are 3% in the USA and 5% in the UK. An investor with £100 in the UK could invest the money for one year to obtain principal plus interest of £105

after one year. An investor with \$200 in the US could also invest money for one year to receive interest and principal of \$206 at the end of that time.

According to interest rate parity theory, the exchange rate after one year will be £105 = \$206, or £1 = 1.9619.

The theory predicts that the currency of a country with a higher interest rate will depreciate in value over time against the currency of a country with a lower interest rate.

Like PPP theory, interest rate parity theory cannot explain all exchange rate movements, especially in the short term, but it might provide a useful guide to changes in the exchange rate over a longer period.

Purchasing power parity theory and interest rate parity theory are important for your examination, and can be used to forecast future exchange rates. Forecasting exchange rates is explained in more detail in a later section.

The FX markets: spot rates

- Bid and offer rates
- Spot rates
- Quoting exchange rates

2 The FX markets: spot rates

2.1 Bid and offer prices

In an examination, you might be given one figure for the current exchange rate between two currencies. In practice, banks quote two rates: a bid rate and an offer rate.

- The bid rate is the rate at which the bank will buy the base currency.
- The offer rate is the rate at which the bank will sell the base currency.

In the foreign exchange markets, most exchange rates are quoted to four decimal places.

It is easy to get confused about which exchange rate should be applied to a particular transaction. **The basic rule to remember is that the bank will use the rate that is more favourable to itself and less favourable to the customer.**



Example

A UK company needs \$20,000 to pay a US supplier. The bank's current rates for sterling/US dollar (US\$/£1) are 1.8850 – 1.8860.

The company needs to buy US dollars in exchange for British pounds, in order to pay the US supplier. The bank is selling dollars and receiving British pounds in exchange. It will apply a rate of 1.8850 to the currency transaction with the company, because 1.8850 will give it more British pounds than the rate of 1.8855. The cost of buying the dollars is therefore £10,610.08 (= \$20,000/1.8850).



Example

The same UK company receives US\$25,000 from a customer, and it wants to convert these dollar receipts into British pounds. The exchange rate is 1.8850 – 1.8860.

The bank will buy dollars and sell the pounds at 1.8860, and so the company will receive £13,255.57 (= \$25,000/1.8860) in exchange for the dollars.

Taking this transaction and the previous example together, the UK company's cash flows in British pounds from the two transactions would be as follows:

	£
Buy \$20,000 at 1.8850: pay	(10,610.08)
Sell \$25,000 at 1.8860: receive	13,255.57
Net receipts	2,645.49

It would be more sensible for the company to pay \$20,000 to the US supplier out of the \$25,000 it receives from its customer. That would leave it needing to sell just US\$5,000 at 1.8860. The receipts in British pounds would then be £2,651.11 (= \$5,000/1.8860) which is more than from buying \$20,000 and selling \$25,000 in separate transactions. The difference is small, but for a company engaged extensively in foreign trade, the total amounts involved can become very large over time.



Exercise 1

- (a) A French company has received Aus\$7,000 from a customer in Australia. The current exchange rate for the euro and the Australian dollar (Aus\$/€1) is 1.5230 – 1.5240.
- How much will the company receive in euros for selling the Australian dollars?
- (b) An Australian company needs to buy €12,000 to pay a Spanish supplier. The exchange rate is the same as above. How much will it cost the company to obtain the euros that it needs?

2.2 Spot rates

In the FX markets, banks trade currencies both spot and forward. A spot transaction is a transaction for the sale of one currency in exchange for another, for ‘immediate’ settlement. ‘Immediate’ settlement in practice usually means after two working days, so that if a company makes a spot transaction with a bank on a Monday, the actual exchange of currencies will happen on Wednesday, two working days later. For the purpose of the examination, however, you can treat spot transactions as transactions for immediate settlement.

For examination purposes, the spot exchange rate is the current exchange rate for a transaction ‘now’ to buy one currency in exchange for another.

2.3 Quoting exchange rates

Normal practice in the foreign exchange markets is to quote exchange rates with the base currency first and the variable currency second. This means, for example, that if the sterling/US dollar rate is 1.8800, we mean that the exchange rate is £1 = US\$1.8800. Similarly, if the euro/US dollar rate is 1.5700, we mean €1 = US\$1.5700.

An examination question may use a different way of quoting exchange rates. For example, a question might state that the dollar/sterling rate is 1.8800, when it means £1 = US\$1.8800. Or it might state that the dollar/euro rate is 1.5700 when it means €1 = US\$1.5700.

It may therefore be important to read an examination question carefully, and make sure that you understand the meaning of a quoted exchange rate, and identify the base currency and the variable currency in the rate.

Another way of presenting bid and offer prices

In your examination you might find that bid and offer prices for exchange rates are presented as an amount above or below a central exchange rate.

For example, the exchange rate for British pounds against the US dollar might be shown as:

$$£1 = \text{US } 1.9750 \pm 0.0010$$

This would mean that the exchange rate is 1.9740 – 1.9760.

The bank will deal at the rate that is more favourable to itself.

Forward FX contracts and forward rates

- Forward contracts
- Forward rates
- Quoting forward exchange rates: premiums and discounts
- Cross rates

3 Forward FX contracts and forward rates

3.1 Forward contracts

Banks trade foreign currencies both spot and forward.

- Spot transactions are for immediate settlement.
- A forward FX contract is a contract entered into 'now' for settlement at an agreed future date (or at any time between two agreed future dates).

A bank will arrange a forward contract for settlement at any future date, but commonly-quoted forward rates are for settlement in one month, three months, six months and possibly one year.

For example, an Italian company can arrange a forward contract 'now' to sell a quantity of US dollars in exchange for euros in three months' time, at a rate of exchange that is agreed 'now'.



Example

A UK company has purchased goods from a supplier in the USA and must pay \$150,000 to the supplier in two months time.

The company can wait for two months, and then buy the \$150,000 from a bank at the spot rate, whatever the spot rate happens to be at that time.

Alternatively, the company can arrange a forward contract now with a bank to buy the \$150,000 in two months' time. The exchange rate is fixed by the forward contract and this is the rate at which the company will buy the dollars in two months, regardless of what the spot rate happens to be at that time.

3.2 Forward rates

Banks are able to quote forward exchange rates for currencies because of the money markets (short-term borrowing and lending markets). Forward exchange rates are different from spot rates, and they differ from spot rates because of the interest rate differences between the two currencies.

A forward rate can be higher or lower than the spot rate, depending on whether the interest rate on the variable currency is higher or lower than the interest rate on the base currency.



Example

The current spot rate for the British pound and the US dollar (US\$/£1) is 1.8000. The interest rate on the British pound is 6% per year and the interest rate on the US dollar is 4% per year. The one year forward rate is the forward rate that a bank will quote now for trading dollars in exchange for pounds in one year's time. This forward rate is:

$$\text{One year forward rate} = \text{Spot rate} \times \frac{(1 + \text{interest rate on the variable currency})}{(1 + \text{interest rate on the base currency})}$$

$$\text{In this example, the one year forward rate will be } 1.8000 \times \left[\frac{1.04}{1.06} \right] = 1.7660$$

Forward rates do not predict future spot rates

A one-year forward rate of £1 = \$1.7660 does not mean that the spot rate of exchange will be \$1.7660 in one year's time. Forward rates do not attempt to predict what future spot rates will be. A forward rate represents the comparative investment value of the two currencies between 'now' and the settlement date for the forward contract.

3.3 Quoting forward exchange rates: premiums and discounts

Forward rates are derived from current spot rates and interest rate differences between currencies. Spot rates change continually, whereas interest rate changes are less frequent. It is therefore common practice in the FX markets to quote forward rates as a premium or a discount to the spot rate.

- When the interest rate on the variable currency is lower than the interest rate on the fixed currency, the forward rate will be lower than the spot rate. The variable currency will be worth more forward than spot, and the forward rate is at a **premium** to the spot rate
- When the interest rate on the variable currency is higher than the interest rate on the fixed currency, the forward rate will be higher than the spot rate. The variable currency will be worth less forward than spot, and the forward rate is at a **discount** to the spot rate.

If you are given spot rates and the premium or discount for the forward rate, you should apply the following rule:

- **Subtract a premium** from the spot rate to derive the forward rate
- **Add a discount** to the spot rate to derive the forward rate.

A premium might be indicated by the letters 'pm' and a discount by 'dis'.

These rules are summarised in the following table:

The interest rate on the variable currency is:	Higher	Lower
The forward rate is quoted forward at a:	Discount to the spot rate (dis)	Premium to the spot rate (pm)
Rule for obtaining the forward rate:	Add the discount to the spot rate	Subtract the premium from the spot rate



Example

A UK company expects to receive US\$75,000 in six months from a US customer and it wishes to hedge the exposure to currency risk by arranging a forward contract. The following rates are available (US\$/£1):

GBP/USD

Spot	1.7530	–	1.7540
Six months forward	240	–	231 pm

The dollar is quoted forward at a premium. The premium is shown in ‘points’ of price, so that 240 – 231 means 0.0240 – 0.0231.

The bank will apply the rate that is more favourable to itself. (If you need to work out which rate is more favourable, use the spot rates to do this). The company will be selling US dollars in exchange for pounds, and the higher rate will be used (the offer rate).

Spot rate	1.7540
Forward points (deduct premium)	(0.0231)
Forward rate	<u>1.7309</u>

The company can use a forward contract to fix its future income from the US dollars at £43,330.06 (75,000/1.7309).



Exercise 2

A US company needs to pay a Mexican supplier in three months. It will have to pay the supplier 10 million Mexican pesos. The company wants to arrange a forward contract to hedge its risk exposure. A bank quotes the following rates (pesos/\$1):

USD/MXP

Spot	11.2470	–	11.2485
Three months forward	340	–	360 dis

Using a forward contract, what will it cost the US company in dollars to pay the Mexican supplier in three months’ time?

Another way of presenting bid and offer prices

In your examination, just as spot rates might be shown as an amount above or below a central exchange rate, forward rates might be quoted in the same way.

For example, the three months forward rate for British pounds against the US dollar might be shown as:

$$£1 = \text{US } 1.9830 \pm 0.0015$$

This would mean that the exchange rate is 1.9815 – 1.9845.

The bank will deal at the rate that is more favourable to itself.

3.4 Cross rates

The exchange rate for two currencies might be derived as a cross rate. This means that they are not traded directly on the FX markets, but both currencies are traded through the US dollar. For example, if the exchange rate for the US dollar against the Hong Kong dollar (USD/HKD) is 8.1000 and the rate for the US dollar against the Canadian dollar (USD/CAD) is 1.2475, the cross rate for the Hong Kong dollar against the Canadian dollar (CAD/HKD) is $8.1000/1.2475$, which is C\$1 = HK\$6.4930.



Exercise 3

The three-month forward rate for the US dollar against the Swiss franc is 1.2166 (US\$1 = SwFr1.2166). The three-month forward rate for the US dollar against the British pound is £1 = US\$1.8610.

What is the three-month forward rate for the Swiss franc against the British pound (quoting the pound as the base currency)?

Forecasting future spot exchange rates

- Reasons for forecasting future spot rates
- Forecasting exchange rates with purchasing power parity theory
- Forecasting exchange rates with interest rate parity theory

4 Forecasting future spot exchange rates

4.1 Reasons for forecasting future spot rates

A company might wish to forecast what spot exchange rates in the future. The most usual reasons for needing this information are:

- to assess foreign investments and a foreign investment strategy, or
- to carry out a capital investment appraisal of a proposed foreign investment.

For example a UK company is might plan to invest in another country, say Argentina. The investment will be in the Argentinian currency, pesos, but the UK company will have to invest British pounds to make the investment, because it needs to buy the pesos. The company will then expect to earn profits in pesos over a number of years and convert these back into British pounds. The value of the returns in sterling (British pounds) will depend partly on the size of cash profits in pesos and partly on the exchange rate between sterling and pesos.

The company will therefore want to consider what will happen to the exchange rate over the term of the investment project. If the peso is expected to fall in value against sterling, the value of the future profits to the UK company will be reduced.

Note: the aim is to forecast future spot rates

It is important to understand that the requirement is to forecast future spot rates of exchange, not to calculate a forward rate for a forward exchange contract.

- A forward rate is an exchange rate that can be obtained now in a forward exchange contract, for settlement at a future date (usually within 12 months). It is not an estimate of what the future spot rate will be at settlement date.
- An estimate of a future spot rate is simply a forecast of what the exchange rate might be at a future date, sometimes several years ahead.

Confusion can arise because although a forward rate is not a prediction of what the future spot exchange rate will be, one technique for estimating future spot rates is similar to the method by which forward rates are actually derived.

There are two related methods of estimating future spot exchange rates:

- purchasing power parity theory
- interest rate parity theory.

These theories were mentioned earlier, in the context of factors that cause changes in exchange rates.

Remember, however, that spot exchange rates move up and down continually, and any forecast of what the spot rate will be can only be an **approximate estimate** of what the average exchange rate for a future period will be.

4.2 Forecasting exchange rates with purchasing power parity theory

Purchasing power parity (PPP) theory states that the spot rates between two currencies will change over time in relation to the rate of inflation in the countries from which the currencies originate.

$$\text{Estimated spot rate in Year } n = \text{Current spot rate} \times \frac{(1 + i_{\text{VBLE}})^n}{(1 + i_{\text{BASE}})^n}$$

where:

i_{VBLE} is the forecast annual rate of inflation for the variable currency

i_{BASE} is the forecast annual rate of inflation for the base currency

n is the (end of the) year for which a forecast of the spot rate is being made.



Example

The current exchange rate for the British pound and the US dollar is £1 = \$2. It is expected that the rate of inflation in the UK will be 3% per year for the next few years, and in the US the rate of inflation will be 2% per year.

Purchasing power parity theory would predict that the following movements in the exchange rate:

End of Year	Adjustment factor	Predicted exchange rate
0		2.0000
1	$2.00 \times (1.02/1.03)^1$	1.9806
2	$2.00 \times (1.02/1.03)^2$	1.9614
3	$2.00 \times (1.02/1.03)^3$	1.9423



Example

The current exchange rate for euro/British pound (£/€1) is 0.8150. A UK company wishes to evaluate a proposed capital investment in Germany. The investment will be for five years, and a large proportion of the project cash flows will be in euros.

The company needs to forecast what the euro/British pound spot rate will be each year for the full project period. It has been estimated that inflation in the UK will be 3% each year UK for years 1 to 4 and 5% in year 5. It has also been estimated that inflation in the euro zone will be 1.5% each year for three years, and 2% in each of years 4 and 5.

The spot exchange rates at the end of each year can be estimated using PPP theory, as follows. (The variable currency in this example is the British pound, since €1 = £0.8150).

Year		Forecast rate
0	Actual rate	0.8150
1	$0.8150 \times (1.03)/(1.015)$	0.8270
2	$0.8150 \times (1.03)^2/(1.015)^2$	0.8393
3	$0.8150 \times (1.03)^3/(1.015)^3$	0.8517
4	$0.8150 \times (1.03)^4/[(1.015)^3(1.02)]$	0.8600
5	$0.8150 \times [(1.03)^4(1.05)]/[(1.015)^3(1.02)^2]$	0.8853

The value of the euro is forecast to increase against the British pound, because the rate of inflation in the eurozone is expected to be lower than the rate of inflation in the UK.

4.3 Forecasting exchange rates with interest rate parity theory

Interest rate parity theory states that changes in an exchange rate are caused by differences in interest rates between two currencies. If this is true, it should be possible to predict future spot exchange rates from differences in expected future interest rates between the currencies.

$$\text{Estimated spot rate in Year } n = \text{Current spot rate} \times \frac{(1 + r_{\text{VBLE}})^n}{(1 + r_{\text{BASE}})^n}$$

where:

r_{VBLE} is the forecast annual rate of interest for the variable currency

r_{BASE} is the forecast annual rate of interest for the base currency

n is the (end of the) year for which a forecast of the spot rate is being made.

This formula is similar to the PPP theory formula, except that the forecast annual interest rate is used instead of the annual forecast rate of inflation.



Example

The current exchange rate for the South African rand against the US dollar is 7.4000 rand = \$1. The forecast annual interest rate for the rand is 6% for the next 5 years and the forecast interest rate for the US dollar is 2% in years 1 and 2 and 4% in years 3 – 5.

The US dollar is the base currency because the exchange rate is expressed in rands to \$1.

Applying interest rate parity theory, we can predict the exchange rate at the end of year 5 as follows:

$$\begin{aligned} \$1 &= 7.4000 \times \frac{(1.06)^5}{(1.02)^2 (1.04)^3} \\ &= 8.4618 \text{ rand to } \$1 \end{aligned}$$

**Example**

The current exchange rate for British pound against the euro (€/£1) is 1.2115. The forecast annual interest rate for the British pound is 5% in years 1 and 2 and 6% in years 3 and 4.

The forecast annual interest rate for the euro is 2.5% in year 1 and 3% in each of years 2 – 4.

Required

Use this data to estimate a spot rate (€/£1) at the end of each year for years 1 – 4.

**Answer**

The current exchange rate for British pound against the euro (€/£1) is 1.2115. The exchange rate is quoted in terms of euros to £1, therefore the pound is the base currency. Applying interest rate parity theory to predict future spot exchange rates:

Year		Forecast rate
0	Actual rate	1.2115
1	$1.2115 \times (1.025)/(1.05)$	1.1827
2	$1.2115 \times [(1.025)(1.03)]/(1.05)^2$	1.1601
3	$1.2115 \times [(1.025)(1.03)^2]/[(1.05)^2(1.06)]$	1.1273
4	$1.2115 \times [(1.025)(1.03)^3]/[(1.05)^2(1.06)^2]$	1.0954

Four-way equivalence

The term 'four-way equivalence' refers to four concepts that together provide a consistent explanation of changes in foreign exchange rates, and a method of predicting future 'spot' exchange rates. These four concepts are:

- purchasing power parity theory
- the Fisher effect (which together with PPP theory makes the international Fisher effect)
- interest rate parity theory
- expectations theory.

Expectations theory is the theory that all relevant information is reflected in the market rates of exchange; therefore forward exchange rate between a pair of currencies reflect market expectations about what the spot rate will be in the future.

**Example**

The currency of Country X is the dollar and the currency of Country Y is the franc. The current spot exchange rate is \$1 = 4.00 francs.

The one year nominal rate of interest on the dollar is 6.00%. Inflation over the course of the next year in Country X is expected to be 5%.

The one year nominal rate of interest on the franc is 8.02%. Inflation over the course of the next year in Country X is expected to be 7%.

This information can be used with four-way equivalence to make the following predictions.

- Using purchasing power parity theory, we would predict that the spot rate in one year's time will be:
$$4.00 \times (1.07/1.05) = 4.0762.$$
- The real return on investment in Country X for the next year is $(1.06/1.05) - 1 = 0.95\%$. The real return in investment in Country Y for the same period is $(1.0802/1.07) - 1 = 0.95\%$.
- Using interest rate parity theory, we would predict that the exchange rate in one year's time will be:
$$4.00 \times (1.0802/1.06) = 4.0762.$$
- The current one-year forward exchange rate will be \$1 = 4.0762 francs, and this is the expected spot rate in one year's time.

Hedging exposure to foreign exchange risk

- The purpose of hedging risk
- Methods of hedging exposures to foreign exchange risk
- Invoicing in the domestic currency
- Leading and lagging
- Matching
- Netting
- Forward contracts and hedging exposure to FX risk
- Introduction to money market hedging

5 Hedging exposure to foreign exchange risk

5.1 The purpose of hedging risk

The purpose of hedging an exposure to risk is to eliminate or reduce the possibility that actual events will turn out worse than expected. The purpose of hedging an exposure to currency risk is to remove (or reduce) the possibility that a future transaction involving a foreign currency will have to be made at a less favourable exchange rate than expected.

Exchange rates can move up or down, and spot rates could move favourably as well as adversely. However, many companies prefer to hedge their currency risks by fixing an exchange rate now for a future transaction, even if this means that it will not be able to benefit from any favourable future movement in the exchange rate.

5.2 Methods of hedging exposures to foreign exchange risk

The most important methods of hedging exposures to currency risk, which you will be expected to know for the examination, are:

- invoicing in the domestic currency
- leading and lagging
- matching receipts and expenditure (or matching assets and liabilities)
- netting balances
- forward exchange contracts
- creating a money market hedge

5.3 Invoicing in the domestic currency

One method of eliminating transaction risk is for an exporter to invoice the customer in the domestic currency. This eliminates all of the transaction risk for the exporter. This is a one-sided technique because **one of the parties to the transaction will always have all the exchange rate risk.**



Example

Suppose that an exporter in Singapore is selling goods on credit to a company in the USA, and is willing to give three months' credit. The exporter can avoid any exposure to foreign exchange risk by negotiating the sales price in Singapore dollars. By doing this, the US company has the exposure to currency risk for three months, because it will need to buy Singapore dollars to make the payment. It is therefore exposed to a rise in the value of the Singapore dollar against the US dollar.

If the Singapore exporter believed that the Singapore dollar was likely to fall in value against the US dollar during the three month credit period, it might try to negotiate a sales price instead in US dollars rather than Singapore dollars. If the sales price is agreed in US dollars, the Singapore exporter would have the exposure foreign exchange risk, but would expect to profit from this exposure rather than make a loss (because it would expect the exchange rate to move in its favour over the next three months).

5.4 Leading and lagging

Leading means making a payment early, before the end of the credit period allowed. Lagging means making a payment as late as possible, possibly by taking longer credit than allowed.

Leading or lagging might be used by a company when it believes that the exchange rate between two currencies will change significantly up or down during a credit period.

- The purpose of leading is to pay early in a currency that is expected to increase in value against the payer's own currency during the credit period.
- The purpose of lagging is to delay payment as long as possible in a currency that is expected to fall in value



Example

A company in the UK purchases goods from a supplier in Malaysia. The UK company is required to pay in Malaysian dollars but has three months' credit from the supplier. When the goods are delivered, the exchange rate is £1 = M\$6.00

The UK company might have strong reasons for believing that the British pound will fall in value against the Malaysian dollar over the next three months. If so, delaying payment means that the eventual cost of the payment in pounds will increase.

The UK company might therefore decide to make the payment immediately, so that it is no longer exposed to the risk of a fall in the value of the pound against the M\$.



Example

A company in Japan has bought goods from a US supplier and payment in US dollars is required after two months. The US dollar has recently been falling in value against the Japanese yen and the depreciation of the dollar against the yen is expected to continue for some time.

The Japanese company might therefore try to delay its payment to the US supplier as long as possible, perhaps by taking longer credit than the two months allowed, because if the dollar does fall in value, the eventual cost in yen of paying the US supplier in dollars will be lower.

5.5 Netting and matching

Netting and matching can be applied to cash flows in a foreign currency or to assets and liabilities denominated in a foreign currency.

- Netting means offsetting a payment against a receipt to get a net payment or a net receipt. Netting can reduce a currency exposure to the net amount.
- Alternatively netting means offsetting a liability against an asset in the same currency.
- Matching is similar, except the receipt and payment are the same amount, or the asset and liability are for the same amount. Matching reduces an exposure to currency risk to 0.

Netting or matching cash flows

When a company expects to have future cash receipts in a foreign currency and future cash payments in the same currency at about the same time, it can use the receipts to make some or all of the payments. To the extent that future receipts match future payments, the foreign exchange risk is eliminated. Movements in the spot exchange rate will affect the receipts and payments equally. The loss from the adverse movement affecting the cash receipts or payments will be offset by the gain from the favourable movement affecting the cash payments or receipts.



Example

A UK company expects to receive US\$400,000 in two months' time and to make payments of \$600,000, also in two months. To hedge its currency exposures, the company can match \$400,000 of receipts and payments, leaving a net exposure of just \$200,000 in payments. This net exposure might be hedged with a forward exchange contract.

Matching assets and liabilities

A company might also try to match assets and liabilities in the same currency, to reduce exposures to foreign exchange risk.

For example suppose that a UK company plans to make an investment in a business operation in the USA. The investment would involve buying non-current assets in US dollars. The company might finance the project by obtaining a US dollar loan. The assets of the project and the financial liabilities would therefore be matched in the same currency.

Cash flows from the project in US dollars could then be used to pay interest on the loan and repay the loan principal. The company's only exposure to foreign exchange risk would then be the net cash flow surplus from the project.

Matching assets and liabilities to reduce translation exposure

A company with a foreign subsidiary might raise debt capital in the currency of the subsidiary, so that when consolidated accounts are prepared for the group, the assets of the subsidiary will be matched, at least partially, by the foreign currency borrowings (liabilities). This will reduce exposure to translation risk, i.e. reduce the reported gains or losses on consolidation.

Centralised cash management

In a large multinational company, a centralised treasury department might be given the responsibility for cash management throughout the group, and might operate centralised bank accounts in a number of currencies.

Each subsidiary in the group might be involved in foreign trade, making payments or obtaining receipts in various currencies.

If all payments to a subsidiary are transferred to a central bank account, and if all payments by a subsidiary are made with cash from a central bank account, the group will be able to net its receipts and payments in all its trading currencies, and in doing so reduce its net exposures to currency risk.

5.7 Forward contracts and hedging exposure to FX risk

Forward FX contracts can be used by companies to hedge an exposure to currency risk. Currency risk will arise, for example, when a company expects to receive a quantity of a foreign currency in several months' time, which it will sell in exchange for its own domestic currency. If it plans to sell the foreign currency in a spot transaction, until it receives the currency it is exposed to the risk that the exchange rate will move adversely and the currency will fall in value and be worth less than its current value.

A forward exchange contract can be used to fix the exchange rate now for a future payment or receipt in foreign currency. This removes the exposure to foreign currency risk.

Although spot exchange rates can move favourably as well as adversely, many companies engaged in international trade usually prefer to avoid exposure to currency risk, and they make extensive use of forward exchange contracts.

**Example**

A British company needs to pay a German supplier €80,000 in three months' time. A bank quotes the following forward rates for three months (€/£1): 1.7820 – 1.7830.

If the company arranges a forward contract to buy the euros in exchange for British pounds, the forward rate will be 1.7820. This is the rate that is more favourable to the bank, because it will receive more pounds in exchange for the euros. The cost to the company of obtaining \$80,000 in three months' time is £44,893.38 (= \$80,000/1.7820).

For the company, an advantage of arranging this forward contract to buy the euros is that:

- the company knows exactly how much it will have to pay in British pounds in three months' time, and
- this forward contract eliminates the risk of an adverse movement in the exchange rate and allows the company to make financial plans (such as cash budgets) with greater certainty.

However, having made a forward exchange agreement, the company has a contractual obligation to carry out the terms of the agreement and buy the euros at 1.6820 at the settlement date. If the spot rate at this date is more favourable, say 1.7500, the company cannot choose to ignore the forward contract and buy euros at the spot rate.

Hedging an exposure to currency risk with a forward contract gives protection against adverse exchange rate movements, but prevents the company from taking advantage of any favourable movement in the spot rate.

**Example**

A UK company enters into a service provision agreement with a US customer and under the terms of the agreement it will receive payment of \$2 million from the customer in one year's time. The UK company intends to hedge its exposure to currency risk by arranging a forward exchange contract.

The spot rate for dollars against British pounds is 1.9800 ± 0.0010

The one-year forward rate is quoted as 1.9350 ± 0.0015 .

What will be the receipts in British pounds in one year's time if the currency risk exposure is hedged with a forward contract?

**Answer**

The one-year forward rate is £1 = \$1.9335 – 1.9365.

The company wants to sell dollars and buy sterling. The bank will apply the rate that is more favourable to itself, which is 1.9365.

(At this rate, it will pay fewer pounds to the UK company than at a rate of 1.9335.)

The receipts in one year's time will therefore be \$2 million/1.9365 = £1,032,791.

Limitations of forward exchange contracts

Although forward exchange contracts are used extensively by companies to hedge exposures to currency risks, they have some limitations.

- It is not possible to arrange forward exchange contracts for some currencies, because not all currencies are traded in the forward market. Some currencies that are traded 'spot' cannot be traded forward.
- There is a limit to time horizon for forward contracts. For the major currencies, such as the US dollar, the euro and the British pound, forward contracts with other major currencies can be arranged with a settlement date of up to one year forward. For other exchange rates, forward contracts might only be possible with a settlement date of several months. Forward contracts cannot therefore be used to hedge long-term exposures to currency risk.

5.8 Introduction to money market hedging

A money market hedge is an alternative to hedging with a forward contract, using the international money markets rather than the forward exchange market. Money market hedges are slightly complex, and so are described separately in the next section.

Money market hedging

- Definition
- Constructing a hedge for a future currency receipt
- Constructing a hedge for a future currency payment

6 Money market hedging

6.1 Definition

A money market hedge is another method of creating a hedge against an exposure to currency risk. Instead of hedging with a forward exchange contract, a company can create a hedge by borrowing or lending short-term in the international money markets, to fix an effective exchange rate 'now' for a future currency transaction.

A slightly different arrangement is needed for a money market hedge for an exposure arising from:

- a future receipt in a foreign currency
- a future payment in a foreign currency.

6.2 Constructing a hedge for a future currency receipt

A company might expect to receive an amount of foreign currency at a future date, which it intends to exchange into its domestic currency. It wants to hedge its exposure to currency risk.

- To create a money market hedge, it should borrow an amount of the currency immediately, for repayment at the same time that the future currency income will be received. The future income in the foreign currency will be used to repay the loan with interest. The amount borrowed should therefore, together with the accumulated interest for the borrowing period, equal the amount of the future currency income.
- Having borrowed the quantity of currency, the company should exchange it immediately (spot) for its domestic currency.
- The domestic currency obtained in this way can be used in the company's business. However, for examination purposes, you might be expected to assume that the domestic currency will be invested or deposited for the same period as the currency loan.
- At the end of the loan period, when the company uses its currency income to repay the currency loan, the deposit plus accumulated interest is an equivalent amount in domestic currency. This can be used to calculate an effective forward interest rate for the hedge of the currency exposure.

A numerical example might help to clarify this technique:



Example

A UK company expects to receive a payment of US\$800,000 in three months' time. It wants to hedge this exposure to currency risk using a money market hedge.

Spot three-month interest rates currently available in the money markets are:

	Deposits	Borrowing
US dollar	4.125%	4.250%
British pound	6.500%	6.625%

The spot exchange rate (US/£1) is 1.9770 – 1.9780.

Step 1

The UK company will be receiving US dollars in three months' time. It should therefore borrow US dollars for three months. The borrowing rate will be 4.25% (the higher of the two quoted rates). This is an annual rate, and in answering an examination question, you should calculate the rate for the interest period as an appropriate fraction of the annual rate. Here, the interest for three months will be $4.25\% \times 3/12 = 1.0625\%$ or 0.010625.

The borrowed dollars plus accumulated interest after three months needs to be \$800,000, therefore the amount of dollars borrowed should be:

$$\frac{\text{Final amount}}{(1 + \text{interest rate for the period})} = \frac{\$800,000}{1.010625} = \$791,589$$

Step 2

The company should sell the borrowed \$791,589 in exchange for British pounds. The appropriate spot rate is 1.9780. The company will receive £400,197.

We now assume that this will be placed on deposit for three months. The interest rate on deposits for sterling is 6.500%. This is an annual rate, and the interest for three months is assumed to be $6.5\% \times 3/12 = 1.625\%$ or 0.01625.

After three months, the deposit plus accumulated interest will be $£400,197 \times 1.01625 = £406,700$.

Step 3

At the end of three months, the company will receive US\$800,000. Its three-month loan will mature, and the \$800,000 is used to pay back the loan plus interest. The company has £406,700 from its deposit (its short-term investment in British pounds).

The money market hedge has therefore fixed an effective exchange rate for the dollar receipts, which is calculated as $\$800,000/£406,700$. This gives an effective three-month forward rate of $£1 = \$1.9671$.

6.3 Constructing a hedge for a future currency payment

To create a money market hedge for a future currency payment, a similar approach is required.

- A company with an obligation to make a payment in foreign currency at a future date should buy a quantity of the currency now and place it on deposit until the payment is due to be made. The amount of currency placed on deposit, plus the accumulated interest, should equal the amount of the future payment.
- Buying the currency now spot will cost money. For the examination, it should usually be assumed that the company has to borrow in domestic currency to buy the foreign currency spot, and that the length of the loan period is the same as the deposit period for the foreign currency.
- At the end of the deposit period, the foreign currency deposit plus interest is used to make the currency payment. The domestic currency loan has accumulated interest, and the total amount now payable to settle the loan can be used to calculate the effective interest rate for the currency transaction.

Again, an example might help to clarify the method.



Example

Suppose that a UK company is expecting to pay a supplier US\$500,000 in six months' time, and it wants to fix an effective exchange rate for this transaction with a money market hedge.

Spot six-month interest rates currently available in the money markets are as follows:

	Deposits	Borrowing
US dollar	4.125%	4.250%
British pound	6.500%	6.625%

The spot exchange rate (US\$/£1) is 1.9770 – 1.9780.

Step 1

The company should deposit US dollars for six months. The deposit rate will be 4.125% (the lower of the two quoted rates). This is an annual rate, and in an examination the rate for the interest period is calculated as an appropriate fraction of the annual rate. Here, the interest for six months will be $4.125\% \times 6/12 = 2.0625\%$ or 0.020625.

The dollars placed on deposit plus accumulated interest after six months needs to be \$500,000, therefore the amount of dollars placed on deposit for six months should be:

$$\frac{\text{Final amount}}{(1 + \text{interest rate for the period})} = \frac{\$500,000}{1.020625} = \$489,896$$

Step 2

These dollars should be bought with British pounds. The appropriate spot rate is 1.9770. The company will therefore pay £247,798 to obtain the dollars.

We now assume that this money has to be borrowed for a six-month loan period. The interest rate on deposits for sterling is 6.625%. This is an annual rate, and the interest for six months will be $6.625\% \times 6/12 = 3.3125\%$ or 0.033125.

After three months, the loan plus accumulated interest will be $£247,798 \times 1.033125 = £256,006$.

Step 3

At the end of six months, the US deposit plus interest is used to make the payment of \$500,000. The sterling loan is repayable with interest, and the amount payable can be used to calculate an effective exchange rate for the money market hedge.

The effective exchange rate is therefore $£1 = \$1.9531 (= \$500,000/£256,006)$

Conclusion: forward exchange contracts and money market hedges

In practice, a money market hedge should result in an effective exchange rate similar to the forward exchange rate. In the examination, however, one method of hedging might well result in a more favourable exchange rate than the other.

An examination question might give you a set of exchange rates and interest rates for two currencies, and details of a transaction that creates a currency risk exposure. The question might then ask you to compare a forward exchange contract with a money market hedge, and recommend which method of hedging is better.

Foreign currency derivatives

- The nature of derivatives contracts
- Futures contracts
- Closing out a futures position
- Other features of currency futures
- Options
- Features of currency options
- Hedging risks with currency options
- Advantages and disadvantages of hedging with options
- Currency swaps
- Conclusion: using currency derivatives

7 Foreign currency derivatives

7.1 The nature of derivative contracts

The concept of derivative contracts can be difficult to understand. A derivative contract is a contract for the purchase or sale of an item that is derived from something else.

For example, there might be a derivative contract for a commodity item such as copper. A contract for the actual purchase of a quantity of copper involves the delivery of the agreed quantity of copper by the supplier and payment by the buyer. A derivative contract in copper involves an agreement for the future sale/purchase of a quantity of 'notional' copper at an agreed price, with no intention to make an actual delivery of any copper to the buyer. The purpose of the derivative contract is to make an agreement now on the future price of the copper, and when the contract is settled the payment (from buyer to seller or seller to buyer) depends on the difference between the agreed price in the contract and the market price of copper when the contract is settled.

Derivatives contracts are therefore contracts that deal in the price of an underlying item, rather than a contract for the actual purchase and sale of the item.

Financial derivatives are derivative contracts in the price of financial items, including:

- foreign exchange rates (the price of currency), and
- interest rates (the price of borrowing or lending).

Types of derivative contract

The main types of financial derivative contract are:

- financial futures
- options
- swaps

This section describes currency derivatives.

7.2 Futures contracts

A future is a forward contract for the purchase or sale of a standard quantity of an item, for settlement or delivery at a specified future date. Futures contracts have some special features.

- They are **traded on an exchange**, known as a futures exchange. In contrast, actual forward contracts are negotiated 'over-the-counter'. For example, a company wishing to hedge a currency risk with a forward contract must negotiate a deal directly with a bank. A company using currency futures must buy or sell futures contracts on a futures exchange that deals in the relevant type of contract.
- Futures are **standardised contracts**. Every futures contract for the purchase/sale of a particular item is identical to every other futures contract for the same item, with the only exception that their settlement dates/delivery dates may differ. For example, a currency future for euros against the US dollar is for the purchase/sale of €125,000.
- On every futures exchange, there are **regular settlement dates** for futures contracts. These are usually in March, June, September and December. A company might therefore buy or sell March futures for settlement in March, or June futures for settlement in June, and so on.

Most currency futures are contracts for the major international currencies. For example:

Currency future (CME)	Amount
US dollar – euro	€125,000
US dollar – yen	12.5 million yen
US dollar – British pound	£62,500
US dollar – Swiss franc	SFr125,000
US dollar – Canadian dollar	C\$100,000

An important feature of most futures contracts, including currency futures, is that the contract involves the purchase and sale of a **notional quantity** of the underlying item. For example a futures contract is a contract for the purchase of a notional quantity of one currency in exchange for another currency. The purpose of a currency futures contract is to trade on the exchange rate, not to arrange to buy or sell currency.

This concept might seem unusual and difficult to understand, and an example might help to illustrate the nature of futures contracts.



Example

It is August. A UK company has sold goods to a US customer for \$600,000, with payment due at the end of December. It wants to hedge its exposure to currency risk.

The most usual methods of hedging this risk would be a forward exchange contract or a money market hedge.

However, the company might decide to hedge the risk exposure with currency futures. Futures contracts are available for buying or selling sterling in exchange for US dollars, and the standard amount for a sterling-dollar future is £62,500. The UK company will be receiving US dollars in December, so it will want to sell dollars and buy sterling.

It can therefore buy an appropriate quantity of sterling-dollar December futures, which fix an exchange rate for the purchase of a quantity of dollars.

At the end of December, the company will receive \$600,000 at sell these in exchange for sterling at the spot rate. It will also settle its futures contracts. The contracts are settled by payment of the difference between the exchange rate agreed in the contracts and the current spot rate at the settlement date for the contract. This might involve a receipt or a payment, depending on whether the spot rate at settlement is more favourable or less favourable than the rate agreed in the futures contract.

Currency futures provide a hedge because:

- If the spot rate moves adversely between August and December, there will be an offsetting profit on the futures position.
- On the other hand, if the spot rate moves favourably for the UK company between August and December, there will be an offsetting loss on the futures position.

In principle, the gain or loss on the futures position, taken together with the spot rate at settlement date, means that the exchange rate was effectively 'fixed' when the futures contracts were arranged in August.



Example

It is April. A US company has sold goods to a customer in France for €1,000,000, with payment due at the end of June. It wants to hedge its exposure to currency risk.

It could hedge the exposure with a forward contractor a money market hedge, and these are the most likely types of hedge that will be used. However the company could hedge its position with June futures.

In June, it will receive payment in euros and will want to exchange the euros into US dollars. It therefore wants to buy dollars and sell euros. Futures contracts are for €125,000, so it will sell 8 June futures (= €1,000,000/€125,000 per contract) at a price agreed in the contract.

At the end of June it will sell the euros it receives at the spot rate in exchange for dollars. When the futures are settled there will be a gain or loss on the contracts, depending on the difference between the exchange rate in the futures contract and the spot exchange rate in June when the futures are settled.

Taking the dollars received from selling the euros 'spot' in June, and the gain or loss on the futures dealing, the net effect will be to fix an effective forward rate for the euros against the dollar when the futures are sold in April.

7.3 Closing out a futures position

Futures contracts are for settlement in March, June, September or December. A company using futures to hedge a currency risk exposure might want to hedge a currency risk that will occur at a date that does not coincide with the settlement date for a futures contract.

This problem is overcome by closing out a futures position.

- If a company has bought September futures, it can close its position by selling an equal number of September futures before settlement date in September, at any time to suit its requirements. On closing out the position there is a gain or loss, which is the difference between the price at which the original futures were bought and the price at which they were sold.
- If a company has sold September futures, and has a 'short position' in the futures, it can close its position by buying an equal number of September futures before settlement date in September, at any time to suit its requirements. On closing out the position there is a gain or loss, which is the difference between the price at which the original futures were sold and the price at which futures were bought to close the position.

7.4 Other features of currency futures

Other features of currency futures that should be noted are as follows.

- It is not usually possible to arrange a 'perfect hedge' for a currency risk exposure with futures contracts. This is because futures contracts are for a standard amount of a currency, and the exposure might not be for a convenient multiple of this standard amount.
- The current exchange rate for buying or selling currency futures is never the same as the current spot exchange rate, until the futures contract eventually reaches settlement date. If a position is closed out before then, the hedge will not be 'perfect'.

Buying or selling futures therefore rarely provides a perfect hedge for a currency risk. This fact, combined with the relative simplicity of arranging a forward contract

or a money market hedge, explains why futures are not often used by non-bank companies for hedging currency risk.



Example

This final example of currency futures might help to show how futures provide a hedge against currency risk. The example is simplified.

It is May. A US company expects to receive £250,000 from a UK customer at the end of September and wants to hedge the currency risk with futures.

Sterling-US dollar futures are for £62,500. The US company will receive payment in sterling and will therefore want to sell sterling in exchange for dollars at the end of September. It should therefore sell 4 September futures (= £250,000/£62,500 per contract). Suppose the price for the sale of the futures is \$1.9800 to £1.

At the end of September, the company receives £250,000 from the UK customer and sells this money at the spot rate, which is \$1.9600. It also settles its futures contracts, and the settlement price for these contracts is the same as the spot rate, \$1.9600.

The situation is as follows:

	\$	\$
Original sale price of futures	1,9800	
Purchase price at settlement	<u>1,9600</u>	
Gain on futures trading (per £1)	<u>0.0200</u>	
× 4 contracts × £62,500 per contract		
Total gain on futures dealing		5,000
Revenue from sale of £250,000 spot (× \$1.9600)		<u>490,000</u>
Total income		<u>495,000</u>

This gives an effective exchange rate of \$495,000/£250,000 = \$1.9800 to £1.

This was the exchange rate at which the futures were sold in May. Hedging with futures therefore fixed an effective exchange rate of \$1.9800.

7.5 Options

An option is another type of derivative contract. However an option contract differs from a normal contract. In a normal contract both parties have a legal obligation to carry out the terms of the contract agreement. For example a futures contract commits the buyer and the seller to their contract obligation.

An option contract, however, gives the buyer of the option a choice about whether to enforce the terms of the contract agreement or whether to let the contract lapse. An option gives its holder the right, but not the obligation, to take a particular course of action at sometime in the future. Typically, an option gives its holder the right, but not the obligation, either to buy or to sell a quantity of a particular item on or before a specified date in the future, at a price that is fixed in the contract.

A currency option give the buyer of the option the right, but not the obligation either to buy or sell a quantity of currency in exchange for another currency, on or before a specified date in the future, at an exchange rate ('strike rate' or 'exercise rate') that is specified in the option contract.

Call options and put options

Financial options are either call options or put options.

- A **call option** gives its holder the right to **purchase** the underlying item in the option agreement.
- A **put option** gives its holder the right to **sell** the underlying item in the option agreement.

For example, a call option on \$1,000,000 might give the option holder the right to buy \$1,000,000 in exchange for British pounds on a specified date in three months time, at an exercise rate of, say, \$2 to £1.

A put option on \$1,000,000 might give its holder the right to sell \$1,000,000 in exchange for sterling at an exercise rate of, say, 1.9800 on or before a specified date in six months' time.

Expiry date: American-style and European-style options

An option agreement has an expiry date, after which the option lapses and the agreement comes to an end.

- An American-style option can be exercised by its holder at any time on or before the expiry date.
- A European-style option can be exercised only at the expiry date for the option and not before.

The terms 'American' and 'European' do not refer to the countries where these types of option are available. Both types of option agreement are made throughout the world.

For example, if a company holds an American-style call option to buy US\$500,000 in exchange for euros at a rate of 1.5000 (US\$/€1) with an expiry date of 20th September, the company can exercise its right to buy the \$500,000 at the agreed rate at any time up to and including 20th September. However, if the option is not exercised by that date, it will lapse (cease to exist).

Option premium

An option has value to an option buyer, because it gives a right that can be exercised at the choice of the option holder. The seller of the option, or option 'writer', has a contractual obligation to comply with the terms of the option contract if the option is exercised by its holder; but the option seller has no rights if the option holder allows the option to lapse.

Option buyers must therefore pay the option seller (option writer) for the option. The purchase price for an option is called the premium.

The premium is paid when the option contract is arranged. It is non-refundable, and the option writer receives the option no matter whether it is eventually exercised or allowed to lapse.

7.6 Features of currency options

The main features of currency options are as follows:

- A currency option gives its holder the right to buy (call option) or sell (put option) a quantity of one currency in exchange for another, on or before a specified date, at a fixed rate of exchange (the strike rate for the option).
- Currency options can be purchased over-the-counter or on an exchange. In practice, companies buying call or put currency options do so in over-the-counter deals with a bank.
- Traded currency options are bought and sold on an options exchange.

7.7 Hedging risks with currency options

An important feature of hedging currency risks with options is that they give the option holder a choice. Some examples will be used to illustrate how this operates.



Example

A UK company expects to receive \$5 million from a US customer in six months time. The dollar-sterling exchange rate is volatile, and the UK company cannot predict which way it thinks the exchange rate will move, up or down. The current spot exchange rate is $\$1.9800 = \pounds 1$.

It therefore decides to hedge its exposure to risk with a currency option. It wants to sell the dollars it receives in six months time, therefore it can buy a put option on \$5 million, with an expiry date in six months. The exercise rate might be \$1.9900. The bank that writes the option will charge a suitable premium.

- At the expiry date for the option, if the spot exchange rate is higher than \$1.9900, the company will exercise its option to sell \$5 million at the strike rate of \$1.9900. The income in sterling will be $\pounds 2,512,563$ (less the premium paid initially to buy the option).
- At the expiry date for the option, if the spot exchange rate is lower than \$1.9900, the company will not exercise the option. Instead it will sell the \$5 million it receives at the available spot rate. For example if the spot rate is \$1.9500, the company will let the option lapse and sell its \$5,000,000 at \$1.9500 to earn $\pounds 2,564,103$ (less the premium paid initially to buy the option).



Example

A German company expects to pay \$3 million to a US supplier in three months time. It cannot predict which way the dollar-euro exchange rate will move, up or down. The current spot exchange rate is \$1.6000 = €1.

It therefore decides to hedge its currency risk with an option. It needs to buy US dollars, so it will arrange to buy a call option on \$3 million with an expiry date in three months time. The strike rate in the option might be \$1.6200 and an appropriate premium will be charged by the bank that writes the option.

- At the expiry date for the option, if the spot exchange rate is lower than \$1.6200, the company will exercise its option to buy \$3 million at the strike rate of \$1.6200. The cost will be €1,851,852 (plus the premium paid initially to buy the option).
- At the expiry date for the option, if the spot exchange rate is higher than \$1.6200, the company will not exercise the option. Instead it will buy the \$3 million at the available spot rate. For example if the spot rate is \$1.6500, the company will let the option lapse and buy the \$3,000,000 at \$1.6500. This would cost €1,818,182 (plus the premium paid initially to buy the option).

7.8 Advantages and disadvantages of hedging with options

The advantages of an option for the option buyer are that:

- it gives the option holder the right to buy or sell currency at the spot rate if this is more favourable than the strike rate in the option
- it gives the option holder the right to exercise the option and buy or sell at the strike rate if this is more favourable than the spot rate.

The key problem with an option is its cost. The cost of the premium might exceed the benefits.

7.9 Currency swaps

Swaps are another form of derivative. Whereas currency futures and options are fairly short-term in nature, with settlement dates or expiry dates in the next few months, swaps are longer in duration and can operate over a period of many years.

A swap is a contract between a bank and a customer (a company) in which the two parties agree to exchange or 'swap' payments over the term of the swap.

A currency swap involves one party making payments in one currency and the other party makes payments in exchange in a second currency.

These contractual payments can be used to fix an exchange rate over a period of several years, for currency exposures that arise over a similar period of time.

Companies can also use currency swaps to borrow at a favourable interest rate in the international loans or bonds markets, and swap their liabilities into a currency of their preference. This could enable them to borrow more cheaply than borrowing directly in the currency of their preference.

The nature of currency swaps

The main features of a currency swap are as follows.

- The two parties to a currency swap, a company and a bank, agree to swap 'interest payments' on a notional amount of principal. One party pays interest on a notional amount of principal in one currency, and the other party pays 'interest' on a notional amount of principal in a second currency.
- The two notional amounts of principal should be equivalent, so there is an agreed exchange rate between the currencies implicit in the transaction.
- The 'interest' payments are made at regular intervals, at a rate of interest specified in the swap agreement.
- At the end of the swap, the two parties make an exchange of principal, paying each other the notional amount of principal in the swap.



Example

A US company arranges a five-year currency swap with a bank. Under the terms of the agreement, the US company will pay the swaps bank interest on 60 million Argentinian pesos, and the bank will pay interest in return on US\$20 million.

Under the terms of the agreement, 'interest' payments will be exchanged every six months, with the US company paying interest at 8% per annum on 60 million pesos and the bank paying interest at 4.5% on US\$20 million.

At the end of the swap, the US company will pay the bank 60 million pesos and will receive in return US\$20 million.

This type of arrangement might enable the US company to hedge exposures to currency risk if it has invested in a five-year project in Argentina, and expects to receive cash in pesos from the investment. It can use its pesos from the project to make the payments under the terms of the currency swap.

If it sells off its investment after five years and receives payment in pesos, the money it receives can be used to pay the 60 million pesos to the swaps bank at the end of the swap.

By netting or matching receipts and payments in pesos, the currency risk exposure has been hedged.



Example

Another use of currency swaps for hedging is illustrated by the following example

A UK company has taken an opportunity to borrow US\$200 million in the bond markets, by issuing a seven-year bond. However, it wants to have its interest liabilities in sterling, not dollars. It might therefore arrange a seven-year currency swap in which the agreed exchange rate is £1 = US\$2.00.

- For the seven years of the swap, the UK company will receive a fixed rate interest in US dollars from the swap counterparty. The interest received on each interest payment date will be interest for the period at the agreed swap rate for US dollars, on \$200 million.
- The UK company will pay interest in the swap on £100 million, also at a fixed rate agreed in the swap.
- The interest received in US dollars can be used to meet the dollar interest liabilities on the bonds. This leaves the company with net interest obligations in sterling.
- At the end of the swap, there is an exchange of principal. The UK company will receive US\$200 million from the swap counterparty and in exchange must pay £100 million. It will use the US\$200 million to redeem the dollar bonds.

The effects of the currency swap may be summarised as follows:

	Interest	Principal payments (end of the swap)
Bonds	Pay dollars	Pay dollars (\$200 million)
Currency swap	Receive dollars Pay sterling	Receive dollars (\$200 million)
Net effect	Pay sterling	Nil

The effect of the currency swap has therefore been to borrow in one currency, but swap the interest and loan principal repayment liabilities into a different currency.

Currency swaps are therefore used to hedge long-term currency risk exposures.

7.10 Conclusion: using currency derivatives

It is important to remember that although some companies might use derivatives to hedge currency risk exposures, it is much more common for companies to use hedging techniques and methods such as netting, leading or lagging, forward exchange contracts and money market hedges.

Interest rate risk

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| 1 | The nature of interest rate risk |
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The nature of interest rate risk

- The effect of a change in interest rates
- Interest rate volatility and interest rate risk
- Short-term and long-term interest rates
- Money market interest rates: LIBOR
- Types of interest rate risk
- Basis risk
- Gap exposure

1 The nature of interest rate risk

1.1 The effect of a change in interest rates

Interest rates can move up or down. Economists are often able to predict the direction of future movements over the fairly short term, but might not be able to predict exactly when interest rates might change, nor by exactly how much.

Interest rate risk is the risk that arises from the potential consequences of unexpected movements, up or down, in an interest rate. Financial institutions such as banks and investment institutions such as pension funds have the largest exposures to interest rate risk, because of their extensive borrowing, lending and/or investments. However, interest rate risk affects any entity or individual who borrows money or who invests in interest-yielding investments.

A movement in interest rates can affect companies in either a positive or a negative way.

- If a company has borrowed at a variable rate of interest, it will have to pay higher interest costs if the interest rate goes up. On the other hand it will pay lower interest costs the interest rate goes down.
- If a company has borrowed at a fixed rate of interest, for example by issuing bonds, it will continue to pay the same rate of interest even if market interest rates go down. However, competitors who have borrowed at a variable rate of interest, or competitors who decide to issue fixed rate bonds after the rate has fallen, will gain a competitive advantage.
- An investor in fixed rate bonds who expects to sell the bonds before their maturity will also be affected by a change in interest rates. A rise in interest yields will result in a fall in the market price of existing fixed rate bonds. A fall in the market interest rate results in higher market prices for (fixed rate) bonds.

Companies with very large borrowings are exposed to significant interest rate risk. For example, if a company has borrowed \$500 million from a syndicate of banks at a variable rate of interest, an increase in the annual interest rate of just 0.25% will result in higher interest costs of \$1,250,000 each year.

1.2 Interest rate volatility and interest rate risk

Interest rates are volatile when they change frequently and the direction of the change, up or down, is difficult to predict.

Interest rate risk is particularly high when:

- interest rate changes are frequent (and sometimes large), and
- it is uncertain whether the next movement in rates will be up or down.

In other words, interest rate risk increases with interest rate volatility. Volatility is likely to be higher when expected inflation rates are high than when expected inflation rates are low.

1.3 Short-term and long-term interest rates

A distinction is made between:

- short-term interest rates, which are money market interest rates
- long-term interest rates, which are bond yields.

Volatility in short-term rates affects short-term lending and borrowing, and also all lending at a variable rate of interest, such as most bank loans. Volatility in longer-term rates affects bond investors.

Note that yields on a corporate bond are affected by:

- interest rates for risk-free bonds (domestic government bonds)
- changes in the perceived credit risk of the bond issuer.

For example, suppose that a company's bonds which have been rated AA by a credit rating organisation are now downgraded to a rating of A+. The yield on the bond will increase to reflect the lower credit rating, and the market price of the bonds will fall. However, the increase in the bond yield is due to a credit risk factor rather than to interest rate risk.

1.4 Money market interest rates: LIBOR

Short-term interest rates for borrowers are set at a margin above either:

- the base rate or official rate of the lending bank, or
- an 'official' money market rate. (Note: The money markets are markets for wholesale borrowing and lending short-term, for periods ranging from overnight up to about 12 months. 'Wholesale' means borrowing and lending in large amounts.)

Each major financial centre has a money market and a 'benchmark' rate that the participants in the market use. In London, the benchmark rate of interest is the London Interbank Offered Rate or LIBOR. This is the rate of interest at which a bank will lend to a top-rated bank in the interbank market.

- There are LIBOR rates for each maturity of lending, such as seven-day LIBOR, one-month LIBOR, three-month LIBOR and so on.

- Each individual UK bank has its own LIBOR rates, but an average 'official' LIBOR rate is calculated daily by the British Bankers Association.
- London is a major international money market centre, and there are LIBOR rates in the major currencies as well as in sterling. For example, there is a US dollar LIBOR and a Swiss franc LIBOR. There is also a euro LIBOR, but the commonly-used benchmark rate for the euro is a rate called the **euribor rate**.
- In Paris, there are PIBOR rates; in Frankfurt there are FIBOR rates; and so on.

A company borrowing British pounds from a bank at a floating rate of interest might pay interest at a margin above LIBOR. For example, if interest is payable every six months, a borrower might pay interest at 1.50% above the six-month sterling LIBOR rate.

(**Basis points:** 1% = 100 basis points, and in the money market, interest rates may be stated as a number of basis points above LIBOR. So LIBOR plus 1.50% might be stated as 150 basis points above LIBOR.)

When a company borrows at a variable rate of interest, it pays interest at the end of each interest period, which might be each month, or every three months, or every six months, and so on. The rate of interest payable for the period is decided by reference to the benchmark rate, such as three-month LIBOR, at the **beginning** of the interest period. As LIBOR rises or falls, the interest payable in each interest period also goes up or down.

Calculating the interest

There are rules in the money markets about how interest should be calculated. The rules differ between currencies. For example:

- Interest on a sterling money market loan is calculated as:

$$\text{Loan principal} \times \text{Annual interest rate} \times (\text{Number of days in the loan period}/365)$$
- Interest on a US dollar money market loan is calculated as:

$$\text{Loan principal} \times \text{Annual interest rate} \times (\text{Number of days in the loan period}/360)$$

For your examination, you might be expected to make the assumption that interest is calculated as:

$$\text{Loan principal} \times \text{Annual interest rate} \times (\text{Number of months in the loan period}/12).$$

1.5 Types of interest rate risk

The main interest rate risk for non-bank companies is the risk from an unexpected rise or fall in interest rates.

- If interest rates rise, the cost of borrowing will rise for a company with a variable rate loan. For example, a company with a five-year variable rate loan on which the interest rate is three-month LIBOR plus 1.5% will have to pay more interest if the LIBOR rate goes up.

- If interest rates fall, for a company with fixed rate debt the cost of borrowing will become higher relative to rival companies that have variable rate borrowing. For example, if a company has issued 6% fixed rate bonds, the relative cost of borrowing will become higher if short-term rates such as the LIBOR rate fall.
- If interest rates rise, investors holding fixed rate bonds will suffer a loss in value on their bonds. This is because whenever interest rates rise, the market value of fixed rate bonds falls.

In addition to risk from unexpected movements up or down in the general rate of long-term or short-term interest, there are other types of interest rate risk. These include:

- basis risk
- gap exposure.

1.6 Basis risk

Basis risk is where an organisation has assets and liabilities with floating interest rates but the interest rates are set on different bases. Examples of different bases for calculating interest are:

- loans with interest charged at the bank's base rate plus
- loans with interest charged at three-month LIBOR plus, or at six-month LIBOR plus.

When one interest rate basis changes, others might not. For example, if there is a fall in LIBOR, a bank's official base rate might not be altered. Similarly if three-month LIBOR goes up by, say, 0.25%, six-month LIBOR might go up by a smaller or a larger amount.



Example

An investor has borrowed money at his bank's base rate plus 1% and has invested it in floating rate bonds on which the interest is LIBOR plus 1.25%.

Basis risk exists because the basis on which interest is payable (bank's base rate) and the basis on which interest is receivable (LIBOR) are different. There is a risk that one of these interest rates might change but the other remains unchanged. For example, the lending bank might raise its base rate by 0.25% but LIBOR might remain unchanged.

1.7 Gap exposure

Gap exposure is where a company has assets and liabilities maturing over different periods. A risk arises because interest rates might change for the period or time 'gap' between the date when the assets mature and the date when the liabilities mature.



Example

An investor has an investment that cost \$2 million and is earning interest at 5.5% per year. This investment will mature in three months time, when \$2 million will be repayable to the investor.

The investment is financed by a loan on which the interest cost is 5.25% per year. This loan is repayable in five months.

There is a gap between the time the investment matures (after three months) and the maturity of the loan (after five months). During month 4 and month 5, the investor will continue to pay interest at 5.25%. He will be able to reinvest his \$2 million for two months to earn more interest, but there is a risk that interest rates might fall and the interest he will earn in those months could be less than the cost of his borrowing.



Example

A bank borrows funds from another bank for three months at an interest rate of LIBOR plus 0.25, and it uses the funds to re-lend for six months to a customer at LIBOR plus 0.75%.

The bank will have to repay the loan after three months, and so will have to find new funding for months 4 – 6. There is a gap between the maturity date of the liability and the maturity date of the asset. There is a risk that interest rates might go up, so that the cost of replacement funding at the end of month 3 could be higher than the interest the bank is receiving on its loan to the customer.

Yield curves and interest rate fluctuations

- Structure of interest rates and yield curves
- Causes of interest rate movements
- Expectations theory
- Liquidity preference theory
- Market segmentation

2 Yield curves and interest rate fluctuations

2.1 Yield curves (the term structure of interest rates)

The cost of interest on bonds is the current investment yield required by investors from their investment in the bonds. The cost of fixed-rate debt, commonly referred to as the 'interest yield', differs according to the remaining term to maturity of the debt.

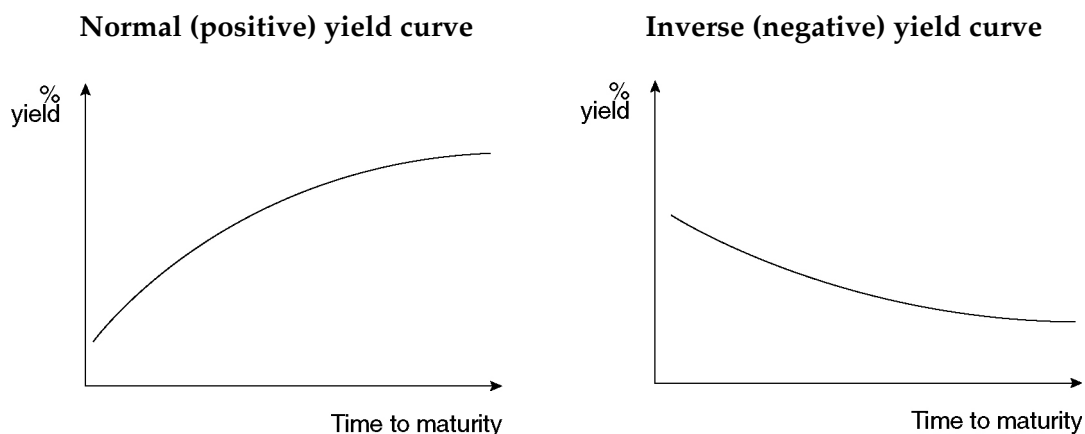
For example, suppose that there are two different bonds, one that will mature in three years and the other that will mature in seven years. Even if there is no difference in investment risk between the two bonds (so risk does not affect the comparative yield), the interest cost of the three-year bonds and the interest cost of the seven-year bonds will not be the same.

- As a general rule, the interest yield on fixed-rate is higher for debt with a longer term remaining to maturity. For example, it should normally be expected that the interest yield on a fixed-rate bond with one year to maturity/redemption will be lower than the yield on a similar bond with ten years remaining to redemption. Interest rates are normally higher for longer maturities to compensate the lender for tying up his funds for a longer time.
- When interest rates are expected to fall in the future, interest yields might vary inversely with the remaining time to maturity. For example, the yield on a one-year bond might be higher than the yield on a ten-year bond when rates are expected to fall in the next few months.
- When interest rates are expected to rise in the future, the opposite might happen, and yields on longer-dated bonds might be much higher than on shorter-dated bonds.

Interest yields on similar debt instruments can be plotted on a graph, with the x-axis representing the remaining term to maturity, and the y-axis showing the interest yield. This type of graph showing the **term structure of interest rates** is commonly called a **yield curve**.

- As indicated above, a normal yield curve slopes upwards, because interest yields are normally higher for longer-dated debt instruments.
- However, on occasions, the yield curve might slope downwards, when it is said to be 'negative' or 'inverse'.

- Sometimes it might slope upwards, but with an unusually steep slope (steeply positive yield curve).



When the yield curve is inverse, this is usually an indication that the markets expect interest rates to fall at some time in the future.

When the yield curve has a steep upward slope, this indicates that the markets expect short-term interest rates to rise at some time in the future.

Yield curve and short-term interest rates

A yield curve can also be constructed for short-term (money market) interest rates. For example, one-month LIBOR, two-month LIBOR, three-month LIBOR, six-month LIBOR and one-year LIBOR might all be different. Short-term interest rates may be upward-sloping, inverse or flat.

Risk-free rate of interest: yield curve for risk-free debt

A yield curve is often shown for risk-free longer-term debt securities. As the name implies, risk-free debt is debt where the investor has no credit risk whatsoever, because it is certain that the borrower will repay the debt at maturity. Debt securities issued in their domestic currency by the government should always be risk-free.

The interest yield on other debt securities, such as corporate bonds, is generally higher than the yield on risk-free debt with the same maturity. For example, the interest rate on a sterling bond of ABC Company with two-years to maturity will be higher than the interest yield on a two-year UK government bond. The higher yield is to compensate investors in corporate bonds for the fact that the debt is not risk-free. The company might default.

2.2 Causes of interest rate movements

There are various factors that affect the slope of the yield curve, and that cause changes in the yield curve.

When interest rates change, there might be a general increase or fall in interest rates across the entire length of the yield curve. A general increase or fall in the yield curve for all maturities is often called a general **shift** in the yield curve.

More often, however, some parts of the yield curve rise or fall when other parts of the yield curve remain unchanged. For example, short-term interest rates might rise but longer-term rates might remain unchanged. (Sometimes when this happens, the yield curve changes from normal to inverse.)

Sometimes interest rates on one part of the yield curve might rise or fall sooner than they rise or fall on a different part of the yield curve. For example, interest rates on maturities up to two years might increase by 0.5%, and interest rates on maturities over two years might not rise until several months later.

Two important factors affecting changes in interest rates are:

- interest rate policy decisions by the government or central bank
- the effect of supply and demand for bonds or loans.

Central bank action

In some countries, short-term interest rates are managed by the central bank on behalf of the government. Changes in short-term interest rates can be used to influence the condition of the economy, such as the rate of inflation and possibly the level of unemployment. Interest rates are managed by the central bank or central government, for example, in the US, the eurozone countries and the UK.

When a central bank raises short-term interest rates, which it is able to do through its activities in lending to the banking system or its activities in the money markets, all short-term interest rates will normally be raised by the banks. For example, if the Bank of England raised its interest rate by 0.25%, all UK commercial banks would immediately raise their LIBOR rates and base rates, probably by 0.25%. There would be no immediate effect on long-term interest rates, although these might go up in time.

Similarly, when a central bank reduces its short-term lending rate to commercial banks, the banks will normally reduce their own interbank lending rates. (However this is not always the case: during the 'banking crisis' in 2007 - 2008, banks in the UK did not reduce their LIBOR rates in response to reductions in lending rates to the banks from the Bank of England.)

Supply and demand for bonds

Interest yields on bonds affect the market price of issued bonds. Higher yields mean lower bond prices, and lower yields result in higher market prices for bonds in issue.

Yields (bond prices) are affected by the supply and demand for bonds in the market. There are different views about what factors affect the demand of investors for bonds. Three explanations of interest rates and changes in interest rates are:

- expectations theory
- liquidity preference theory
- market segmentation.

2.3 Expectations theory

Expectations theory is a theory stating that long-term interest rates can be used to predict investor expectations of future short-term interest rates. Put another way, long-term interest rates are derived from current short-term interest rates and expectations of what short-term rates will be in the future, up to the end of the longer-term interest period.

Some simplified examples might help to illustrate the theory.



Example

The current one year interest rate is 5.50% and the current six-month interest rate is 5.25%.

If expectations theory is correct for short-term interest rates, we would be able to identify investor expectations of what the six-month rate will be in six months time. This is because investors will be indifferent about whether to invest money now for 12 months, or whether to invest for six months and then re-invest the returns from the six-month investment for a further six months. If either of these options provided a bigger return, investors would choose it in preference to the other.

Let the six-month rate at the end of month 6 be r .

Since investing for 12 months will provide the same return as investing for six months and then another six months:

$$\begin{aligned}
 [1 + (0.0525) \times 6/12] [1 + (r \times 6/12)] &= 1.0550. \\
 1.02625 \times (1 + r/2) &= 1.0550 \\
 (1 + r/2) &= 1.0550/1.02625 = 1.0280 \\
 r/2 &= 0.0280 \\
 r &= 0.0560 = 5.6\%.
 \end{aligned}$$

Investors expect the six-month rate to have risen to 5.6% at the end of month 6.



Example

The current one-year interest rate is 6%. Investors expect the one-year rate to fall to 5.75% by the end of Year 1, 5.50% by the end of Year 2 and 5.4% by the end of Year 3.

If expectations theory is valid, the total return from investing for 12 months now, then again at the end of year 1, year 2 and year 3 should be the same as the total return from investing now for four years.

The current four-year interest rate can be calculated as follows:

Let the current four-year interest rate be r .

$$(1.0600)(1.0575)(1.0550)(1.0540) = (1 + r)^4$$

$$1.246463 = (1 + r)^4$$

$$(1 + r) = 1.0566 = 5.66\%.$$

Expectations theory and changes in interest rates

If expectations theory is correct, changes in investor expectations about what shorter-term interest rates will be in the future will result in changes in current longer-term interest rates.

For example, suppose that the central bank raises short-term interest rates by 0.25%. If investors expect these changes in rates to continue in the future, their expectations about future short-term interest rates will change. This will lead to changes in longer-term interest rates, which will increase to allow for investor expectations of higher shorter-term rates.

There is a strong rational justification for expectations theory, and to a certain extent the theory is probably valid. If longer-term rates did not reflect investor expectations of future short-term rates, investors should be able to make profits by investing in either shorter-term or longer-term bonds.

However, it is unlikely that expectations theory on its own explains interest rates and changes in interest rates. The Bank of England commented (Bank of England Quarterly Bulletin, May 1995): 'In practice for a number of reasons it is unlikely that expectations theory holds exactly: long-term interest rates are unlikely to be **simply** the average of actual and expected future short-term rates.'

2.4 Liquidity preference theory

Liquidity preference is the preference that people have for holding cash rather than investing it. Liquidity preference theory states that in order to overcome this preference of individuals for holding cash, borrowers must offer interest. Individuals might have cash in the bank on which they earn no interest but for which they have no immediate use: they could be persuaded to invest this cash by the attraction of interest on the investment.

The theory also states that investors also prefer short-term interest-yielding investments rather than long-term interest-yielding investments. This is because there is greater risk with longer-term investments than with shorter-term investments.



Example

If there is no expectation of future changes in interest rates, liquidity theory states that investors would prefer to invest in one-year bonds at 6% than to invest in four-year bonds at 6%.

The reason they would prefer one-year bonds at 6% over four-year bonds at 6% is that there is more investment risk in the four year bonds. The value of the one-year bond is based on interest for one year at 6% and the guaranteed redemption value of the bond after one year. If interest rates went up unexpectedly, their investment would lose some value but not much.

The value of the four-year bond is based on interest for four years at 6% (\$24 on \$100 bonds over four years) and the redemption value of the bonds at the end of Year 4. If interest rates went up unexpectedly, their investment would lose more in value than the one-year bond, because more of the bond's value is in the future interest income.

Liquidity preference can therefore be described as a risk aversion of investors. Given no difference in interest yields, they will prefer shorter-term investments to longer-term investments.

To persuade investors to overcome their liquidity preference and invest in longer-term investments, it is therefore necessary to offer higher yields on longer-dated bonds.

Liquidity preference theory therefore states that yields on longer-dated bonds are higher than would be predicted by basic expectations theory, because investors must be offered a higher yield to overcome their risk aversion and liquidity preference.

2.5 Market segmentation

Market segmentation theory differs from expectations theory and liquidity preference theory. It disagrees with the view that the yield curve can be seen as interest rates for different maturities in a single investment market.

It states that the market for bonds and other interest-yielding investments is not a single market. The market is divided into different segments, and interest yields in each segment of the market are determined by factors within that segment. Many investors focus on just one segment of the market: for example an investment institution might deal exclusively in bonds with maturities of five to ten years, and not deal at all in bonds with maturities below five years or over ten years. In contrast, pension funds might choose to invest heavily in long-dated bonds, to match their pension liabilities that are also long-dated.

Since the market is segmented, the theory states that there is no reason why interest rates in different segments of the market should be related to each other.

Investors specialising in a certain segment of the market will stay in this segment whatever the expectations of interest rates in other segments of the market. This can lead to anomalies in the shape of the yield curve.



Example

Pension funds are major investors in the bond markets. These funds have long-term liabilities, because they will be required to pay pensions to members of their pension scheme for many years into the future. Pension fund managers are therefore attracted to very long-term bonds, such as government 30-year or 50-year bonds.

The strong demand for long-dated bonds has exceeded the supply of the bonds in the past, and the long-dated bond market has been a separate segment of the bond market. Heavy demand for the bonds has kept the yields on long-dated bonds low, even when yields on shorter-dated bonds, say 10 – 15 year bonds, have been higher. Lower yields on very long-dated bonds are inconsistent with the predictions of expectations theory or liquidity preference theory.

Hedging interest rate risk: FRAs

- Hedging methods
- Matching and smoothing
- Asset and liability management
- Forward rate agreements (FRAs)
- The features of an FRA agreement
- How an FRA works

3 Hedging interest rate risk: FRAs

3.1 Hedging methods

Some organisations might wish to hedge their exposures to interest rate risk. They might also want to take advantage, if possible, from any favourable movements in interest rates. There are several ways in which risks can be hedged and opportunities to benefit from interest rate changes can be exploited. These include:

- matching and smoothing
- asset and liability management
- forward rate agreements or FRAs

3.2 Matching and smoothing

Matching and smoothing are 'internal' methods of hedging interest risk.

Matching involves setting off interest income against interest payments, so that the interest rate exposure is to the net amount of interest payments (or net interest income). This method of interest rate hedging might be difficult for companies to achieve as interest payments on loans are likely to be much higher than interest payments on deposits or investments. Matching is likely to be more practicable for financial institutions such as banks.

Smoothing is where companies have a balance of fixed and floating rate debt. For example a company might choose to have 50% of its debt capital in the form of fixed interest liabilities and the other 50% in floating rate liabilities. If interest rates rise the disadvantage of higher variable interest rates will be offset by the comparatively low fixed rates. If interest rates fall the disadvantage of the fixed rate will be offset by a lower variable rate.

3.3 Asset and liability management

Asset and liability management in the context of financial management means managing risk in financial assets and liabilities. In banks for example, asset and liability management involves monitoring risk, such as interest rate risk and credit risk, in a bank's portfolio of assets and liabilities.

Where possible, assets (e.g. loans to customers) are matched with liabilities (e.g. borrowings by banks) in order to control risk arising from gap exposures and basis risk etc.

3.4 Forward rate agreements (FRAs)

Forward rate agreements (FRAs) are used extensively by some companies to hedge exposures to short-term interest rate risk.

A forward rate agreement (FRA) is a forward contract for an interest rate. FRAs are negotiated 'over-the-counter' with a bank. In some respects, an FRA is similar to a forward exchange rate. It is a contract arranged 'now' that fixes the rate of interest for a loan or deposit period starting at some time in the future. For example, an FRA can be used to fix the interest rate on a six-month loan starting in three months' time.

How are banks able to offer fixed rates of interest for future lending periods?

Banks are able to quote forward rates for interest rates because there is a large and active money market, and banks are able to borrow and deposit funds short-term. As a result, if a bank can borrow for nine months at one rate of interest and deposit funds for three months at another rate of interest, it can work out a rate to quote to a customer that wants to borrow between the end of month 3 and the end of month 9. A 'forward rate' can be fixed now that will guarantee the bank a profit on the transaction.

A numerical example might help to illustrate this point.



Example

A bank can borrow dollars for nine months at 5% and can deposit dollar funds for three months at 4.75%. Suppose that it borrows \$1 million for nine months and places them on deposit for three months.

- After nine months, it will have to repay \$1 million + (\$1 million × 5% × 9/12) = \$1,037,500. The loan repayment is \$1,000,000 and interest payable is \$37,500.
- After three months, its dollar deposit will grow to \$1 million + (\$1 million × 4.75% × 3/12) = \$1,011,875. The interest received is \$11,875.
- To break even by lending to a customer from the end of month 3 to the end of month 9 (six months), the bank would need to earn interest of \$25,625 (\$37,500 – \$11,875) on its end-of-month 3 investment of \$1,011,875..
- The (annual) interest rate on the month 6-month lending would therefore have to be: $\frac{25,625}{1,011,875} \times \frac{12}{6} \times 100\% = 5.06\%$

This is not what banks would do in practice, but the example is intended to show that banks are able to use spot money market rates (which are rates for borrowing or depositing funds 'now') to derive interest rates for a future interest period, knowing that they will make a suitable profit.

3.4 The features of an FRA agreement

An FRA, like a forward exchange contract, is a binding agreement between a bank and a customer. It is an agreement that fixes an interest rate 'now' for a future interest period.

- An FRA for an interest period starting at the end of month 3 and lasting until the end of month 9 is a 3v9 FRA or a 3/9 FRA.
- Similarly, an FRA for a three-month period starting at the end of month 2 is a 2v5 FRA or a 2/5 FRA.

The interest rate period is a money-market term – less than 12 months. Similarly the interest rate that is fixed is a money market (i.e. short-term) rate of interest.

Notional principal

An FRA is an agreement that fixes a forward interest rate on a **notional amount** of money or 'notional principal'.

A forward exchange contract for currency is an agreement to buy and sell currency at a future date, when there will be an exchange of currencies between the bank and its customer. An FRA is different. It is not an actual agreement to take out a loan or to make a deposit. An FRA is an agreement that fixes a future interest rate, and it does this by stating the amount of a notional loan or deposit. The size of the notional amount of principal (the notional loan or deposit) is specified in the FRA agreement.

This idea might seem unusual: an FRA is a contract on a future rate of interest; it is not a contract to provide an actual loan or deposit.

For example a company might want to fix an interest rate now on a three-month loan starting in two months' time, with a 2v5 FRA.

- It will arrange the FRA with one bank, and this effectively fixes the future three-month borrowing rate.
- The actual three-month loan at the end of month 2 can be obtained from a different bank. The loan does not have to be arranged with the bank with which the FRA contract was made.

Buying and selling FRAs

FRAs are bought and sold.

- If a company wishes to fix an interest rate (cost) for a future borrowing period, it buys an FRA. In other words, **buying an FRA fixes an effective forward rate for short-term borrowing.**
- If a company wishes to fix an interest rate (income) for a future deposit period, it sells an FRA. Selling an FRA fixes a forward rate for a short-term deposit.

The counterparty bank sells an FRA to a buyer and buys an FRA from a seller.

FRA rates

A bank trading in FRAs will publish indicative rates. For example, prices for sterling FRAs might be quoted as follows:

3 v 6	5.27 – 5.23
4 v 7	5.32 – 5.28
5 v 8	5.39 – 5.34
9 v 12	5.63 – 5.56
3 v 9	5.40 – 5.36
4 v 10	5.45 – 5.41
6 v 12	5.50 – 5.45

A bank will always apply the rate to an FRA agreement that is more favourable to itself. For example, a company wanting to fix the interest cost with a 6 v 12 FRA, using the rates in the table above, would be quoted a rate of 5.50% for the FRA. This is because a 'lending' rate of 5.50% is more favourable to the FRA bank than a rate of 5.45%.

3.5 How an FRA works

An FRA works by comparing the fixed rate of interest in the FRA agreement with a benchmark rate of interest, such as LIBOR. The comparison takes place at the beginning of the notional interest period for the FRA.

- If the FRA rate is higher than the benchmark rate (LIBOR), the buyer of the FRA must make a payment to the seller of the FRA, in settlement of the contract
- If the FRA rate is lower than the benchmark rate (LIBOR), the buyer of the FRA receives a payment from the seller of the FRA, in settlement of the contract.

The amount of the payment is calculated from the difference between the FRA rate and the benchmark rate (LIBOR rate), applied to the notional principal amount for the FRA and calculated for the length of the interest period in the agreement.



Example

Suppose that a company knows that it will need to borrow \$10 million in three months' time for a period of six months. (Alternatively, suppose that a company has a floating rate loan of \$10 million, with interest payable every six months, and the next interest period due to start in three months' time.)

The company can hedge its exposure to the risk of a rise in the six-month interest rate by buying a 3 v 9 FRA for a notional principal amount of £5 million. If the bank's FRA rates for 3 v 9 FRAs are 5.40 – 5.36, the rate applied to the agreement will be 5.40%. The benchmark rate of interest, or '**reference rate**', will be the six-month dollar LIBOR rate.

Settlement of the FRA

Suppose that at the end of month 3, six-month LIBOR is 6.25%. The FRA rate is lower than 6.25%. The actual interest rate for borrowing is 6.25% but the FRA has fixed a rate of 5.40%. The FRA rate is settled by a payment from the bank to the buyer of the FRA.

- The difference between the FRA rate and LIBOR is 0.85%. The payment to settle the FRA will therefore be based on an interest difference of: $0.85\% \times \$10 \text{ million} \times 6/12 = \$42,500$.
- The actual payment will actually be less than this, because the FRA is settled immediately, at the beginning of the notional interest period, and not at the end of the period. The \$42,500 is therefore discounted from an end-of-interest period value to a start-of-interest period value, using the reference rate of interest as the discount rate. This PV is the amount received in settlement of the FRA.

Suppose that at the end of month 3, six-month LIBOR is 4.75%. The FRA rate (5.40%) is higher than the spot rate. The actual borrowing rate in the money market is 4.75% and the FRA has fixed a rate of 5.40%. Therefore the FRA rate is settled by a payment from the buyer of the FRA to the bank. The difference between the FRA rate and LIBOR is 0.65%.

- The payment to settle the FRA will therefore be based on this interest rate difference: $0.65\% \times \$10 \text{ million} \times 6/12 = £32,500$.
- Again, because the payment is at the beginning of the interest period and not at the end of the period, the \$32,500 should be discounted to a present value at the reference rate of interest. This PV is the amount of the payment in settlement of the FRA.

How an FRA fixes a forward interest rate

Continuing the example, the company will presumably want to borrow \$10 million for six months from the end of month 3. It will do so by arranging an ordinary short-term loan with a bank. The interest rate on the loan might be set at US dollar LIBOR + 1%.

- Suppose that at the end of month 3, six-month dollar LIBOR is 6.25%. The company will therefore borrow for six months at 7.25% (= LIBOR + 1%). It will receive a payment from the FRA of 0.85%, so that the net cost of borrowing will be 6.40% (7.25% – 0.85%). This net effective interest rate is equal to the FRA rate of 5.40% plus the margin of 1% above LIBOR for the borrowing. The company has therefore been able to fix LIBOR at 5.40% with the FRA.
- Suppose that at the end of month 3, six-month LIBOR is 4.75%. The company will therefore borrow for six months at 5.75% (= LIBOR + 1%). However, it must also make a payment of 0.65% to settle the FRA, bringing the total cost of borrowing for the six months to 6.40% (5.75% + 0.65%). Again, this total effective rate is equal to the FRA rate of 5.40% plus the 1% margin, and the FRA has therefore fixed the effective LIBOR rate at 5.40%.

Conclusion: using an FRA to hedge an interest rate risk exposure

An FRA, like a forward exchange rate, therefore fixes an interest rate in advance.

- An FRA can therefore be used by a borrower to hedge an exposure to a future increase in the short-term interest rate, or to protect a depositor against a future fall in the interest rate.
- However, the user of an FRA cannot benefit from any favourable movement in the interest rate, because the FRA fixes the interest rate and is a binding contract.

**Exercise 1**

A company has forecast that due to an expected cash shortage, it will need to borrow \$20 million for three months in two months' time. A bank quotes the following rates for FRAs:

2 v 3	3.61 – 3.59
2 v 5	3.67 – 3.63
3 v 5	3.68 – 3.65

Required

What would be the FRA agreement with the bank, and what rate would apply to the agreement?

If the company can borrow at LIBOR + 50 basis points, what will be its effective rate of borrowing for the three months if US dollar LIBOR is 4.50% at the start of the notional interest period for the FRA?

Interest rate derivatives

- Interest rate swaps
- The effect of a coupon swap
- Using interest rate swaps to hedge interest rate risk
- Interest rate options
- Types of interest rate option
- Short-term interest rate futures (STIRs)
- Hedging short-term interest rate exposures with STIRs

4 Interest rate derivatives

Just as there are currency derivatives for hedging or dealing in currency risk, there are interest rate derivatives for hedging or dealing in interest rate risk. The main types of derivative contract for interest rates are:

- interest rate swaps
- interest rate options, including caps, floors and collars
- interest rate futures

4.1 Interest rate swaps

An interest rate swap is an agreement between two parties, such as a company and a bank that deals in swaps (a 'swaps bank'), for a period of time that is usually several years. Swaps are therefore usually **long-term** agreements on interest rates.

In a swap agreement, the parties agree to exchange 'interest payments' on a notional amount of principal, at agreed dates throughout the term of the agreement. An interest rate swap is therefore a contract for the exchange of 'interest' without an actual loan being made.

The most common type of interest rate swap is a coupon swap. The interest rate payments that are exchanged in a simple 'coupon swap' are as follows:

- One party to the swap pays a fixed rate (the swap rate) on the notional principal.
- The other party pays interest at a reference rate or benchmark rate for the interest period, such as LIBOR, on the same amount of notional principal.

The exchange of 'interest' payments is at regular intervals, such as every three months, six months or one year for the full term of the swap agreement.

This straightforward type of interest rate swap is called a 'plain vanilla' swap.



Example: plain vanilla swap

A company might arrange a four-year swap with a bank, for which the notional principal amount is \$20 million and:

- the company pays interest every six months at a fixed rate of, say, 4.25%
- the bank pays interest every six months at the six-month LIBOR rate for the four-year period.

Since both parties pay interest every six months, if the payment dates coincide, the swap payments will simply be settled by a net payment for the difference in rates from one party to the other.

Over the life of the four-year swap, there will be eight exchanges of interest payments. However, in an interest rate swap, there is no exchange of principal. The interest relates to a notional amount of principal, not an actual loan.

- If the six-month LIBOR rate for one of the periods is, say, 5.00%, the exchange of payments would be settled by a payment from the bank to the company of 0.75% interest (5.00% – 4.25%) on \$20 million for six months.
- If the six-month LIBOR rate for one of the periods is, say, 3.00%, the exchange of payments would be settled by a payment from the company to the bank of 1.25% interest (4.25% - 3.00%) on \$20 million for six months.

The payments in a plain vanilla swap are at the end of each notional interest period, therefore the amounts payable are not discounted (unlike an FRA).

Swap rates

Swap rates are the fixed rates that will be used by a bank in a coupon swap agreement. Swap rates might be quoted as follows:

US dollar

Term	Bid	Ask
Years	%	%
1 year	4.03	4.06
2 years	4.17	4.20
3 years	4.29	4.32
4 years	4.63	4.66
5 years	4.91	4.94
6 years	5.14	5.17
7 years	5.33	5.36
10 years	5.73	5.76
15 years	6.16	6.19
20 years	6.35	6.38

These rates might be for a swap against three-month US dollar LIBOR. The lower rate (the bid rate) is the rate that the bank would pay in a swap. The higher rate (the ask rate) is the fixed rate that the bank would receive in a swap. Banks dealing in swaps make a profit or 'turn' from the difference between the bid and ask rates.

Swap rates for the major international currencies are quoted for terms of up to 30 years.

4.2 The effect of a coupon swap

In a coupon swap, one party pays a fixed rate of interest and the other pays 'the floating', which is the variable reference rate of interest, such as six-month LIBOR. For a company with a loan or bonds in issue, **the effect of arranging a swap can therefore be:**

- to swap from fixed rate interest liabilities to floating rate liabilities, or
- to swap from floating rate liabilities to fixed rate liabilities.



Example

A company has a bank loan of \$30 million on which it pays variable rate interest at dollar LIBOR + 1%. The loan has five more years to maturity. The company is worried about the risk that interest rates will soon rise, and it wants to set a limit on its interest costs.

It might therefore arrange a five-year swap with a bank, with interest rates to coincide with the interest payments on its bank loan.

The bank might quote rates of 5.34 – 5.39 for a five-year swap in sterling.

The company will receive the floating rate in the swap, to offset the floating rate payments on its bank loan. It will pay the fixed rate, and the rate will therefore be 5.39%.

The swap therefore alters the net interest payments for the company as follows:

	%
Actual loan payments	(LIBOR + 1)
Swap receipts/(payments)	
Receive the floating	LIBOR
Pay the fixed	(5.39)
Net interest cost	(6.39)

The company had a floating rate liability of LIBOR + 1%, and has now changed this into a net fixed interest liability of 6.39%.

On each interest payment date, the company will pay LIBOR + 1% in interest on its bank loan, and under the swap agreement will receive or pay the difference between LIBOR for the period and the fixed rate of 5.39%.

You might see that an interest rate coupon swap is similar in concept to an FRA, but is for a longer period of time and covers more than one interest period.

The company might subsequently change its mind. For example, after two years, it might decide that it wants a floating rate liability again. If so, it can go back to a

floating rate liability by arranging with the bank to cancel the swap and agreeing a cancellation payment.



Exercise 2

A company has 5% bonds in issue with a nominal value of 40 million euros. The bonds have ten more years to maturity. The company wants to exchange its fixed rate liability for a floating rate liability in euros. A bank quotes the following rate for a ten-year swap: 4.22 – 4.25.

By arranging a swap, what will be the effective interest cost for the company?

4.3 Using interest rate swaps to hedge interest rate risk

Interest rate swaps are used by companies to manage interest rates on their borrowings, when the company has large amounts of borrowings at fixed or floating rates of interest. (Swaps can also be used to manage interest rates on interest-earning assets, in the case of investment institutions and banks). They can therefore be a method of hedging exposures to interest rate risk.

There are three main ways in which swaps might be used to manage interest rate risks for a company that borrows in large amounts:

- to manage the proportions of fixed rate and floating rate liabilities in a company's overall debts
- to obtain a fixed rate for borrowing when this is not possible in any other way
- to obtain a more favourable interest rate through 'arbitrage'.

Swapping interest rate liabilities

Some large companies use interest rate swaps to manage their net interest liabilities (in each currency). For example, a company that borrows extensively, through a combination of bank loans and bond issues, might have a policy that:

- 25% of its debts should be at a fixed rate
- 25% of its debt should be at a floating rate, and
- the remaining 50% may be at a fixed or floating rate, or a mixture of fixed and floating, depending on the judgement of the finance director or treasury department.

The company might then use interest rate swaps to alter its net liabilities, within the company's policy guidelines, between fixed rate and floating rate. It might move towards more floating rate liabilities if interest rates are expected to fall, and towards fixed rate liabilities when interest rates are expected to rise.

The advantage of using swaps is that a company can alter its net liabilities from fixed to floating rate or floating to fixed rate, without having to alter or re-negotiate its actual loans or bond issues. For example, a company with fixed rate bonds can swap from fixed to floating rate liabilities with a swap, without having to redeem the bonds early and negotiate a floating rate loan with a bank.

Obtaining fixed rate liabilities

Many companies are unable to obtain fixed rate debt. Fixed rate interest liabilities come from issuing bonds. Medium-term bank loans are normally at a floating rate of interest. If a company is too small to issue bonds, or does not have the credit status to issue bonds, it must borrow from banks to obtain debt finance.

If a company wants fixed rate liabilities, but can only borrow from a bank at a variable rate, it can:

- obtain a loan at a variable rate and
- swap its variable rate liability into an effective fixed rate liability by means of a swap.



Example

A company borrows from its bank for five years at LIBOR plus 150 basis points. It wants its interest rate liabilities to be fixed, so it makes a five-year swap transaction with a bank, in which it pays a fixed rate of 5.8% and receives LIBOR.

As a result of the swap, the company's net interest obligations are fixed at 7.3%.

	%
Loan payments	(LIBOR + 1.50)
Swap payments and receipts	
Receive the floating rate	LIBOR
Pay the fixed rate	(5.80)
Net interest cost	(7.30)

Credit arbitrage

At one time, swaps were sometimes used to obtain a lower interest rate on borrowing. This was possible because swaps banks were able to identify opportunities for 'credit arbitrage'. These opportunities arose because of anomalies in the rates of interest at which different companies could borrow. Swaps could be used to exploit these anomalies and enable companies to borrow at a lower effective rate of interest.

When an opportunity for credit arbitrage exists, one of the following situations will occur.

Situation 1

Two companies want to borrow. They can both borrow at either a fixed rate or a floating rate. Company A has to pay a higher rate of interest than Company B. However, the difference in borrowing costs between the two companies is less for fixed rate borrowing than for variable rate borrowing.

For example:

	Fixed rate borrowing cost	Variable rate borrowing cost
Company A	7.25%	LIBOR + 1.5%
Company B	6.50%	LIBOR + 0.5%
Difference	<u>0.75%</u>	<u>1.0%</u>

Credit arbitrage is possible using an interest rate swap if Company A wants to borrow at a variable rate of interest and Company B wants to borrow at a fixed rate.

Situation 2

Two companies want to borrow. They can both borrow at either a fixed rate or a floating rate. Company C has to pay a higher rate of interest than Company D. However, the difference in borrowing costs between the two companies is more for fixed rate borrowing than for variable rate borrowing.

For example:

	Fixed rate borrowing cost	Variable rate borrowing cost
Company C	7.75%	LIBOR + 1.5%
Company D	6.50%	LIBOR + 0.5%
Difference	<u>1.25%</u>	<u>1.0%</u>

Credit arbitrage is possible using an interest rate swap if Company C wants to borrow at a fixed rate of interest and Company B wants to borrow at a variable rate.



Example

A bank is aware that two companies can borrow at the following rates:

	Fixed	Floating
Company A	5.50%	LIBOR + 0.50%
Company B	6.40%	LIBOR + 1%

Company A wants to borrow at a floating rate, and can do so at LIBOR + 0.50%. Company B wants to borrow at a fixed rate, and can do so at 6.40%. However, an opportunity for credit arbitrage exists, because company A can borrow at a fixed rate 0.90% lower than company B, but at a floating rate only 0.50% lower than company B. The opportunity for credit arbitrage totals 0.40% (0.90% - 0.50%).

A bank might therefore propose the following arrangement:

- Company A should borrow at a fixed rate, by issuing bonds at 5.50%. Company B should borrow at a floating rate, by obtaining a bank loan at LIBOR + 1%.
- Company A should enter into a swap with the bank in which it receives 5.20% fixed and pays LIBOR.

- Company B should enter into a swap with the bank in which it pays 5.25% fixed and receives LIBOR.

The net interest cost of each company would be as follows:

	Company A	Company B
	%	%
Borrowing cost	(5.50)	(LIBOR + 1)
Swap payments		
Receive	5.20	LIBOR
Pay	(LIBOR)	(5.25)
Net cost	<u>(LIBOR + 0.30)</u>	<u>(6.25)</u>

Company A reduces its net borrowing cost by 0.20% below the cost of borrowing directly at a floating rate, and company B reduces its fixed rate cost by 0.15% below the cost of issuing bonds at 6.40%. The bank makes a profit of 0.05% from the difference between its fixed rates in the swap for receiving (5.25% from company B) and paying (5.20% to company A).

4.4 Interest rate options

Options were explained in the previous chapter. Options on interest rates give the holder of the option the ability to fix an effective maximum interest rate for borrowing or a minimum interest rate on a deposit.

An interest rate option is an option on a notional loan or deposit, where the loan or deposit period begins:

- on the expiry date for the option for a European-style option, or
- on or before the expiry date for the option, for an American-style option.

The option guarantees a maximum or a minimum rate of interest for the option holder, and interest rate options are therefore sometimes called **interest rate guarantees** or **IRGs**.

- A call option guarantees a maximum rate of interest.
- A put option guarantees a minimum rate of interest.

The maximum or minimum rate of interest guaranteed by the option is the strike rate for the option, in comparison with an agreed benchmark rate of interest, such as LIBOR or euribor.



Example

For example, a company might buy an interest rate call option on a six-month loan starting in three months' time (i.e. the option has an expiry date in three months' time). The option might relate to a notional principal amount of \$10 million, and the strike rate might be 5%. This would give the option holder the right in three months' time to borrow the (notional) \$10 million for six months at a rate of 5%.

Since it is an option, the option holder can choose whether to exercise this right or whether to let the option lapse at expiry.

An interest rate option is for a notional loan or deposit. If it is exercised, an actual loan or deposit is not created. Instead, the option is 'cash-settled' by a payment from the writer of the option to the option holder, for the difference between the strike rate in the option and the 'spot' reference rate of interest (e.g. LIBOR) when the option is exercised..

4.5 Types of interest rate option

Many interest rate options are arranged over-the-counter (OTC). These include:

- borrowers' options and lenders' options
- caps, floors and collars.

Options on interest rate futures are traded on the futures exchanges where the interest rate futures are also traded.

Borrowers' options

A borrowers' option guarantees a maximum borrowing rate for the option holder. It is an interest rate call option. The strike rate or exercise rate for the option is compared with an agreed reference rate or benchmark interest rate, such as LIBOR.

- If the reference rate of interest is higher than the strike rate when the option reaches expiry, the option will be exercised. For example if a borrower's option gives its holder the right to borrow \$20 million for three months at a strike rate of 4.5% but the three-month LIBOR rate is 6%, the option will be exercised. The option writer must then make a payment to the option holder for the difference between the actual LIBOR interest rate (reference rate) and the strike rate for the option.
- If the reference rate of interest is lower than the strike rate when the option reaches expiry, the option holder will let the option lapse.

A borrower's option can therefore be used to fix a maximum effective borrowing rate for a future short-term loan, but allow the option holder to benefit from any fall in the interest rate up to the expiry date for the option.

An option has a purchase cost for its buyer, and the premium for the option might be expressed either:

- as an actual percentage of the notional principal amount, or
- as an annual rate of interest on the notional principal amount.



Example

A company intends to borrow US\$10 million in four months' time for a period of three months, but is concerned about the volatility of the US dollar LIBOR rate. The three-month US\$ LIBOR rate is currently 3.75%, but might go up or down in the next four months. The company therefore takes out a borrower's option with a

strike rate of 4% for a notional three-month loan of US\$10 million. The expiry date is in four months' time. The option premium is the equivalent of 0.5% per annum of the notional principal. For simplicity, we shall suppose that the company is able to borrow at the US dollar LIBOR rate.

- (a) If the three-month US dollar LIBOR rate is higher than the option strike rate at expiry, the option will be exercised. If the three-month LIBOR rate is 6%, the company will exercise the option, and the option writer will pay the option holder an amount equal to the difference between the strike rate for the option (4%) and the reference rate (6%). The payment will be based on 2% of \$10 million for three months. (This payment is discounted because a borrower's option is settled at the beginning of the notional interest period, and not at the end of the interest period).
- (b) If the three-month US dollar LIBOR rate is lower than the option strike rate at expiry, the option will not be exercised. For example, if the LIBOR rate after four months is 3%, the option will not be exercised and will lapse.

These possible outcomes are summarised in the table below, assuming (for the purpose of illustration) a spot LIBOR rate at the option expiry date of (a) 6% and (b) 3%.

	LIBOR rate at expiry	
	6%	3%
	Exercise the option	Do not exercise
	%	%
Borrow for three months at	6.00	3.00
Receive from option writer	(2.00)	-
Cost of option premium	0.50	0.50
Effective interest cost (% annual rate)	<u>4.50</u>	<u>3.50</u>

If the borrower can borrow at the reference rate of interest, a borrower's option sets the maximum borrowing cost at the strike rate plus the option premium cost.

Lenders' options

A lender's option guarantees a minimum deposit rate (savings rate) for the option holder. It is an interest rate put option. In all other respects, it is similar to a borrower's option. The strike rate for the option is compared with an agreed reference rate or benchmark interest rate, such as LIBOR.

- If the reference rate of interest is lower than the strike rate when the option reaches expiry, the option will be exercised. The option writer must make a payment to the option holder for the difference between the actual interest rate (reference rate) and the strike rate for the option.
- If the reference rate of interest is higher than the strike rate when the option reaches expiry, the option holder will let the option lapse.

Swaptions

A swaption is an option on a swap. It gives its holder the right, but not the obligation, to enter into a swap agreement at a future date, on terms that are fixed now.

Swaptions are not commonly used, particularly by companies, because of the cost of the option premium.

Caps, floors and collars

A borrower's option is an option on the interest rate for a short-term loan and a lender's option is similarly an option on the interest rate for one notional short-term deposit.

Some companies might want to hedge their interest rate risk on longer-term bank loans, where they are paying a variable interest rate on the loan over a period of several years. The interest rate on the loan is re-set regularly, typically every three or six months. For example a company might borrow \$20 million for five years, with interest payable at LIBOR + 0.50%, and the interest rate re-set every three months in line with changes in the market (spot) LIBOR rate.

The company might want to hedge its exposure to the risk of an increase in LIBOR over the term of the loan, and might want to use options to fix a maximum rate for the borrowing. A single borrower's option will not be sufficient to enable the company to hedge its interest rate risk over the full term of the loan. Instead, the company can arrange an interest rate cap.

An **interest rate cap** is a series of borrower's options. The exercise date for each option can be scheduled to coincide with the date that the interest rate on a variable rate loan is re-set. In the example, an interest rate cap could be purchased by the company giving it a series of borrower's options over the five-year term of its loan. The options would be timed to coincide with the interest rate re-set dates for the loan – the first after six months, the next after one year, the next after 18 months and so on. In this way, the company is able to fix a maximum effective rate on its borrowing over the full term of the bank loan.

An **interest rate floor** is similar in concept to a cap, except that it is a series of interest rate put options. It gives its holder the right to fix a minimum interest rate for deposits over a period of time.

The main disadvantage of interest rate caps and floors is the high cost charged for the premium by the bank writing the option. The high cost of the premium can discourage companies from using caps to fix a maximum borrowing cost.

An **interest rate collar** is an alternative product for which the cost of the premium is lower. When used instead of an interest rate cap it:

- fixes a maximum interest rate for borrowing over the full term of the option, which might be for several years (in the same way as for a cap), but

- unlike a cap, it also fixes a minimum borrowing cost. If the LIBOR rate falls below a floor level, the option holder will be obliged by the option writer (the bank) to borrow for the interest period at the higher floor rate.

4.6 Short-term interest rate futures (STIRs)

Futures were described in the previous chapter. They are exchange-traded forward contracts. Futures on short-term interest rates are traded extensively, particularly by banks, but could be used by non-bank companies as a means of hedging short-term interest rate risk (i.e. hedging exposures to changes in the near future in a short-term interest rate such as LIBOR).

A short-term interest rate future (STIR) is a contract for the purchase and sale of a standard notional deposit, usually a three-month bank deposit. It has many similarities with a forward rate agreement (FRA), the main difference being that FRAs are 'over-the-counter' products whereas futures are exchange-traded.

The most commonly-traded STIRs include the following:

Contract	Underlying amount = three-month deposit of:
Eurodollar	US\$1,000,000
Euribor	€1,000,000
Short sterling	£500,000

Prices

The futures price for STIRs is the annual interest rate. It is the interest rate at which the seller of the future agrees to 'sell' the notional three-month deposit to the buyer of the futures. However, the rate is deducted from 100, which means that:

- a rate of 4% per year is indicated by a futures price of 96.0000 (100 – 4)
- a rate of 5.2175% is indicated by a futures price of 94.7825
- a price of 93.5618 represents an annual interest rate for the three-month deposit of 6.4382%.

For example, if a company sells a March eurodollar future at 96.50, it is selling to the buyer of the future a notional three-month deposit of \$1,000,000, starting in March, on which the interest rate is 3.5%. The seller therefore will receive 3.5% and the buyer of the future will pay 3.5%. In practice, like FRAs, interest rate futures are not settled by the provision of an actual deposit of \$1,000,000. They are cash settled for the difference between the price at which the future was sold/bought and the current reference rate of interest (LIBOR) at the settlement date.

A reason for pricing STIRs at 100 less the interest rate is that:

- when interest rates go up, the market value of the future will fall, and
- when interest rates fall, the price of the future will rise.

In this way, prices for STIRs move in the same way as cash market prices for bonds and other interest products.

4.7 Hedging short-term interest rate exposures with STIRs

STIRs can be used to hedge exposures to the risk of a rise or fall in short-term interest rates between the time the future is sold or bought and the settlement date for the future. Most STIRs are traded for settlement dates within the next six months or so. Using short-term interest rate futures is similar to using currency futures to hedge a currency exposure. However, the following rules need to be applied:

- If the aim is to hedge against the risk of an increase in the short-term interest rate, the hedge is created by **selling futures**. If the interest rate does go up, futures prices will fall, and there will be a profit on the short position in STIRs
- If the aim is to hedge the risk of a fall in the short-term interest rate, the hedge is created by **buying futures**.



Example

It is February. A company intends to borrow £10 million in June for three months and for simplicity it is assumed that the company can borrow at the LIBOR rate. It decides to hedge its exposure to a rise in the LIBOR rate between 'now' and June by selling June sterling interest rate futures. Suppose the selling price for the futures is 94.00 (= 6%).

When the futures reach their settlement date in June, the actual LIBOR rate might be 7.5%. If so, the company will borrow £10 million at 7.5%. However, in settlement of its futures position, it has sold notional deposits at 6% and on settlement buys them back at the current LIBOR rate of 7.5%, giving itself a 1.5% profit on the futures trading. Its net effective interest cost for the next three months is therefore $7.5\% - 1.5\% = 6\%$, which is the rate at which it sold the futures in February.

If the LIBOR rate at settlement in June had been 5.5%, the company would have borrowed for three months at 5.5% but would have made a loss on settlement of its futures position. The loss would be 0.5% (= $6\% - 5.5\%$) and so its effective interest cost for the next three months would be $5.5\% + 0.5\% \text{ loss} = 6\%$ - the rate fixed by the sale of the futures in February.

Number of futures for a hedge

If a company knows that it will need to borrow \$20 million for three months in September, and that the borrowing rate will be linked to dollar LIBOR, it can sell September futures. Since each future is for a three-month deposit of \$20 million, it will need to sell 20 September futures.

Short-term interest rate futures are futures for three-month deposits. If a company wishes to hedge an interest rate risk for a different interest period, such as two months, four months or six months, the number of futures to create the hedge should be adjusted by a factor:

(Interest period to be hedged / 3 months).



Example: number of futures for the hedge

It is now the end of October. A company expects to borrow \$5 million for six months from February, in four months' time and is concerned about the risk of a rise in the eurodollar interest rate. It decides to hedge the exposure with eurodollar futures. Each eurodollar future is for a three-month deposit of \$1,000,000.

The company will hedge the position by selling March futures. The number of contracts required for the hedge for a six-month loan is:

$$\frac{\$5,000,000}{\$1,000,000 \text{ per contract}} \times \frac{6 \text{ months}}{3 \text{ months}} = 10 \text{ contracts}$$

If changes in the three-month interest rate and changes in the six-month interest rate are similar during the period that the hedge is in place, hedging with three-month STIRs will be an effective method of hedging exposures to movements in the six-month interest rate.

Closing a futures position before settlement

The previous chapter explained how sellers or buyers of futures can close their futures position before their settlement date. For example a seller of December futures can close the position by purchasing the same number of December futures at any time before settlement date in December.

On closing a futures position, there is a gain or loss on the futures trading, equal to the difference between the buying and selling prices.



Example: hedging with short-term interest rate futures

In July a company bought 10 December Eurodollar STIRs at 96.00. In November it closed its position by buying 10 December futures at 95.40.

It makes a profit on closing the position, because the buying price is less than the selling price by 0.60%. Since a future involves the sale of a notional deposit of \$1,000,000 for three months, the value of the profit on futures trading for each future is $0.60\% \times \$1,000,000 \times 3/12 = \$1,500$. The total profit on 10 futures is therefore \$15,000.



Example: hedging with short-term interest rate futures

A company will need to borrow 8 million euros from the end of May. It is now January. The company is concerned about the risk of a rise in the euribor rate (the benchmark interest rate for the euro) and it wishes to hedge its position with futures. The current spot euribor rate is 3.50% (for both three months and six months) and the current June euribor futures price is the same, 96.50.

Required:

- (a) How should the company hedge its interest rate exposure if it plans to borrow the 8 million euros for (1) three months or (2) six months?

- (b) Suppose that in May when the company borrows the 8 million euros, the three-month and six-month spot euribor rate is 4.25% and the June futures price is the same, 95.75 (100 – 4.25). Calculate the effective annual interest rate that the company has secured with its futures hedge if it borrows the 8 million euros for (1) three months or (2) six months.

a**Answer**

The exposure is to the risk of a rise in the euribor rate. Therefore the company should:

- sell 8 June euribor futures (€8,000,000/€1,000,000 per contract) if it is hedging a three-month loan exposure, and
- sell 16 June contracts (8 contracts × 6 months/3 months) if it is hedging a six-month loan exposure.

In May, the futures position will be closed. The selling price is 95.75.

Open futures position: sell at	96.50
Close position: buy at	<u>95.75</u>
Gain	<u>00.75</u>

Gain = 0.75% per contract.

Total gain on futures position:

- (a) Hedging the three-month rate = 8 contracts × 0.75% × €1,000,000 × 3/12 = €15,000.
- (b) Hedging the six-month rate = 16 contracts × 0.75% × €1,000,000 × 3/12 = €30,000.

The company will borrow 8 million euros at 4.25%.

	(a) Hedging the three-month rate	(b) Hedging the six-month rate
	€	€
Interest cost: €8 million × 3/12 × 4.25%	85,000	
Interest cost: €8 million × 6/12 × 4.25%		170,000
Minus gain on futures position	<u>(15,000)</u>	<u>(30,000)</u>
Net effective cost	<u>70,000</u>	<u>140,000</u>

The net effective cost can be converted into an effective annual interest rate that has been achieved by the hedge with futures.

- (a) Net effective interest rate for hedge of three-month rate =

$$\left(\frac{70,000}{8,000,000} \right) \times \frac{12}{3} = 0.035 \text{ or } 3.50\%.$$

(b) Net effective interest rate for hedge of six-month rate =

$$\left(\frac{140,000}{8,000,000} \right) \times \frac{12}{6} = 0.035 \text{ or } 3.50\%.$$

This hedge against interest rate using futures therefore fixes the effective interest rate at the interest rate when the futures position was opened.

Difficulties with short-term interest rate futures as a method of hedging risk

A problem with short-term interest rate futures as a method of hedging interest rate risk is that it is often difficult to arrange a 'perfect hedge'.

- Futures contracts are for standard quantities of notional deposits. The amount of a loan that needs to be hedged might not be a convenient multiple of the size of interest rate futures. For example, to hedge the interest rate on a future three-month loan of \$11.5 million, a company would need to sell either 11 futures (\$11 million) or 12 futures (\$12 million). It cannot sell 11.5 futures.
- Positions in futures contracts are normally closed before settlement date for the contract, and there is a gain or loss on closing out the position. However futures prices are not the same as the current spot interest rate until settlement date is reached. The gain or loss on closing a futures position is therefore not exactly the same as the difference between the original futures price (to open the futures position) and the spot market interest rate on the date the position is closed.

Because STIRs do not provide a perfect hedge, companies that choose to hedge exposures to changes in short-term interest rates in the near future are more likely to do so with FRAs rather than STIRs.

4.8 Conclusion: using financial derivatives

This chapter and the previous chapter have both tried to explain how financial futures might be used to hedge interest rate risk or currency risk.

In practice, swaps, options and futures are used mainly by banks and other financial and investment institutions, although they are sometimes used by other companies. Non-bank companies are likely to prefer other methods of hedging exposures to risk, including forward contracts (forward exchange contracts and FRAs).

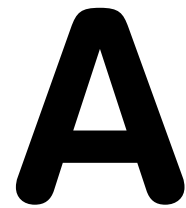
A final point to note is that although derivatives can be used to hedge risk, they can also be used to speculate and try to make profits on movements in the prices of financial items such as currency rates and interest rates.

In the case of options, option writers hope to profit by receiving the option premium and hoping that the option will not be exercised at expiry (or if the option is exercised, its 'loss' on exercise is less than the premium income it has received). Options are a 'zero sum game' in which the option writer makes a profit only if the option buyer makes a loss.

In the case of futures, a company (or bank) might expose itself to risk by opening up a large position in currencies, interest rates or share prices, hoping to make a large

profit from favourable price movements – but with the risk of making large losses if the market price moves adversely.

This is why companies that allow their treasury department to make some speculative deals in derivatives need to set 'dealing limits' or 'exposure limits' on how much speculative trading they are allowed.



Answers to exercises

Chapter 6: Cash management

Exercise 1

$$\sqrt{\frac{2 \times 250 \times 16,000,000}{0.05}}$$

$$= \$400,000.$$

Exercise 2

Miller-Orr model exercise

$$\text{Daily interest rate} = {}^{365}\sqrt{(1.07)} - 1 = 0.000185$$

$$\text{Spread} = 3 \times \left[\frac{{}^{3/4} \times 120 \times (1,800)^2}{0.000185} \right]^{1/3}$$

$$= 3 \times \$11,638$$

$$= \$34,914.$$

(a) The upper limit = \$40,000 + \$34,914 = \$74,914, say \$75,000.

(b) The return point = \$40,000 + \$11,638 = \$51,638. This may be rounded to \$51,500 or \$52,000.

Chapter 7: Introduction to investment appraisal and capital investment decisions

Exercise 1

Total cash profits:	\$
Years 1 – 3 (3 × \$66,000)	198,000
Years 4 – 6 (3 × \$42,000)	<u>126,000</u>
	324,000
Less depreciation over six years (240,000 – 24,000)	<u>216,000</u>
Total profits	<u>108,000</u>
 Average annual profit (\$108,000/6)	 \$18,000

$$(a) \quad ARR = \frac{\$18,000}{(\$240,000 + \$40,000)} \times 100\% = 6.4\%$$

(b)

	\$
Starting value of the equipment	240,000
Value of the equipment at the end of Year 6	<u>24,000</u>
	264,000
Average capital employed in the equipment (÷ 2)	132,000
Working capital	<u>40,000</u>
Average investment	<u>172,000</u>

$$ARR = \frac{\$18,000}{\$172,000} \times 100\% = 10.5\%$$

(c) A project should not be undertaken on the basis of its ARR.

Exercise 2

Year	Project A		Project B	
	Cash flow	Cumulative cash flow	Cash flow	Cumulative cash flow
	\$	\$	\$	\$
0	(80,000)	(80,000)	(80,000)	(80,000)
1	20,000	(60,000)	60,000	(20,000)
2	36,000	(24,000)	24,000	4,000
3	36,000	12,000		

(1) If cash flows occur at the end of each year, Project A will pay back after three years and Project B will pay back after two years.

- (2) If cash flows occur at a constant rate throughout the year:
 Project A will pay back after 2 years + $[(24,000/36,000) \times 12 \text{ months}]$
 = 2 years 8 months.
 Project B will pay back after 1 year + $[(20,000/24,000) \times 12 \text{ months}]$
 = 1 year 10 months.
- (3) Both projects meet the policy requirement that investments must pay back within three years. The preferred choice would be project B, which pays back more quickly.
- (4) However, an investment decision should not be made on the basis of payback alone. Payback ignores the total expected returns from a project. In this example, project A is expected to be more profitable over its full life.
 In addition, payback method ignores the time value of money.

Chapter 8: Discounted cash flow

Exercise 1

To obtain an investment of \$125,000 after 5 years, the investor would need to invest now:

$$\$125,000 \times \frac{1}{(1.08)^5}$$

$$= \$125,000 \times 0.6806$$

$$= \$85,075$$

Exercise 2

Year	Cash flow	Cost of capital 12%		Cost of capital 8%		
		Discount factor at 12%	PV	Discount factor at 8%	PV	
	\$		\$		\$	
0	(70,000 + 5,000)	(75,000)	1.000	(75,000)	1.000	(75,000)
1	25,000	0.893	22,325	0.926	23,150	
2	20,000	0.797	15,940	0.857	17,140	
3	30,000	0.712	21,360	0.794	23,820	
4	20,000	0.636	12,720	0.735	14,700	
5	(3,000 + 7,000 + 5,000)	15,000	0.567	8,505	0.681	10,215
NPV			+ 5,850		+ 14,025	

Exercise 3

Annuity factor at 8%, years 1 – 10	6.710
Annuity factor at 8%, years 1 – 5	3.993
Therefore annuity factor at 8%, years 6 – 10	<u>2.717</u>

Year	Annual cash flow	Discount factor at 8%	Present value
	\$		\$
0	(70,000)	1.000	(70,000)
1 – 5	15,000	3.993	59,895
6 – 10	10,000	2.717	27,170
NPV			+17,065

Exercise 4

The year 5 value of an annuity of \$80,000 per year in perpetuity, at a discount factor of 12%:

$$= \$80,000/0.12 = \$666,667.$$

Year	Annual cash flow	Discount factor at 12%	Present value
	\$		\$
0	(800,000)	1.000	(800,000)
1 – 5	100,000	3.605	360,500
5	666,667	0.567	378,000
NPV			(61,500)

At a cost of capital of 12%, the investment has a negative NPV and should not be undertaken.

Chapter 9: DCF: taxation and inflation

Exercise 1

Workings

Tax allowances on the investment

Year of claim		Tax saving (30% of allowance)	Cash flow year
		\$	\$
0	Cost	120,000	
	Allowance (25%)	(30,000)	
		90,000	1
1	Allowance (25%)	(22,500)	
		67,500	2
2	Allowance (25%)	(16,875)	
		50,625	3
3	Allowance (25%)	(12,656)	
		37,969	4
4	Disposal	(45,000)	
	Balancing charge	(7,031)	
		(2,109)	5

NPV calculation

Year	0	1	2	3	4	5
	\$	\$	\$	\$	\$	\$
Capital equipment	(120,000)				45,000	
Savings before tax		50,000	50,000	50,000	50,000	
Tax on savings (30%)			(15,000)	(15,000)	(15,000)	(15,000)
Cash effect of allowances		9,000	6,750	5,063	3,797	(2,109)
Net cash flow	(120,000)	59,000	41,750	40,063	83,797	(17,109)
DCF factor at 11%	1.000	0.901	0.812	0.731	0.659	0.593
PV of cash flow	(120,000)	53,159	33,901	29,286	55,222	(10,146)
NPV		+ 41,422				

The NPV is + \$41,422. This indicates that the project should be undertaken.

Exercise 2**Cash flows with inflation**

Year	Machine	Revenue	Costs	Net cash flow	DCF factor at 16%	PV
	\$	\$	\$	\$		\$
0	(200,000)			(200,000)	1.000	(200,000)
1		214,000	(112,000)	102,000	0.862	87,924
2		228,980	(125,440)	103,540	0.743	76,930
3		306,261	(175,616)	130,645	0.641	83,743
4		196,619	(118,014)	78,605	0.552	43,390
5	25,526	140,255	(88,117)	77,664	0.476	36,968
						+ 128,955

Chapter 10: DCF: risk and uncertainty**Exercise 1**

Year	Discount factor at 10%	Strong economy Probability 0.75		Weak economy Probability 0.25	
		Cash flow	PV	Cash flow	PV
		\$	\$	\$	\$
0	1.000	(1,000,000)	(1,000,000)	(1,000,000)	(1,000,000)
1	0.909	400,000	363,600	100,000	90,900
2	0.826	600,000	495,600	300,000	247,800
3	0.751	400,000	300,400	200,000	150,200
4	0.683	300,000	204,900	50,000	34,150
NPV			364,500		(476,950)

Expected value of the NPV

$$= (0.75 \times \$364,500) + (0.25 \times \$(-476,950))$$

$$= + \$154,138.$$

Using the EV of NPV as the basis for making the investment decision, the project should be undertaken.

However, there is a 25% risk that the NPV will be negative.

Chapter 11: Capital investment appraisal: further aspects**Exercise 1****(a) Replace every year**

Year		Cash flow	Discount factor at 12%	PV
		\$		\$
0	Purchase cost	(30,000)	1.000	(30,000)
1	Running costs	4,000		
1	Disposal value	15,000		
1	Net cash flow, Year 1	11,000	0.893	9,823
				<u>(20,177)</u>
	Annuity factor at 12%, Year 1			0.893
	Equivalent annual cost			<u>\$(22,595)</u>

(b) Replace every two years

Year		Cash flow	Discount factor at 12%	PV
		\$		\$
0	Purchase cost	(30,000)	1.000	(30,000)
1	Running costs	(4,000)	0.893	(3,572)
2	Running costs	(5,000)		
2	Disposal value	10,000		
2	Net cash flow, Year 2	5,000	0.797	3,985
				<u>(29,587)</u>
	Annuity factor at 12%, Years 1 – 2			1.690
	Equivalent annual cost			<u>\$(17,507)</u>

(c) Replace every three years

Year		Cash flow	Discount factor at 12%	PV
		\$		\$
0	Purchase cost	(30,000)	1.000	(30,000)
1	Running costs	(4,000)	0.893	(3,572)
2	Running costs	(5,000)	0.797	(3,985)
3	Running costs	(6,500)		
3	Disposal value	6,000		
3	Net cash flow, Year 3	(500)	0.712	(356)
				<u>(37,913)</u>
	Annuity factor at 12%, Years 1 – 3			2.402
	Equivalent annual cost			<u>\$(15,784)</u>

(d) Replace every four years

Year		Cash flow	Discount factor at 12%	PV
		\$		\$
0	Purchase cost	(30,000)	1.000	(30,000)
1	Running costs	(4,000)	0.893	(3,572)
2	Running costs	(5,000)	0.797	(3,985)
3	Running costs	(6,500)	0.712	(4,628)
4	Running costs	(8,000)		
4	Disposal value	1,000		
4	Net cash flow, Year 4	(7,000)	0.636	(4,452)
				<u>(46,637)</u>
	Annuity factor at 12%, Years 1 – 4			3.037
	Equivalent annual cost			<u>\$(15,356)</u>

Recommendation

The machine should be replaced every four years, because this replacement policy gives the lowest equivalent annual cost.

Chapter 14: Capital structure

Exercise 1

	\$	\$	% increase
Sales	<u>800,000</u>	<u>1,000,000</u>	+ 25%
Variable costs	200,000	250,000	
Fixed costs	<u>400,000</u>	<u>400,000</u>	
Total costs	<u>600,000</u>	<u>650,000</u>	
Profit before interest and tax	200,000	350,000	+ 75%
Interest (\$1,200,000 × 10%)	<u>120,000</u>	<u>120,000</u>	
Profit before tax	80,000	230,000	
Tax at 40%	<u>32,000</u>	<u>92,000</u>	
Earnings	<u>48,000</u>	<u>138,000</u>	+ 187.5%
Number of shares	800,000	800,000	
EPS	\$0.06	\$0.1725	+ 187.5%

(a) Operational gearing = $\frac{75\%}{25\%} = 3.0$

(b) Financial gearing = $\frac{187.5\%}{75\%} = 2.5$

(c) Combined gearing = $\frac{187.5\%}{25\%} = 7.5$

(d) Operational gearing × Financial gearing = Combined gearing
 $3.0 \times 2.5 = 7.5$

An increase of 1% in sales will result in an increase in EPS of 7.5%, because of the effects of operational and financial gearing.

Chapter 16: Cost of capital

Exercise 1

Value of the convertible bond if it is expected to convert the bonds into shares

Year		Amount	Discount factor at 6%	Present value
		\$		\$
1	Interest	4.00	0.943	3.77
2	Interest	4.00	0.890	3.56
2	Share value (25 × \$4.25)	106.25	0.890	94.56
				<u>101.89</u>

Value of the convertible bond if not converted into shares

Year		Amount	Discount factor at 6%	Present value
		\$		\$
1	Interest	4	0.943	3.77
2	Interest	4	0.890	3.56
3	Interest	4	0.840	3.36
4	Interest and capital redemption	104	0.792	82.37
				<u>93.06</u>

The value of the convertible bond will be 101.78, in the expectation that the bonds will be converted into shares when the opportunity arises.

Exercise 2

	Market value	Cost	Market value x cost
	\$m		\$m
Equity	80	10%	8.0
Debt	<u>20</u>	5%	<u>1.0</u>
	<u>100</u>		<u>9.0</u>

$$WACC = (9/100) \times 100\% = 9\%.$$

Ignoring corporate taxation, Modigliani and Miller argued that the WACC at all levels of gearing is the same (9%), and the market value of the company is also the same, \$100 million.

If debt is increased to \$40 million and equity is replaced by the increase in debt capital, the total market value will remain at \$100 million. The market value of equity = Total value - Value of debt = \$100 million - \$40 million = \$60 million.

$$\begin{aligned} \text{New cost of equity} &= 9\% + 40/60 [9\% - 5\%] \\ &= 9\% + 2.67\% \\ &= 11.67\%. \end{aligned}$$

Chapter 19: Foreign exchange risk**Exercise 1**

- (a) The French company will be given the more unfavourable rate for selling Australian dollars, 1.5240.

$$\text{It will receive } 7,000/1.5240 = \text{€}4,593.18.$$

- (b) The Australian company needs to buy euros and will be given the more unfavourable rate, which is 1.5240. The cost will be Aus\$18,288 (12,000 × 1.5240).

Exercise 2

The company will be given the more unfavourable rate, $11.2470 + \text{discount } 0.0340 = 11.2810$.

Cost of Mexican pesos = $10,000,000 / 11.2810 = \text{US}\$886,446.24$.

Exercise 3

US\$1 = SwFR 1.2166

£1 = US1.8610

Therefore £1 = $(1.2166 \times 1.8610) = \text{SwFr } 2.2641$.

Chapter 20: Interest rate risk**Exercise 1**

It needs a 2v5 FRA.

It needs to borrow, therefore the FRA bank will quote the higher rate, 3.67%.

If three-month LIBOR is 4.5% on the fixing date for the FRA, the FRA bank will pay the equivalent of $(4.5\% - 3.67\%) = 0.83\%$.

	%
Three-month borrowing rate (4.5% + 50 basis points)	5.00
Less: settlement received in FRA agreement	<u>(0.83)</u>
Effective borrowing rate	<u>4.17</u>

This is the same as the FRA rate of 3.67% + the basis points borrowing margin = $3.67\% + 0.50\% = 4.17\%$.

Exercise 2

Since the company wants to swap to net floating rate payments, it will receive the fixed rate in the swap. The bank will quote the lower of the two rates (the less favourable to its customer).

	%
Cost of bonds	(5.00)
Swap	
Receive	4.22
Pay	<u>(LIBOR)</u>
Net effective interest cost	<u>(LIBOR + 0.78)</u>

Q&A

Practice questions

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1 Equity ratios

The following figures have been extracted from the annual accounts of Rainy:

Issued share capital: 1,000,000 ordinary shares of \$1 each, fully paid.

Issued debt capital: \$250,000 10% debentures.

Reserves

Capital (share premium reserve)	\$200,000
Accumulated profits	\$800,000

Profit and distributions

Profit for the year	\$600,000 (before interest and tax)
Ordinary dividend payments	\$0.20 per share

The current market price of Rainy's equity shares is \$3.20 each. Its debentures are priced at \$90 per cent. The company's rate of corporation tax (income tax) is 30%.

Required

Calculate the ratios that are likely to be of interest to an investor or potential investor in Rainy.

Comment on each.

2 Corporate governance

- What is the main purpose of statutory or voluntary codes of corporate governance?
- What are the main problems or issues that a code of corporate governance might be expected to cover?

3 Cash operating cycle

The working capital (or cash operating) cycle of a business is the length of time between the payment for purchased materials and the receipt of payment from selling the goods made with the materials.

The table below gives information extracted from the annual accounts of Entity M for the past three years.

Entity M - Extracts from annual account

	Year 1	Year 2	Year 3
	\$	\$	\$
Inventory:			
Raw materials	108,000	145,800	180,000
Work in progress	75,600	97,200	93,360
Finished goods	86,400	129,600	142,875
Purchases	518,400	702,000	720,000
Cost of goods sold	756,000	972,000	1,098,360
Sales	864,000	1,080,000	1,188,000
Trade receivables	172,800	259,200	297,000
Trade payables	86,400	105,300	126,000

Required

- calculate the length of the working capital cycle (assuming 365 days in the year); and
- list the actions that the management of Entity M might be take to reduce the length of the cycle.

4 Working capital

DON is a small manufacturing company. Its summarised accounts for the last two years are presented below:

Balance sheets as at 31st March

	Year 5		Year 6	
	\$000	\$000	\$000	\$000
Fixed assets		820		1,000
Current assets				
Inventory	340		420	
Trade receivables	360		570	
Cash	10		0	
	_____	710	_____	990
Total assets		1,530		1,990
Equity and liabilities				
Equity shares of \$0.25		400		400
Accumulated profits		450		530
Total equity		850		930
Medium-term bank loan		200		200
Current liabilities				
Bank overdraft	140		250	
Trade payables	280		510	
Other payables	60		100	
	_____	480	_____	860
Total equity and liabilities		1,530		1,990

Income statements for the year ending 31st March:

	Year 5	Year 6
	\$000	\$000
Sales	1,800	2,900
Gross profit	210	260
Profit before tax	120	160
Taxation	30	40
	90	120

DON paid dividends of \$40,000 each year to the equity shareholders.

Required

Evaluate whether DON is over-trading.

Over-trading is defined as expanding a business quickly with insufficient long-term finance, and relying excessively on short-term sources of finance. A business entity is therefore over-trading when it attempts to carry on a growing volume of business with insufficient working capital

5 Inventory management

KL Games uses wooden boxes as the container for a product that it makes. It has a requirement for 40 wooden boxes a day, for each of the 250 working days (50 weeks) in each year. The boxes are currently bought in batches of 200 from a local supplier for \$2 each. The cost of ordering the boxes from the local supplier is \$65, regardless of the size of the order.

The annual inventory holding cost is 25% of the inventory value.

Required

- Calculate the economic order quantity and the frequency of placing orders. Calculate the annual saving in costs that would be obtained by using the EOQ as the order size instead of buying in batches of 200 boxes per order.
- Recommend whether or not it is worthwhile to make use of the local supplier's new quantity discount scheme below.

Order quantity	Discount
boxes	
0 – 999	0%
1,000 – 4,999	5%
5,000	10%

6 Trade receivables management

Entity M is reviewing its credit policy. It is estimated that if the period of credit allowed to customers is reduced to 60 days, there will be a 25% reduction in annual sales, but bad debts would be reduced by \$30,000 each year. It would also be necessary to spend an extra \$20,000 each year on credit control. Entity M has cash flow difficulties and relies on overdraft finance, for which the interest rate is 9%.

Required

Calculate the effect of these changes on the annual profit. Base your answer on the level of sales in Year 3, and assume that purchases and inventory would be reduced in the same proportion as the reduction in sales.

Entity M - Extracts from annual accounts	Year 3
Inventory	\$
Raw materials	180,000
Work in progress	93,360
Finished goods	142,875
Purchases	720,000
Cost of goods sold	1,098,360
Sales	1,188,000
Trade receivables	297,000
Trade payables	126,000

7 Discount and factor

- (a) A business entity offers its customers trade credit of 90 days. It is considering whether to offer a settlement discount of 2% for payment within seven days.

Required

Calculate the cost of offering the discount, as an annual interest cost.

- (b) Entity C has monthly sales of \$100,000. A factor has offered to take over the administration of Entity C's trade receivables, on a non-recourse basis (or without recourse basis). It would charge a fee of 4% of the value of invoices processed. If the factor takes over this work, Entity C would save monthly administration costs of \$2,000 and would avoid its bad debts, which are 0.75% of sales.

Entity C has been informed by the factor that the average collection period (the time between issuing an invoice and receiving payment from the customer) will be reduced from 2 months to 1 month.

The factor will also provide finance by lending 80% of the value of unpaid invoices, charging interest at an annual rate of 8% on the cash that it lends. At the moment, Entity C finances its trade receivables with bank overdraft finance at 9% per year interest.

Required

Calculate the net effect on annual profits of Entity C if the factor took over the administration of the trade receivables and provided finance on the terms described above.

8 Baumol and Miller-Orr

- (a) Entity X uses a bank account for its daily expenditures. There are no payments into the account. Instead, whenever the account needs more cash, Entity X sells a quantity of marketable securities. These currently provide an interest yield of 5% per year. The cost of selling securities is \$60 per transaction, regardless of the size of the transaction.

Annual payments from the account are \$3,000,000.

Required

Use the Baumol cash management model to decide the optimal size of transaction for selling marketable securities, and the frequency with which securities will be sold. Assume a 365-day year.

- (b) Entity Y uses a bank account for its daily income and expenditures. Each year, it expects income and expenditure to be \$3,000,000. However, daily cash flows are variable, and the standard deviation of daily cash flows is \$2,200. The annual interest rate is 5%.

If the cash balance goes above a certain level, the entity will buy marketable securities to earn interest on the surplus cash. If the cash balance reaches a minimum level, the entity will sell some marketable securities to obtain more cash. The cost of buying or selling securities is \$60 per transaction.

Entity Y uses the Miller-Orr cash management model. It has decided that it should have a minimum cash balance of \$20,000.

Required

Calculate:

- (a) the spread between the lower and upper cash limits
- (b) the upper cash limit
- (c) the return point.

9 Appraisal

A company is considering whether to invest in a new item of equipment costing \$45,000 to make a new product. The product would have a four-year life, and the estimated cash profits over the four-year period are as follows.

Year	\$
1	17,000
2	25,000
3	16,000
4	4,000

The project would also need an investment in working capital of \$8,000, from the beginning of Year 1.

The company uses a discount rate of 11% to evaluate its investments, but has an additional rule that projects will not be undertaken unless they pay back within three years.

Required

Calculate the NPV of the project at the discount rate of 11%.

Using the NPV you have calculated at 11%, and the NPV at a discount rate of 15%, estimate the internal rate of return (IRR) of the project.

Calculate the payback period and state whether the project should be undertaken.

10 Investment appraisal methods

Congo is considering whether to invest in either of two **mutually-exclusive projects**, Project 1 and Project 2. Both projects involve the purchase of machinery with a life of five years.

- Project 1: The machine would cost \$556,000 and would have a net disposal value of \$56,000 at the end of Year 5. The project would earn annual cash flows (receipts minus payments) of \$200,000.
- Project 2: The machine would cost \$1,616,000 and would have a net disposal value of \$301,000 at the end of Year 5. The project would earn annual cash flows (receipts minus payments) of \$500,000.

Congo uses the straight-line method of depreciation. Its cost of capital is 15%.

Ignore taxation, inflation and investment in working capital.

Required

- (a) For each of the two projects, calculate:
 - (i) the accounting rate of return ratio, over the project life (average annual accounting profit as a percentage of the average book value of the investment, to the nearest one per cent)
 - (ii) the payback period, to the nearest month
 - (iii) the net present value, and
 - (iv) the internal rate of return to the nearest one per cent.
- (b) State which project, if any, you would select for acceptance.

Note

At a discount rate of 25%, the following discount factors apply:

Year 5: 0.328.

Years 1 – 5: 2.689.

11 NPV

A company has a cost of capital of 10%. Calculate the NPV of an investment project with the following estimated cash flows:

Years	Cash flow each year
	\$
0	(70,000)
1	15,000
2 – 4	12,000
5 – 10	8,000

State whether the project should be undertaken.

12 DCF and relevant costs

Consolidated Oil wants to explore for oil near the coast of Ruritania. The Ruritanian government is prepared to grant an exploration licence for a five-year period for a fee of \$300,000 per year. The option to buy the licence must be taken immediately; otherwise another oil company will be granted the licence.

However if it does take the licence now, Consolidated Oil will not start its explorations until the beginning of the second year.

To carry out the exploration work, the company will have to buy equipment now. This would cost \$10,400,000, with 50% payable immediately and the other 50% payable one year later. The company hired a specialist firm to carry out a geological survey of the area. The survey cost \$250,000 and is now due for payment.

The company's financial accountant has prepared the following projected income statements. The forecast covers years 2-5 when the oilfield would be operational.

Projected income statements

	Year							
	2	3	4	5				
	\$000	\$000	\$000	\$000	\$000	\$000	\$000	\$000
Sales		7,400	8,300	9,800	5,800			
Minus expenses:								
Wages and salaries	550	580	620	520				
Materials and consumables	340	360	410	370				
Licence fee	600	300	300	300				
Overheads	220	220	220	220				
Depreciation	2,100	2,100	2,100	2,100				
Survey cost written off	250	-	-	-				
Interest charges	650	650	650	650				
	4,710	4,210	4,300	4,160				
Profit	2,690	4,090	5,500	1,640				

Notes

- (i) The licence fee charge in Year 2 includes the payment that would be made at the beginning of year 1 as well as the payment at the beginning of Year 2. The licence fee is paid to the Ruritanian government at the beginning of each year.
- (ii) The overheads include an annual charge of \$120,000 which represents an apportionment of head office costs. The remainder of the overheads are directly attributable to the project.
- (iii) The survey cost is for the survey that has been carried out by the firm of specialists.
- (iv) The new equipment costing \$10,400,000 will be sold at the end of Year 5 for \$2,000,000.
- (v) A specialised item of equipment will be needed for the project for a brief period at the end of year 2. This equipment is currently used by the company in another long-term project. The manager of the other project has estimated that he will have to hire machinery at a cost of \$150,000 for the period the cutting tool is on loan.
- (vi) The project will require an investment of \$650,000 working capital from the end of the first year to the end of the licence period.

The company has a cost of capital of 10%. Ignore taxation.

Required

Calculate the NPV of the project.

13 Annuities and perpetuities

A company has estimated that its cost of capital is 8.8%. It is deciding whether to invest in a project that would cost \$325,000.

Required

- (a) Calculate the NPV if the net cash flows of the project after Year 0 are: Years 1 – 6: \$75,000 per year.
- (b) Calculate the NPV if the net cash flows of the project after Year 0 are:

Year	\$
1	50,000
2 – 6	75,000

- (c) Calculate the NPV if the net cash flows of the project after Year 0 are \$50,000 every year in perpetuity.

14 Investment appraisal and tax

JKL is considering whether to invest in the purchase of a new machine costing \$250,000. The machine will have a four-year life and a net disposal value of \$100,000 at the end of Year 4.

In addition, \$38,000 of working capital will be required from the start of the project, increasing to \$50,000 at the beginning of the second year. All the working capital will be recovered at the end of Year 4.

The project is expected to generate extra annual revenues of \$200,000 and incur annual cash operating costs of \$80,000 for each year of the project. JKL's cost of capital is 10% after tax.

Corporation tax is charged on profits at 35%. Tax is payable in the year following the year in which the profits occur. There will be a 25% annual writing-down allowance on capital expenditure, for tax purposes. The tax-allowable depreciation is calculated by the reducing balance method.

Required

Calculate the NPV of the project and state whether or not it should be undertaken.

15 More investment appraisal and tax

CVB is considering whether to invest in new equipment costing \$600,000. The equipment is expected to have an economic life of five years and will have no disposal value at the end of Year 5 (and no disposal costs).

CVB's after-tax cost of capital is 15%. Tax is charged at an annual rate of 35% and is payable in the year following the year in which the taxable profits arise.

The following forecasts relate to the project under consideration:

	\$000s				
Year	1	2	3	4	5
Sales income	250	250	300	350	400
Direct materials	50	55	58	64	70
Direct labour	25	25	30	30	35
Total direct costs	75	75	88	94	105
Depreciation	120	120	120	120	120

There will be tax allowances on the cost of the equipment, calculated at 25% each year on the reducing balance basis. The first depreciation tax allowance (capital allowance) would be claimed in year 0 (or very early in year 1).

Assume that:

- (1) taxable profits are defined as income minus direct costs and capital allowances
- (2) cash profits in each year = sales minus direct costs

Required

Calculate the Net Present Value of the project and recommend whether or not the project should be undertaken.

16 Investment appraisal and inflation

ASD, a manufacturing company, is considering a proposal to invest in machinery that it will use to increase its output and sales by 10,000 units in each of the next five years. The full purchase cost of the machinery would be \$225,000. This price includes a payment of \$20,000 made 12 months ago to the machinery supplier for a non-refundable down-payment for purchase of the machinery.

The company currently makes and sells a single product. This has a selling price of \$15 per unit and at present-day prices the direct costs per unit are \$3.75 for material and \$2.50 for labour. Incremental production overheads (all cash expenses) would be \$37,500 in each year, at current price levels.

Assume that all cash flows occur at the end of the year to which they relate.

ASD's cost of capital is 10%.

Required

- (a) Calculate the NPV of the project, ignoring inflation.
- (b) Calculate the NPV of the project, at a cost of capital of 10%, taking the following inflationary increases in revenues and costs into consideration:
 - Because of inflation, selling prices will rise by 7% in each year.
 - Material costs will rise by 5% each year, labour costs by 6% each year and overheads by 2% each year.

Comment on the differences in your results, compared with the NPV you calculated in part (a).

17 DCF exercises

- (a) Calculate the NPV of an investment with the following estimated cash flows, assuming a cost of capital of 8%:

Years	Annual cash flow
	\$
0	(3,000,000)
1 – 4	500,000
5 – 8	400,000
9 – 10	300,000
11 onwards in perpetuity (per year)	100,000

- (b) The cash flows for an investment project have been estimated at current prices, as follows:

Year	Equipment	Revenue	Running costs
	\$	\$	\$
0	(900,000)		
1		800,000	(400,000)
2		800,000	(400,000)
3		600,000	(350,000)
4	200,000	400,000	(300,000)

It is expected that the cash flows will differ because of inflation. The annual rates of inflation are expected to be:

- Equipment value: 4% per year
- Revenue: 3% per year
- Running costs: 5% per year.

The cost of capital is 12%

Required

- (i) Calculate the NPV of the project ignoring inflation.
- (ii) Calculate the NPV of the project allowing for inflation.

18 DCF and tax

A company is considering whether or not to invest in a four-year investment project. The project will require the purchase of equipment costing \$800,000. This will have an estimated residual value of \$200,000 at the end of Year 4. The equipment will be depreciated by the straight-line method.

The profits before interest and tax from the project are expected to be \$400,000 each year. Tax is payable at 30% one year in arrears.

The equipment will qualify for capital allowances (tax depreciation allowances) of 25% each year, using the reducing balance method. The first claim for an allowance would be made against Year 0 profits.

The after-tax cost of capital is 15%.

Required

Calculate the NPV of the project.

19 Risk in investment appraisal

East must purchase a new machine for making a new product. There is a choice between two machines, Machine A and Machine B. Each machine has an estimated life of three years with no expected scrap value.

Machine A costs \$15,000 and Machine B costs \$20,000.

The variable costs of manufacture would be \$1 per unit if Machine A is used and \$0.50 per unit if Machine B is used. The product will sell for \$4 per unit.

The demand for the product is uncertain. Following some market research, the following estimates of annual sales demand have been made:

<u>Annual demand</u>	<u>Probability</u>
Units	
2,000	0.2
3,000	0.6
5,000	0.2

The sales demand in each year will be the same. For example, if the demand is 2,000 units in Year 1, it will be 2,000 units for every year of the project.

Taxation and fixed costs will be unaffected by any decision made.

East's cost of capital is 6%.

Required

- (a) Calculate the NPV for each of investment options, Machine A and Machine B, for each of the possible levels of sales demand.
- (b) Calculate the expected NPV for each of the investment options.
- (c) Assume now that the decision is taken to buy Machine A.
 - (i) Calculate the probability that the NPV of the project will be negative
 - (ii) Calculate the minimum annual sales required for the NPV of the project to be positive.

20 Lease or buy

A company is considering whether to acquire a new machine. The machine has a purchase cost of \$30,000, an expected useful life of five years and a disposal value of \$6,000 at the end of year 5. The machine would generate additional cash flows of \$10,000 in each of its five years.

Two methods of financing are under consideration:

- (i) To buy the machine with money obtained from a bank loan, at an interest rate of 8% after tax.

- (ii) To lease the machine. The lease payments to the lessor would be \$7,000 at the end of each of the next five years.

The company's cost of capital is 10% after tax.

Corporation tax is 30%. If the machine is purchased, the company will be able to claim capital allowances (tax depreciation allowances) of 25% each year on a reducing balance basis. Tax is payable at the end of the year following the year in which the profits are earned. The first capital allowance would be claimed against profits earned during Year 1.

Required

- (a) Recommend whether the machine should be acquired.
 (b) If your recommendation is to acquire the machine, recommend whether it should be purchased or leased.

21 Asset replacement

A business entity is considering its policy for the replacement of machines. One type of machine in regular use is machine X. This machine has a maximum useful life of four years, but maintenance costs and other running costs rise with use. An estimate of costs and disposal values is as follows:

Machine X: Purchase cost \$40,000

Year	Maintenance costs and other running costs in the year	Disposal value at the end of the year
	\$	\$
1	8,000	25,000
2	12,000	20,000
3	20,000	10,000
4	25,000	0

The cost of capital is 10%.

Required

Calculate the equivalent annual cost of a replacement policy for the machine of replacement:

- (a) every one year
 (b) every two years
 (c) every three years
 (d) every four years.

Recommend a replacement policy for the machine.

22 Capital rationing

A company has identified five investment projects that it would like to undertake. None of the investments can be delayed. If they are not undertaken now, the opportunity to invest will be lost. Details of the five investments are as follows:

Investment	Capital investment required in Year 0	NPV of the investment
	\$	\$
A	60,000	12,000
B	80,000	21,600
C	50,000	8,500
D	45,000	10,800
E	55,000	9,900

Capital is in short supply, and only \$150,000 is available for investment. The company cannot therefore undertake all five investments.

Required

In order to maximise the total NPV of its investments, recommend which investments to undertake:

- assuming that all five investment projects are divisible.
- assuming that none of the five investments is divisible, and the choice is either 0% and 100% of each investment.

23 Misteri Company

Misteri Company is considering whether to purchase a machine for the manufacture of a new product, Product X. It has been estimated that Product X would have a life of four years and at a selling price of \$8 per unit, annual sales demand would be 400,000 units in Year 1, 600,000 units in Year 2 and 800,000 in each of Years 3 and 4. Variable production and selling costs would be \$6 per unit. Incremental annual fixed cost expenditures (all cash cost items) would be \$500,000 in Year 1, rising by \$20,000 each year.

The machine, which has an annual output capacity of 700,000 units of Product X, would cost \$1,200,000 and would have a resale value of \$200,000 at the end of Year 4. Capital allowances would be available on a 25% annual reducing balance basis, with a balancing charge or allowance in the year of disposal. Tax at 25% is payable one year in arrears of the profits to which it relates.

Misteri Company is financed 70% by equity capital and 30% by debt capital. The equity has a cost of 10% and the debt has a cost of 8.9%.

Required

Calculate the net present value of the proposed project and recommend whether the investment in the machine should be undertaken.

24 Valuation model

The shareholders in a company expect a return of 8% per year on their investment. In the year just ended, the company paid dividends of \$0.24 per share.

Required

- (a) Assume that the company pays out all of its annual profits as dividends, and the annual dividend per share is expected to be \$0.24 in perpetuity.
Using the dividend valuation model, suggest what the expected share price of the company should be.
- (b) Assume that the expected annual rate of growth in dividends is expected to be 3%.
Using the dividend growth valuation model, suggest what the expected share price of the company should be.
- (c) Assume that the company is expected to retain 60% of its profits and reinvest the money to earn an annual return of 9%.
Using the dividend growth valuation model (the Gordon growth model), suggest what the expected share price of the company should be.

25 Rights

A company wishes to increase its production capacity by purchasing additional plant and equipment. Its income statement for the year ended 30th November Year 3 is as follows:

	\$m
Sales revenue	224
Profit before interest and taxation	45.5
Interest	11.4
Profit before tax	34.1
Tax	7.7
Profit after tax	26.4
Earnings per share	\$0.30

To finance the new investment, the company will make a 1 for 4 rights issue. The shares are currently quoted on the Stock Exchange at \$5.50 per share and the new shares will be offered to shareholders at \$4.50 per share.

Ignore the transaction costs of the share issue.

Required

Calculate:

- (a) the theoretical ex-rights price per share
(b) the value of the rights on each existing share.

26 Rights issue

Smeaton Furniture wishes to increase its production capacity by purchasing additional plant and equipment at a cost of \$3.8 million. The abridged profit and loss account for the year ended 30th November 20X6 is as follows:

	\$m
Sales turnover	140.6
Profit before interest and taxation	8.4
Interest	6.8
Profit before tax	1.6
Tax	0.4
Profit after taxation	1.2
Earnings per share	15 cents

In order to finance the purchase of the new plant and equipment, the directors of the company have decided to make a rights issue equal to the cost of the equipment. The shares are currently quoted on the Stock Exchange at \$2.70 per share and the new shares will be offered to shareholders at \$1.90 per share.

Required

- (a) Calculate:
- (i) the theoretical ex-rights price per share
 - (ii) the value of the rights on each existing share
 - (iii) assuming the increase in production capacity will lead to an increase in profit after tax of \$600,000 per annum and the P/E ratio of the company will remain unchanged after the rights issue, calculate the market value per share after the rights issue.
- (b) What are the options available to a shareholder who receives a rights offer from a company?

27 Convertible bonds

A company has the following equity shares and bonds in issue:

- 2,000,000 equity shares of \$0.50 each.
- \$1,000,000 of 4% convertible bonds.

The current earnings per share (EPS) is \$0.25.

The rate of tax is 30%.

The convertible bonds are convertible into equity shares at the rate of 40 shares for every \$100 of bonds.

Required

On the basis of this information, calculate the expected change in EPS if all the bonds are converted into equity shares.

28 Warrants and convertibles

Conver and Warren each have in issue 2,000,000 ordinary shares of \$1 nominal value.

Conver also has \$2,500,000 of 12% convertible debentures in issue. Each \$100 of bonds is convertible into 20 ordinary shares at any time until the date of expiry of the bonds. If the bonds have not been converted by the expiry date, they will be redeemed at 105.

Warren has 500,000 equity warrants in issue. Each warrant gives its holder an option to subscribe for 1 ordinary share at a price of \$5.00 per share. The warrants can be exercised at any time until the date of their expiry.

The shares of both companies, the convertible debentures and the warrants are all actively traded in the stock market.

Required

- (a) Calculate the value of each \$100 unit of convertible debentures of Conver and the value of each warrant of Warren on the day of expiry, if the share price for each company at that date is:

- (i) \$4.40
- (ii) \$5.20
- (iii) \$6.00
- (iv) \$6.80

In each of the four cases (i)–(iv), advise the holders of the convertibles and warrants whether they should exercise their conversion and option rights. Ignore taxation.

- (b) Calculate the earnings per share for each company.

- (i) In a year when all the convertibles and warrants remained outstanding for the whole period.
- (ii) For the first full year following conversion of all the convertibles in Conver and the exercise of all the warrants in Warren.

Profits for each company are currently \$1.2 million each year before interest and taxation. The corporation tax rate is 50%.

Assume that any new cash raised by the company will be invested to earn 10% each year before taxation.

29 Gearing

The following information is available about Company A and Company B:

	Company A	Company B
Capital structure	\$	\$
Equity shares of \$1	10,000	10,000
Reserves	20,000	90,000
	<hr/>	<hr/>
	30,000	100,000
10% debt capital	70,000	0
	<hr/>	<hr/>
	100,000	100,000
	<hr/>	<hr/>
Annual profit	\$	\$
Sales	80,000	80,000
Variable costs	10,000	60,000
	<hr/>	<hr/>
Contribution	70,000	20,000
Fixed operating costs	60,000	10,000
	<hr/>	<hr/>
Profit before interest and tax	10,000	10,000
Interest costs	7,000	0
	<hr/>	<hr/>
Profit	3,000	10,000
Tax (20%)	600	2,000
	<hr/>	<hr/>
Profit after tax (= earnings after interest and tax)	2,400	8,000
	<hr/>	<hr/>

Assume that annual sales now increase for both companies by 25% to \$100,000.

Required

- (a) Calculate the increase in earnings for each company as a result of the increase in sales. Assume that there is no change in the variable costs as a percentage of sales or in total annual fixed costs.
- (b) For each company, calculate:
 - (i) the operational gearing ratio (the percentage change in earnings before interest and tax as a ratio of the percentage increase in sales)
 - (ii) the financial gearing ratio (the percentage change in earnings after tax as a ratio of the percentage increase in earnings before interest and tax)
 - (iii) the combined gearing effect.

30 Financial and operating gearing

SETH produces and sells a single product. The company has issued share capital of 800,000 equity shares of \$1 each. For the year ended 31st March Year 4, the company sold 60,000 units of the product at a price of \$30 each.

The income statement for the year to 31st March Year 4 is as follows:

	\$000	\$000
Sales		1,800
Variable costs	720	
Fixed costs	360	
	_____	1,080
Net profit before interest and tax		720
Minus interest payable		190
Net profit before tax		530
Tax at 35%		186
Net profit after tax		344

The company has decided to introduce a new automated production process, in order to improve efficiency. The new process will increase annual fixed costs by \$120,000 (including depreciation) but will reduce variable costs by \$7 per unit. There will be no increase in annual sales volume.

The new production process will be financed by the issue of \$2,000,000 12.5% debentures.

Required

- (a) Calculate the change in earnings per share if the company introduces the new production process.
- (b) Assume that the company introduces the new production process immediately on 1st April Year 5. Calculate for the year to 31st March Year 5:
 - (i) the degree of operating gearing
 - (ii) the degree of financial gearing
 - (iii) the combined gearing effect.

31 Financing schemes

The balance sheet of Brunel as at 31st November Year 6 is as follows:

Balance sheet as at 30th November Year 6

	\$m	\$m
Non-current assets		24.8
Current assets		
Inventory	18.5	
Trade receivables	21.4	
Bank	1.9	
	_____	41.8
Total assets		66.6

Equity and liabilities	
\$0.50 ordinary shares	10.0
Accumulated profits	22.4
	<hr/>
Total equity	32.4
10% Debentures	15.0
Current liabilities	
Trade payables	15.1
Taxation	4.1
	<hr/>
	19.2
	<hr/>
Total equity and liabilities	66.6
	<hr/>

An income statement for the year to 30th November Year 6 is as follows:

	\$m
Sales	115.4
Profit before interest and taxation	17.9
Interest payable	1.5
Profit before taxation	16.4
Tax (25%)	4.1
Profit after taxation	12.3

The company wishes to expand its production facilities to meet an increase in sales demand for its products. It will need \$18 million of new capital to invest in equipment. It is expected that annual profit before interest and taxation will increase by \$5 million.

Brunel is considering the following three possible methods of financing the expansion programme:

- (i) Issuing 9 million \$0.50 equity shares at a premium of \$1.50 per share.
- (ii) Issuing 12 million 12% \$1 preference shares at par and \$6 million 10% debentures at par.
- (iii) Issuing 6 million equity shares at a premium of \$1.50 per share and \$6 million 10% debentures at par.

Assume that the rate of tax on profits is 25%.

Required

- (a) For each of the financing schemes under consideration:
 - (i) prepare a projected income statement for the year ended 30th November Year 7.
 - (ii) calculate the expected earnings per share for the year ended 30th November Year 7.

- (iii) calculate the expected level of financial gearing as at 30th November Year 7, assuming that dividend payments during the year are \$0.30 per share.
- (b) Assess each of the three financing schemes under consideration from the viewpoint of an existing equity shareholder in Brunel.

32 Free cash flow

A company expects to make profits before interest and tax next year of \$3 million.

Other budgeted information is as follows:

	\$
Interest charges	400,000
Taxation	600,000
Dividend payments	1,200,000
Depreciation charges	550,000
Increase in working capital	150,000
Capital expenditure:	
Asset replacement expenditure	1,000,000
Discretionary expenditure	700,000

Required

Calculate the expected amount of free cash flow next year.

33 Valuation

A company has just paid an annual dividend of 38. The board of directors has a target of increasing the share price to 800, and is considering policies for investment and growth.

Shareholders expect a return on their investment of 10% per year.

Required

Calculate the annual expected growth rate in dividends that would be required to raise the share price to 800. Use the dividend growth model to make your estimate.

34 Valuation of bonds

Assume that bond investors require a return of 9% per year on their investments.

Required

Estimate the market value of the following bonds:

- (a) Irredeemable 7.5% bonds that pay interest annually.
- (b) Bonds paying coupon interest of 6% per year annually, that are redeemable at par in four years' time.

- (c) Bonds paying coupon interest of 10%, redeemable at par after three years, where interest is payable every six months.

Notes:

An annual cost of capital of 9% is equal to a six-monthly cost of capital of 4.4%.

DCF factor at 4.4%, periods 1 – 7 = 5.914

DCF factor at 4.4%, periods 1 – 8 = 6.623

- (d) A convertible bond with a coupon of 5% and interest payable annually: these bonds are convertible after three years into equity shares at the rate of 20 shares for every \$100 nominal value of bonds. The expected share price in three years' time is \$7.

35 Annuities and bond prices

- (a) Calculate the value of the following bonds:
- (i) a zero coupon bond redeemable at par in ten years' time
 - (ii) a bond with an 8% coupon, with interest payable half-yearly, and redeemable at par after ten years.
- Assume that the yield required by investors is 5%, and that this is 2.5% each half year for the purpose of valuing the 8% coupon bond.
- (b) Calculate the value of both bonds in part (a) of the question if the yield required by investors goes up by 1%, to 6% for the zero coupon bond and 3% each half year for the 8% coupon bond.

36 Efficient markets

A company's board of directors makes a decision on 1st May to invest in a new project that will have an NPV of + \$4,000,000. The decision is announced to the stock market on 12th May.

The company has 50 million shares in issue and at close of trading on 30th April these had a market value of \$4 each.

Required

State what would happen to the share price of the company if the stock market:

- (a) has weak form efficiency
- (b) has semi-strong form efficiency
- (c) has strong-form efficiency.

37 WACC

A company has just paid an annual dividend of \$0.18. Investors expect the annual dividend to grow by 3% each year in perpetuity, The current share price is \$1.55 and the total market value of the company's shares is \$1,200,000.

The company has debt capital on which the yield is 7.8% before tax. The rate of tax is 30%. The total value of the company's debt is \$350,000.

Calculate the weighted average cost of capital. Use the dividend growth model to estimate the cost of equity.

38 Optimal WACC

A company has estimated that its cost of debt capital varies according to the level of gearing, as follows:

Gearing	Cost of debt
	%
20	5.0
30	5.4
40	5.8
50	6.5
60	7.2

Gearing is measured as the market value of the company's debt as a proportion of the total market value of its equity plus debt.

The rate of tax is 30%. The ungeared equity beta factor for the company is 0.90.

The risk-free rate of return is 4% and the return on the market portfolio is 9%

Required

Identify the optimal gearing level and WACC.

39 MM, gearing and company valuation

A company has 4,000,000 equity shares in issue. The shares have a current market value of \$10 each. The company is considering whether to issue \$15,000,000 of debt finance and use the cash to buy back and cancel some equity shares. The tax rate is 30%.

According to Modigliani and Miller, if the company decided to issue the debt capital and repurchase shares, what would be:

- (a) the total value of the geared company, and
- (b) the value of equity in the company?

40 Geared beta

A company has \$1,500,000 in equity capital and \$500,000 in debt capital (at market values). The beta value of the equity is 1.126 and the beta of the debt capital is 0.

The risk-free cost of capital is 5% and the market portfolio return is 11%. The tax rate is 30%.

Required

- Calculate the current weighted average cost of capital (WACC).
- Calculate the asset beta for the company and explain what this means.
- Calculate what the equity beta, the cost of equity and the WACC would be if the company consisted of 60% equity and 40% debt.

41 Diversify

Bustra Company is engaged in plastics manufacture. It is now considering a new investment that would involve diversification into chemicals manufacture, where the business risk is very different from the plastics manufacturing industry.

Research has produced the following information about three companies currently engaged in chemicals manufacturing, in the same part of the industry that Bustra is planning to invest.

Company	Equity beta	Financed by:
A	2.66	40% equity capital, 60% debt capital
B	1.56	75% equity capital, 25% debt capital
C	1.45	80% equity capital, 20% debt capital

Bustra is financed by 60% equity capital and 40% debt capital, and would intend to maintain this same capital structure if the new capital investment is undertaken.

The risk-free rate of return is 5% and the return on the market portfolio is 9%. Tax is at the rate of 25%. You should assume that the debt capital of Bustra and Companies A, B and C is risk-free.

Required

- Calculate a suitable cost of equity for the proposed investment by Bustra in chemicals manufacturing.
- Suggest a weighted average cost of capital that should be used to carry out an investment appraisal (NPV calculation) of the proposed project.

42 Acquisition

Big Entity is considering a takeover bid for Little Entity, another company in the same industry. Little is expected to have earnings next year of \$86,000.

If Big acquires Little, the expected results from Little will be as follows:

	Year after the acquisition		
	Year 1	Year 2	Year 3
	\$	\$	\$
Sales	200,000	280,000	320,000
Cash costs/expenses	120,000	160,000	180,000
Capital allowances	20,000	30,000	40,000
Interest charges	10,000	10,000	10,000
Cash flows to replace assets and finance growth	25,000	30,000	35,000

From Year 4 onwards, it is expected that the annual cash flows from Little will increase by 4% each year in perpetuity.

Tax is payable at the rate of 30%, and the tax is paid in the same year as the profits to which the tax relates.

If Big acquires Little, it estimates that its gearing after the acquisition will be 35% (measured as the value of its debt capital as a proportion of its total equity plus debt). Its cost of debt is 7.4% before tax. Big has an equity beta of 1.60.

The risk-free rate of return is 6% and the return on the market portfolio is 11%.

Required

- Suggest what the offer price for Little should be if Big chooses to value Little on a forward P/E multiple of 8.0 times.
- Calculate a cost of capital for Big.
- Suggest what the offer price for Little might be using a DCF-based valuation.

43 Interest rate parity

The following are spot exchange rates.

- US\$/£1 (GBP/USD): 1.8000
- €/£1 (GBP/EUR): 1.5000
- US\$/€1 (EUR/USD): 1.2000

The rates of interest for the next three years are 2.5% on the euro, 3.5% on the US dollar and 5% on sterling.

Required

If the interest rate parity theory applies, what will the spot exchange rates:

- after one year
- after three years?

44 Foreign exchange

- (a) A UK company expects to pay \$750,000 to a supplier in three months' time. The following exchange rates are available for the dollar against sterling (GBP/USD):

Spot	1.8570	–	1.8580
3 months forward	1.8535	–	1.8543

The company is concerned about a possible increase in the value of the dollar during the next three months, and would like to hedge its FX risk.

Required

Explain how the exposure to currency risk might be hedged, and the amount that the UK company will have to pay in sterling in three months' time to settle its liability.

- (b) A German company expects to receive US\$450,000 from a customer in two months' time. It is concerned about the risk of a fall in the value of the dollar in the next two months, and would like to hedge the currency risk using a forward contract.

The following rates are available for the dollar against the euro (EUR/USD):

Spot	1.3015	–	1.3025
2 months forward	25c	–	18c premium

Required

Calculate the company's income in euros from settlement of the forward contract in two months' time.

- (c) A US company must pay £750,000 to a UK supplier in four months' time. It is concerned about the risk of a fall in the value of the dollar in the next two months, and would like to hedge the currency risk using a forward contract.

The following rates are available for the dollar against sterling (\$ per £1):

Spot	1.9820	±	0.002
4 months forward	1.9760	±	0.003

Required

Calculate the cost to the US company of hedging its currency exposure with a forward contract.

45 Money market hedge

A UK company expects to receive \$600,000 in six months' time from a customer. It intends to convert these dollars into sterling.

The current spot rate for the dollar against sterling (GBP/USD) is 1.8800. The six-month interest rates are 5% per year for sterling and 3.5% per year for the US dollar.

Required

- Show how the company can create a money market hedge for its exposure to a fall in the value of the dollar.
- Estimate what the exchange rate should be for a six-month forward contract, GBP/USD.

46 Dunborgen

The treasurer of Dunborgen Company wants to hedge an exposure to currency risk. Dunborgen is a company whose domestic currency is the euro, and the company must make a payment of US\$500,000 to a US supplier in six months' time.

The following market rates are available:

Exchange rates: \$ per €1

Spot	1.604 ± 0.002
6 months forward	1.570 ± 0.004

Six month interest rates	Borrowing	Deposits
Euro	4.8%	4.4%
US dollar	2.5%	2.0%

(These interest rates are expressed as an annual rate of interest.)

Required

Compare the cost of hedging the currency risk exposure with:

- a forward exchange contract
- a money market hedge.

Recommend which method of hedging would be preferable in this situation.

47 FRA

A company will need to borrow \$5 million for six months in three months' time. It can borrow at LIBOR + 0.50%. It expects interest rates to rise before it borrows the money, and so has decided to use an FRA to hedge the risk.

The following FRA rates are available:

2v5	3.82	–	3.77
3v6	3.85	–	3.80
3v9	3.97	–	3.91
6v9	3.92	–	3.87

Required

- (a) How would the company use an FRA to hedge its interest rate risk, and what effective interest rate would be obtained by the hedge.
- (b) What is the difference between an FRA and an interest rate coupon swap?

48 Swap

A company has a bank loan of \$8,000,000 on which it pays a floating rate of US LIBOR plus 1.25%. The company believes that interest rates will soon increase and remain high for the foreseeable future, and it would therefore like to switch its debt liabilities from floating rate to fixed rate.

The loan has four years remaining to maturity. A bank has quoted the following rates for four-year interest rate swaps in dollars:

5.20% - 5.25%

Required

Show how an interest rate swap can be used to switch from floating rate to fixed rate liabilities, and calculate what the effective fixed rate would be.

49 Credit arbitrage

Entity A has an AA credit rating and Entity B has a BBB- credit rating. Both companies want to raise the same amount of long-term debt capital. Entity A wants to borrow at a floating rate of interest and Entity B wants to borrow at a fixed rate.

They are able to borrow at the following rates:

	Fixed rate	Floating rate
Entity A	6.35%	LIBOR + 0.75%
Entity B	7.25%	LIBOR + 1.25%

A bank has identified an opportunity to arrange interest rate swaps with the companies. It would expect to receive a profit margin on the arrangement of 0.10% of the notional principal amount in the swap. The remaining benefits of the credit arbitrage should be shared equally between the two entities.

Required

Explain how the interest rate swaps might be arranged, and show the effective interest rate that will be paid by each entity as a result of the swap.

50 Currency futures

The euro/US dollar currency future is a contract for €125,000. It is priced in US dollars, and the tick size is \$0.0001.

Currency futures are not normally used by companies to hedge currency risks. However, assume that a French company intends to use currency futures to hedge the following currency exposure.

It is now February. The French company has to make a payment of US\$640,000 in May to a supplier.

The price of June euro/US dollar futures is currently 1.2800.

The company is concerned that the value of the dollar will increase in the next few months, and it therefore decides to use futures to hedge the exposure to currency risk.

Required

- (a) How should the company hedge its currency risk with futures?
- (b) Suppose that in May when the company must make the payment in dollars, the June futures price is 1.2690 and the spot rate (US\$/€1) is 1.2710.

Show what will happen when the futures position is closed, and calculate the effective exchange rate that the company has obtained for the US\$640,000.

Q&A

Answers to practice questions

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1 Equity ratios

<u>Earnings per share (EPS)</u>	<u>\$</u>
Profit before interest and tax	600,000
Interest (10% × \$250,000)	25,000
Profit before tax	575,000
Tax (30%)	172,500
Profit available to equity (earnings)	402,500
Number of equity shares	1,000,000
EPS	\$0.4025

This is a measure of the profit per equity share.

$$\text{P/E ratio} = \frac{\$3.20}{\$0.4025} = 7.95 \text{ times}$$

$$\text{Dividend yield} = \frac{\$0.20}{\$3.20} \times 100\% = 6.25\%$$

$$\text{Dividend cover} = \frac{\$0.4025}{\$0.20} = 2.01 \text{ times}$$

This shows that approximately 50% of the earnings for the year have been paid out as dividends and the remainder reinvested in the company.

$$\text{Interest yield on debentures} = \frac{\$10}{\$90} \times 100\% = 11.1\%$$

$$\text{Gearing based on market values} = \frac{\$250,000 \times \left(\frac{90}{100}\right)}{1,000,000 \times \$3.20} \times 100\%$$

$$\text{Gearing based on market values} = \frac{\$225,000}{\$32 \text{ million}} \times 100\% = 7.03\%$$

Note: Gearing could also be measured as market value of debt capital as a % of total market capitalisation (equity + debt). It would then be $\frac{\$225,000}{\$32,225,000} = 6.98\%$

2 Corporate governance

- (a) The main aim of a code of corporate governance should be to ensure that the directors or managers of a company should run the company in the interests of its shareholders.
- (b) The main issues in corporate governance, for both statutory and voluntary codes, are likely to be:

- (i) the composition of the board of directors: achieving a balance of skills and experience, preventing the board from being dominated by one individual or a small group of individuals, the role of non-executive directors (and in particular independent non-executive director)
- (ii) the decision-making responsibilities of the board (and how much decision-making responsibility should be delegated to management)
- (iii) the process of nominating new directors for appointment to the board
- (iv) the process of deciding the remuneration of directors, and trying to ensure that remuneration systems reward directors for success and do not reward them for failure
- (v) the reliability of financial reporting, the independence of the external auditors, and the role of the audit committee
- (vi) communications between a company and its shareholders
- (vii) risk management and internal control, and the review of internal control and risk management systems
- (viii) restricting the scope for insider trading or market abuse.

Corporate social responsibility and protection for whistle-blowers could also be added to this list.

3 Cash operating cycle

- (a) Working capital cycle:

	Year 1	Year 2	Year 3
	days	days	days
Raw materials inventory cycle			
(Raw materials/Purchases) × 365 days	76	76	91
Minus Credit from suppliers			
(Trade payables /Purchases) × 365 days	(61)	(55)	(64)
	15	21	27
Production cycle			
(Work-in-progress/Cost of sales) × 365 days	37	37	31
Finished goods inventory cycle			
(Finished goods/Cost of sales) × 365 days	42	49	47
Credit to customers			
(Trade receivables/Sales) × 365 days	73	88	91
Total length of working capital cycle	167	195	196

- (b) A long working capital cycle means that a large amount of capital will be tied up in working capital.

Actions to reduce the length of the cycle

- **Reduce raw materials inventory cycle** – review the inventory levels and quantities purchased.

Possible disadvantages of reducing inventory levels:

- Risk of stock-outs and production hold-ups
- Loss of bulk discounts.
- Delay payment to suppliers
Possible disadvantages of delaying payments
 - Loss of cash discounts
 - A bad business relationship with suppliers
 - Possible loss of reliable suppliers of supply
 - Suppliers might decide to charge higher prices.
- Speed up the production cycle
Possible disadvantages of making the production cycle shorter
 - Investment may be required in new technology and training
 - Higher rates of pay may be necessary
 - More efficient production should not be allowed to lead to a build-up of finished goods inventories.
- Reduce inventories of finished goods
 - Possible disadvantage of reducing finished goods inventories
 - Possible loss of profit due to stock-outs
- Reduce the period of credit allowed to customers
Possible disadvantage of reducing credit
 - Improved credit control will cost more
 - Cash discounts may be expensive to encourage prompt payment
 - Some loss of sales, because customers might buy from competitors offering better credit terms.

4 Working capital

Overtrading (sometimes referred to as under-capitalisation) occurs when a business entity attempts to expand its sales rapidly without adequate finance, especially medium and long-term finance.

There are several symptoms of overtrading. These are:

- (a) Very rapid growth in sales.
- (b) An increase in inventory levels as a proportion of sales. This means slower inventory turnover.
- (c) Sometimes there are also initial increases in trade receivables. However, as the cash flow problems of the entity get worse, there might be an effort to collect debts more quickly in order to improve the cash flow. If this happens, the average credit period allowed to customers will fall.
- (d) Payments to suppliers and other creditors are delayed. The total of trade payables therefore increases significantly.
- (e) Short-term bank borrowing increases. There is a rise in the bank overdraft. Interest payments therefore increase.

- (f) The proportion of total assets financed by equity will decline.
- (g) The current ratio and liquidity ratio get worse.
- (h) There is a rapid increase in sales relative to the entity's total assets.
- (i) Profit margins fall, and new investment may be delayed.

There is some evidence of over-trading in the case of DON:

- (a) Sales have increased by 61% during the year.
- (b) Inventory levels have increased by 23%. However, this is much less than the increase in sales turnover.

Trade receivables have increased by 58%, which is slightly less than the growth in sales. The average credit period for customers has fallen from 73 days to 72 days.

- (c) Payments to both suppliers have been delayed. Trade payables in Year 5 (measured as payables/sales \times 365 days) were paid in 57 days, but this increased to 64 days in Year 6. However, the increase in the time taken to pay is probably not excessive.
- (d) Short-term borrowing (the bank overdraft) increased from \$140,000 to \$250,000.
- (e) Assets were financed by:

	Year 5	Year 6
	%	%
Equity	56	47
Trade payables	22	31
Bank overdraft	9	13
Medium-term bank loan	13	10

The percentage of total assets financed by equity has fallen by a large amount.

- (f)

	Year 5	Year 6
Current ratio	1.48	1.15
Liquidity ratio	0.77	0.66

Liquidity has worsened.

- (g)

	Year 5	Year 6
Sales/gross assets	1.18	1.46

Sales are being supported by a lower amount of assets per \$1 of sales. This might indicate overtrading, but it might also be the result of increased efficiency.

(h)

	Year 5	Year 6
Gross margin	11.7%	8.96%
Profit before tax/sales	6.7%	5.5%

From the above data it appears that DON is showing many of the symptoms of overtrading.

Although DON is profitable, it is likely to experience cash flow problems if the overtrading gets worse.

5 Inventory management

(a) **Economic order quantity**

(i) $d = 40 \times 250 = 10,000$

$C_o = \$64$

$C_h = 25\% \times \$2 = \0.50

$$EOQ = \sqrt{\frac{2 \times 64 \times 10,000}{0.50}} = 1,600 \text{ units}$$

(ii) **Frequency of orders** = $\frac{1,600}{10,000} \times 250 \text{ days} = 40 \text{ days}$

(iii)

	\$	\$
Annual cost of ordering 200 each time		
Holding costs: $200/2 \times \$0.50$	50	
Ordering costs: $10,000/200 \times \$64$	3,200	
		3,250
Annual cost of ordering 1,600 each time		
Holding costs: $1,600/2 \times \$0.50$	400	
Ordering costs: $10,000/1,600 \times \$64$	400	
		800
Saving by ordering in EOQ-size batches		2,450

(b) **Discounts**

The EOQ is higher than the quantity required to obtain a 5% discount; therefore we do not need to check the total cost of buying in order sizes of 1,000 (the lowest order size for a discount of 5%). Buying the EOQ quantity should be cheaper.

	\$	\$
Annual cost of ordering 1,600 each time		
Purchase costs: $10,000 \times 95\% \times \2	19,000	
Holding costs: $1,600/2 \times 25\% \times 95\% \times \2	380	
Ordering costs: $10,000/1,600 \times \$64$	400	
	19,780	
Annual cost of ordering 5,000 each time		
Purchase costs: $10,000 \times 90\% \times \2	18,000	
Holding costs: $5,000/2 \times 25\% \times 90\% \times \2	1,125	
Ordering costs: $10,000/5,000 \times \$64$	128	
	19,253	

The higher discount is worthwhile. The order quantity should be 5,000 units.

6 Trade receivables management

Loss of sales based on Year 3 = $25\% \times \$1,188,000 = \$297,000$

However, the cost of these sales will be avoided.

Gross profit percentage = $(1,188,000 - 1,098,360)/1,188,000$

= 0.755. Gross profit is 7.55% of sales. It is assumed that the loss from the reduction in sales will be: $7.55\% \times \$297,000 = \$22,424$

	\$
Loss of profit from fall in sales	(22,424)
Additional cost of credit control	(20,000)
	(42,424)
Reduction in bad debts	30,000
Reduction in profit, before savings in interest	(12,424)

Working capital changes

		\$
Reduction in inventories		
Raw materials	(25% × 180,000)	45,000
Work in progress	(25% × 93,360)	23,340
Finished goods	(25% × 142,875)	35,719
		104,059
Reduction in trade payables	(25% × 126,000)	(31,500)
Reduction in trade receivables		
Current trade receivables	297,000	
Receivables after the change = $(60/365) \times 75\% \times \$1,188,000$	146,466	
		150,534
Reduction in working capital		223,093

Cost of financing working capital	9%
Saving per year in interest from reduction	\$20,078

Net effect on annual profit	\$
Reduction in profit, before savings in interest (see above)	(12,424)
Reduction in interest cost	<u>20,078</u>
Net increase in annual profit	<u>7,654</u>

Reducing the credit period to 60 days will result in annual savings of \$7,654.

To achieve these savings, there would have to be a fall in sales by 25%.

Senior management might decide that the size of the savings does not justify such a large fall in annual sales, because of the longer-term consequences this might have for the business.

7 Discount and factor

(a) Cost of offering the discount for early payment =

$$[1 + 2 / (100 - 2)]^{365 / (90 - 7)} - 1$$

$$= (1.02041)^{4.39759} - 1$$

$$= 1.093 - 1 = 0.093 \text{ or } 9.3\%.$$

(b) Annual sales = = \$100,000 × 12 months = \$1,200,000.

Average trade receivables without the factor = \$1,200,000 × 2 months / 12 months = \$200,000.

Average trade receivables with the factor = \$1,200,000 × 1 month / 12 months = \$100,000.

Annual costs	\$	\$
<hr/>		
Without the factor		
Administration (12 × \$2,000)	24,000	
Bad debts (0.75% × \$1,200,000)	9,000	
Interest cost of finance (9% × \$200,000)	<u>18,000</u>	
		51,000
With the factor		
Fees (4% × \$1,200,000)	48,000	
Interest cost of finance		
Factor finance (8% × 80% × \$100,000)	6,400	
Overdraft finance (9% × 20% × \$100,000)	1,800	
		<u>56,200</u>
Net extra cost of the factor per year		<u>5,200</u>

8 Baumol and Miller-Orr

- (a) Optimum size of transaction for investment sales =

$$\sqrt{\frac{2 \times 60 \times 3,000,000}{0.05}}$$

$$= \$84,852, \text{ say } \$85,000.$$

The frequency of investment sales =

$$\frac{\$85,000}{\$3,000,000} \times 365 \text{ days} = \text{every } 10.3 \text{ days}$$

- (b) Standard deviation of daily cash flows = 2,200.

Therefore the variance of daily cash flows = $(2,200)^2 = 4,840,000$.

Daily interest cost = $5\%/365 \text{ days} = 0.0137\%$.

(i)

$$\text{Spread} = 3 \times \left[\frac{\frac{3}{4} \times 60 \times 4,840,000}{0.000137} \right]^{1/3}$$

(Note: 'to the power of $1/3$ = the cube root)

$$\text{Spread} = 3 \times \$11,671 = \$35,013, \text{ say } \$35,000.$$

- (ii) Upper limit = Minimum cash balance + Spread
 $= \$20,000 + \$35,000 = \$55,000$.

- (iii) Return point = $\$20,000 + (1/3 \times \$35,000) = \$31,667$.

When the cash balance reaches \$55,000, the entity will buy \$23,333 of investments, and the cash balance will return to \$31,667.

Similarly, when the cash balance reaches \$20,000, the entity will sell \$11,667 of investments, to return the cash balance to \$31,667.

9 Appraisal

The cash outflow in Year 0 = cost of equipment + working capital investment =
 $\$45,000 + \$8,000 = \$53,000$.

The cash inflow for year 4 = project's net cash profits + working capital recovered =
 $\$4,000 + \$8,000 = \$12,000$.

Year	Cash flow	Cost of capital 11%		Cost of capital 15%	
		Discount factor	PV	Discount factor	PV
	\$		\$		\$
0	(53,000)	1.000	(53,000)	1.000	(53,000)
1	17,000	0.901	15,317	0.870	14,790
2	25,000	0.812	20,300	0.756	18,900
3	16,000	0.731	11,696	0.658	10,528
4	12,000	0.659	7,908	0.572	6,864
NPV			+ 2,221		(1,918)

(a) NPV at 11% cost of capital = + \$2,221

$$(b) \quad IRR = 11\% + \left[\frac{2,221}{(2,221 + 1,918)} \times (15 - 11)\% \right]$$

$$= 11\% + 2.1\% = 13.1\%$$

(c)

Year	Cash flow	Cumulative cash
		flow
	\$	\$
0	(53,000)	(53,000)
1	17,000	(36,000)
2	25,000	(11,000)
3	16,000	5,000
4	12,000	

Payback is during year 3.

If it is assumed that cash flows occur at an even rate through each year, the payback period in years and months

$$= 2 \text{ years} + [(11,000 / 16,000) \times 12 \text{ months}]$$

$$= 2 \text{ years } 8.25 \text{ months.}$$

The project has a positive NPV at a cost of capital of 11% and pays back within three years. Without taking other factors into consideration (for example, risk and uncertainty) the project should be undertaken.

10 Investment appraisal methods

(a) (i) Accounting rate of return: (ARR)

Project 1

$$\text{Average annual profit} = \$200,000 - \$100,000 \text{ depreciation} = \$100,000.$$

$$\text{Average capital employed} = \text{Average carrying value of machine}$$

$$= \frac{1}{2} (\$556,000 + \$56,000) = \$306,000$$

$$\text{ARR} = \frac{\$100,000}{\$306,000} \times 100\% = 32.7\%$$

Project 2

Average annual profit = \$500,000 - \$263,000 depreciation = \$237,000.

Average capital employed = $\frac{1}{2}$ (\$1,616,000 + \$301,000) = \$958,500.

$$\text{ARR} = \frac{\$237,000}{\$958,500} \times 100\% = 24.7\%$$

(ii) **Payback**

Project 1

$$\text{Payback period} = \frac{\$556,000}{\$200,000} = 2.8 \text{ years, or 2 years 9 months}$$

Project 2

$$\text{Payback period} = \frac{\$1,616,000}{\$500,000} = 3.2 \text{ years, or 3 years 2 months}$$

(iii) **Net present value (NPV)**

Project 1

Year	Discount factor at 15%	Project 1		Project 2	
		Cash flow	PV	Cash flow	PV
		\$	\$	\$	\$
0	1.000	(556,000)	(556,000)	(1,616,000)	(1,616,000)
1 – 5	3.352	200,000	670,400	500,000	1,676,000
5	0.497	56,000	27,832	301,000	149,597
NPV			142,232		209,597

(iv) **Internal rate of return (IRR)**

Both projects have a positive NPV at 15%. Try a higher discount rate:

Try 20%

$$\begin{aligned} \text{NPV of Project 1} &= -556,000 + (200,000 \times 2.991) + (56,000 \times 0.402) \\ &= -556,000 + 598,200 + 22,512 \\ &= +\$64,712 \end{aligned}$$

$$\begin{aligned} \text{NPV of Project 2} &= -1,616,000 + (500,000 \times 2.991) + (301,000 \times 0.402) \\ &= -1,616,000 + 1,495,500 + 121,002 \\ &= +\$502 \end{aligned}$$

Try 25%

$$\begin{aligned} \text{NPV of Project 1} &= -556,000 + (200,000 \times 2.689) + (56,000 \times 0.328) \\ &= -556,000 + 537,800 + 18,368 \end{aligned}$$

$$= + \$168$$

$$\begin{aligned} \text{NPV of Project 2} &= -1,616,000 + (500,000 \times 2.689) + (301,000 \times 0.328) \\ &= -1,616,000 + 1,495,500 + 121,002 \\ &= -\$172,772 \end{aligned}$$

$$\text{IRR of Project 1} = 25\% + \left[\frac{168}{(64,712 - 168)} \times (25 - 20)\% \right]$$

$$= 25.01\%, = 25\% \text{ to the nearest } 1\%.$$

$$\text{IRR of Project 2} = 20\% + \left[\frac{502}{502 + 172,772} \times (25 - 20)\% \right]$$

$$= 20.01\%, = 20\% \text{ to the nearest } 1\%.$$

Tutorial note

The NPV of project 1 at 20% and the NPV of project 2 at 25% are close to zero, indicating that the IRR to the nearest 1% must be 20% and 25% respectively.

The calculations of the approximate IRR are shown here to illustrate the technique, which you should learn.

- (b) Project 2 should be recommended because it has a higher NPV.

When there are mutually exclusive projects, ignoring risk and uncertainty, the NPV method should be used to make the project selection.

It does not matter that project 1 seems better on the basis of ARR, payback and IRR.

11 NPV

Workings

	Discount factor at 10%
Annuity factor, years 1 – 4	3.170
Discount factor, Year 1	<u>0.909</u>
Annuity factor, years 2 – 4	<u>2.261</u>
Annuity factor, years 1 – 10	6.145
Annuity factor, years 1 – 4	<u>3.170</u>
Annuity factor, years 5 – 10	<u>2.975</u>

Year	Cash flow	Cost of capital 10%	
		Discount factor	PV
	\$		\$
0	(70,000)	1.000	(70,000)
1	15,000	0.909	13,635
2 – 4	12,000	2.261	27,132
5 – 10	8,000	2.975	23,800
NPV			<u>(5,433)</u>

The project has a negative NPV and so should not be undertaken.

12 DCF and relevant costs

Year	0	1	2	3	4	5
	\$000	\$000	\$000	\$00	\$000	\$000
Sales			7,400	8,300	9,800	5,800
Wages			(550)	(580)	(620)	(520)
Materials			(340)	(360)	(410)	(370)
Licence fee		(300)	(300)	(300)	(300)	(300)
Overheads			(100)	(100)	(100)	(100)
Equipment	(5,200)	(5,200)				2,000
Specialised equipment			(150)			
Working capital		(650)				650
	<u>(5,200)</u>	<u>(6,150)</u>	<u>5,960</u>	<u>6,960</u>	<u>8,370</u>	<u>7,160</u>
Discount factor at 10%	1.000	0.909	0.826	0.751	0.683	0.621
Present value	(5,200)	(5,590)	4,923	5,227	5,717	4,446

$$\text{NPV} = + \$9,523,000$$

The project has a positive NPV. The project should be undertaken because it will increase the value of the company and the wealth of its shareholders.

13 Annuities and perpetuities

- (a) Present value of net cash flows of \$75,000 in Years 1 – 6 =

$$\frac{\$75,000}{0.088} \left[1 - \frac{1}{(1.088)^6} \right]$$

$$= \$852,273 (1 - 0.603)$$

$$= \$338,352$$

Year	Cash flow	Cost of capital 8.8%	
		Discount factor	PV
	\$		\$
0	(325,000)	1.000	(325,000)
1 – 6	75,000 per year		<u>338,352</u>
NPV			<u>+ 13,352</u>

The project has a positive NPV and should be undertaken.

- (b) The annuity PV formula can be used to calculate the 'present value' as at the end of Year 1 for annual cash flows from Year 2 onwards.

End-of-Year 1 'present value' of net cash flows of \$75,000 in Years 2 – 6 =

$$\frac{\$75,000}{0.088} \left[1 - \frac{1}{(1.088)^5} \right]$$

$$= \$852,273 (1 - 0.656)$$

$$= \$293,182$$

Year	Cash flow	Cost of capital 8.8%	
		Discount factor	PV
	\$		\$
0	(325,000)	1.000	(325,000)
1	50,000	1/1.088	45,956
2 – 6	293,182	1/1.088	<u>269,469</u>
NPV			<u>(9,575)</u>

The project has a negative NPV and should not be undertaken.

- (c)

Year	Cash flow	Cost of capital 8.8%	
		Discount factor	PV
	\$		\$
0	(325,000)	1.000	(325,000)
1 onwards in perpetuity	50,000	1/0.088	<u>568,182</u>
NPV			<u>+ 243,182</u>

The project has a positive NPV and should be undertaken.

14 Investment appraisal and tax

Workings

Tax allowances on the investment

Year of claim			Tax saving (35% of allowance)	Cash flow year
		\$	\$	
0	Cost	250,000		
	Allowance (25%)	<u>(62,500)</u>	21,875	1
		187,500		
1	Allowance (25%)	<u>(46,875)</u>	16,406	2
		140,625		
2	Allowance (25%)	<u>(35,156)</u>	12,305	3
		105,469		
3	Allowance (25%)	<u>(26,367)</u>	9,228	4
		79,102		
4	Disposal	<u>100,000</u>		
		<u>(20,898)</u>	(7,314)	5

NPV calculation

Year	0	1	2	3	4	5
	\$	\$	\$	\$	\$	\$
Capital equipment (250,000)					100,000	
Working capital (38,000)	(38,000)	(12,000)			50,000	
Cash profits before tax		120,000	120,000	120,000	120,000	
Tax on profits (35%)			(42,000)	(42,000)	(42,000)	(42,000)
Cash effect of allowances		<u>21,875</u>	<u>16,406</u>	<u>12,305</u>	<u>9,228</u>	<u>(7,314)</u>
Net cash flow	(288,000)	129,875	94,406	90,305	237,228	(49,314)
DCF factor at 10%	1.000	0.909	0.826	0.751	0.683	0.621
PV of cash flow	<u>(288,000)</u>	<u>118,056</u>	<u>77,979</u>	<u>67,819</u>	<u>162,027</u>	<u>(30,624)</u>
NPV		<u>+ 107,257</u>				

The NPV is + \$107,257. This indicates that the project should be undertaken.

15 More investment appraisal and tax

Tax allowances on the investment

Year of claim		Tax saving (35% of allowance)	Cash flow year
		\$	\$
0	Cost	600,000	
	Allowance (25%)	<u>(150,000)</u>	1
1		450,000	
	Allowance (25%)	<u>(112,500)</u>	2
2		337,500	
	Allowance (25%)	<u>(84,375)</u>	3
3		253,125	
	Allowance (25%)	<u>(63,281)</u>	4
4		189,844	
	Allowance (25%)	<u>(47,461)</u>	5
5		142,383	
	Disposal	<u>0</u>	
		<u>142,383</u>	6
		49,834	

Note: It is assumed that the company has taxable profits against which it can claim an allowance in Year 0 (or early in Year 1).

Year	0	1	2	3	4	5	6
	\$000	\$000	\$000	\$000	\$000	\$000	\$000
Sales		250	250	300	350	400	
Materials		(50)	(55)	(58)	(64)	(70)	
Labour		<u>(25)</u>	<u>(25)</u>	<u>(30)</u>	<u>(30)</u>	<u>(35)</u>	
Cash profits		175	170	212	256	295	
Tax at 35%			(61)	(60)	(74)	(90)	(103)
Capital equipment	(600)						
Cash effect of allowances		<u>53</u>	<u>39</u>	<u>30</u>	<u>22</u>	<u>17</u>	<u>50</u>
Net cash flow	(600)	228	148	182	204	222	(53)
DCF factor at 15%	1.000	0.870	0.756	0.658	0.572	0.497	0.432
PV of cash flow	<u>(600)</u>	<u>198</u>	<u>112</u>	<u>120</u>	<u>117</u>	<u>110</u>	<u>(23)</u>
NPV		<u>34</u>					

The project is just worthwhile, because the NPV is + \$34,000. However, the NPV is quite small in relation to the size of the capital investment, and in view of the fact that it is a five-year project.

It might be appropriate to carry out some risk and uncertainty analysis on the project, before deciding whether or not to undertake it.

16 Investment appraisal and inflation

(a)

Contribution each year	=	$$(15 - 3.75 - 2.50) \times 10,000$	=	\$87,500
Minus: Production overheads	=			\$37,500
Contribution	=			<u>\$50,000</u>

Year	Capital cost	Contribution	Net cash flow	DCF factor at 10%	Present value
	\$	\$	\$		\$
0	(205,000)		(205,000)	1.000	(205,000)
1 - 5		50,000	50,000	3.791	<u>189,500</u>
NPV					<u>(15,500)</u>

Ignoring inflation, the project is not worthwhile.

(b) Workings

Year	Sales: Inflation at 7%	Materials: Inflation at 5%	Labour: Inflation at 6%	Overheads: Inflation at 2%	Net cash flow
	\$	\$	\$	\$	\$
At current prices	150,000	(37,500)	(25,000)	(37,500)	
1	160,500	(39,375)	(26,500)	(38,250)	56,375
2	171,735	(41,344)	(28,090)	(39,015)	63,286
3	183,756	(43,411)	(29,775)	(39,795)	70,775
4	196,619	(45,582)	(31,562)	(40,591)	78,884
5	210,382	(47,861)	(33,456)	(41,403)	87,662

Year	Capital cost	Contribution	Net cash flow	DCF factor at 10%	Present value
	\$	\$	\$		\$
0	(205,000)		(205,000)	1.000	(205,000)
1		56,375	56,375	0.909	51,245
2		63,286	63,286	0.826	52,274
3		70,775	70,775	0.751	53,152
4		78,884	78,884	0.683	53,878
5		87,662	87,662	0.621	<u>54,438</u>
NPV					<u>59,987</u>

Allowing for inflation in the cash flows, the NPV of the project is about + \$60,000.

The effect of inflation, particularly because selling prices are expected to rise at a faster rate than costs, is to turn a negative NPV into a positive NPV.

It would be a risky decision to invest in a project, when the project relies for its positive NPV on estimates of future inflation rates.

17 DCF exercises

(a)

Annuity factor at 8%, years 1 – 8	5.747
Annuity factor at 8%, years 1 – 4	3.312
Annuity factor at 8%, years 5 – 8	<u>2.435</u>
Annuity factor at 8%, years 1 – 10	6.710
Annuity factor at 8%, years 1 – 8	5.747
Annuity factor at 8%, years 9 – 10	<u>0.963</u>

The Year 10 value of a perpetuity of \$100,000 each year in perpetuity from Year 11 onwards:

$$= \$100,000 \times 1/0.08$$

$$= \$1,250,000$$

Years	Annual cash flow	Discount factor at 8%	PV
	\$		\$
0	(3,000,000)	1.000	(3,000,000)
1 – 4	500,000	3.312	1,656,000
5 – 8	400,000	2.435	974,000
9 – 10	300,000	0.963	288,900
10	1,250,000	0.463	578,750
NPV			<u>+ 497,650</u>

(b) (i) **Ignoring inflation**

Year	Annual cash flow	Discount factor at 12%	PV
	\$		\$
0	(900,000)	1.000	(900,000)
1	400,000	0.893	357,200
2	400,000	0.797	318,800
3	250,000	0.636	159,000
4	300,000	0.567	170,100
			<u>+ 105,100</u>

(ii) **Allowing for inflation**

Year	0	1	2	3	4
	\$	\$	\$	\$	\$
Equipment	(900,000)				243,101
Revenue		824,000	848,720	655,636	450,204
Running costs		<u>(420,000)</u>	<u>(441,000)</u>	<u>(405,169)</u>	<u>(364,652)</u>
Net cash flow	(900,000)	404,000	407,720	250,467	328,653

Discount factor at 12%	1.000	0.893	0.797	0.636	0.567
Present value	(900,000)	360,772	324,953	159,297	186,346
NPV = + 131,368					

18 DCF and tax

Annual depreciation = $\$(800,000 - 200,000) / 4 \text{ years} = \$150,000 \text{ per year.}$

Annual cash profits = Accounting profit + Depreciation = $\$250,000 + \$150,000 = \$400,000.$

Tax depreciation allowances (capital allowances)

Year of claim		Written down value	Tax saved at 30%	Year of cash flow
		\$	\$	
0	Allowance (25%)	800,000 <u>(200,000)</u>	60,000	1
1	Allowance (25%)	600,000 <u>(150,000)</u>	45,000	2
2	Allowance (25%)	450,000 <u>(112,500)</u>	33,750	3
3	Allowance (25%)	337,500 <u>(84,375)</u>	25,313	4
4	Disposal value	253,125 <u>(200,000)</u>		
4	Balancing allowance	<u>53,125</u>	15,938	5

Year	0	1	2	3	4	5
	\$	\$	\$	\$	\$	\$
Equipment	(800,000)				200,000	
Capital allowance		60,000	45,000	33,750	25,313	15,938
Cash profit		400,000	400,000	400,000	400,000	
Tax on cash profit			<u>(120,000)</u>	<u>(120,000)</u>	<u>(120,000)</u>	<u>(120,000)</u>
Net cash flow	(800,000)	460,000	325,000	313,750	505,313	(104,062)
Discount factor, 15%	1.000	0.870	0.756	0.658	0.572	0.497
Present value	(800,000)	400,200	245,700	206,448	289,039	(51,719)
NPV = + \$289,668						

19 Risk in investment appraisal

(a) and (b)

Machine A

		2,000 demand	3,000 demand	5,000 demand
Year		\$	\$	\$
0		(15,000)	(15,000)	(15,000)
1	(\$4 - \$1)/unit	6,000	9,000	15,000
2		6,000	9,000	15,000
3		6,000	9,000	15,000
Discounted cash flows	Discount factor at 6%	PV	PV	PV
		\$	\$	\$
Year 0	1.000	(15,000)	(15,000)	(15,000)
1	0.943	5,658	8,487	14,145
2	0.890	5,340	8,010	13,350
3	0.840	5,040	7,560	12,600
NPV		1,038	9,057	25,095

Expected value of NPV = $(0.2 \times 1,038) + (0.6 \times 9,057) + (0.2 \times 25,095) = \$10,661$

		2,000 demand	3,000 demand	5,000 demand
Year		\$	\$	\$
0		(20,000)	(20,000)	(20,000)
1	(\$4 - \$0.5)/unit	7,000	10,500	17,500
2		7,000	10,500	17,500
3		7,000	10,500	17,500
Discounted cash flows	Discount factor at 6%	PV	PV	PV
		\$	\$	\$
Year 0	1.000	(20,000)	(20,000)	(20,000)
1	0.943	6,601	9,902	16,503
2	0.890	6,230	9,345	15,575
3	0.840	5,880	8,820	14,700
NPV		(1,289)	8,967	26,778

Expected value of NPV = $(0.2 \times (1,289)) + (0.6 \times 8,967) + (0.2 \times 26,778) = \$9,938$

Note: A quicker way of calculating expected values is to:

- calculate the EV of annual sales (which is 3,200 units)
- calculate the cash flows and NPV for annual sales of 3,200 units.

However, this approach makes it more difficult to carry out risk and uncertainty analysis.

On the basis of the figures, it would seem that Machine A should be purchased.

- It has a higher expected value of NPV.
- It is also a lower risk option, because the NPV will be positive even when sales are only 2,000 units each year. With machine B, the NPV would be negative if the annual sales are just 2,000 units.
- Machine A also gives a higher NPV if sales are 3,000 units, which is the most likely outcome.

(c) Sensitivity analysis on the Machine A investment.

(i) The NPV is + \$1,038 even when sales are 2,00 units each year. The probability of a negative NPV is 0%. (With machine B, the risk of a negative NPV is 20%).

(ii) The project will achieve a 6% return if the NPV of annual cash profits is \$15,000.

Discount factor at 6% for years 1 – 3 = 2.673

Annual cash profits to achieve a PV of \$15,000 = $\$15,000 / 2.673 = \$5,612$.

The contribution per unit is \$3.

Therefore minimum annual sales to achieve an NPV of \$0 = $\$5,612 / \3 per unit

= 1,871 units.

If annual sales exceed 1,871 units, the NPV with Machine A will be positive at a discount rate of 6%.

20 Lease or buy

(a) Evaluate the investment decision

Year of claim		Tax saving (30% of allowance)	Cash flow year
		\$	
	Cost	30,000	
1	Allowance (25%)	<u>(7,500)</u>	2
		22,500	
2	Allowance (25%)	<u>(5,625)</u>	3
		16,875	
3	Allowance (25%)	<u>(4,219)</u>	4
		12,656	
4	Allowance (25%)	<u>(3,164)</u>	5
		9,492	
5	Disposal	<u>6,000</u>	
	Balance	<u>(3,492)</u>	6
		1,048	

Year	Cash flows						
	0	1	2	3	4	5	6
	\$	\$	\$	\$	\$	\$	\$
Equipment	(30,000)					6,000	
Tax relief			2,250	1,688	1,266	949	1,048
Project cash flows		10,000	10,000	10,000	10,000	10,000	
Tax on these at 30%			(3,000)	(3,000)	(3,000)	(3,000)	(3,000)
Net cash flow	(30,000)	10,000	9,250	8,688	8,266	13,949	(1,952)
DCF factor at 10%	1.000	0.909	0.826	0.751	0.683	0.621	0.564
Present value	(30,000)	9,090	7,641	6,525	5,646	8,662	(1,101)

$$\text{NPV} = + \$6,463$$

The acquisition is worthwhile.

(b) **Evaluate the financing decision:**

Now consider how it should be financed. The project cash flows and tax on these are now irrelevant to this decision. Only the financing cash flows need to be considered.

The cost of financing is the after-tax cost of borrowing, which is 8%.

Leasing Year	Cash flows					
	1	2	3	4	5	6
	\$	\$	\$	\$	\$	\$
Lease payments	(7,000)	(7,000)	(7,000)	(7,000)	(7,000)	
Tax relief		2,100	2,100	2,100	2,100	2,100
Net cash flow	(7,000)	(4,900)	(4,900)	(4,900)	(4,900)	2,100
DCF factor at 8%	0.926	0.857	0.794	0.735	0.681	0.630
Present value	(6,482)	(4,199)	(3,891)	(3,602)	(3,337)	1,323

$$\text{PV of the cost of leasing} = \$20,188$$

Purchase Year	Cash flows						
	0	1	2	3	4	5	6
	\$	\$	\$	\$	\$	\$	\$
Equipment	(30,000)					6,000	
Tax relief			2,250	1,688	1,266	949	1,048
Net cash flow	(30,000)	0	2,250	1,688	1,266	6,949	1,048
DCF factor at 8%	1.000		0.857	0.794	0.735	0.681	0.630
Present value	(30,000)		1,928	1,340	931	4,732	660

PV of the cost of purchasing = \$20,409

Leasing has the lower PV of costs (although only by about \$200) and is slightly cheaper.

On this basis, the company might decide to lease the asset. However, the difference in cost is so small that other non-financial factors might influence the decision.

21 Asset replacement

(a) Replace every year

Year		Cash flow	Discount factor at 10%	PV
		\$		\$
0	Purchase cost	(40,000)	1.000	(40,000)
1	Running costs	(8,000)		
1	Disposal value	25,000		
1	Net cash flow, Year 1	17,000	0.909	15,453
				<u>(24,547)</u>
	Annuity factor at 10%, Year 1			0.909
	Equivalent annual cost			<u>\$(27,004)</u>

(b) Replace every two years

Year		Cash flow	Discount factor at 10%	PV
		\$		\$
0	Purchase cost	(40,000)	1.000	(40,000)
1	Running costs	(8,000)	0.909	(7,272)
2	Running costs	(12,000)		
2	Disposal value	20,000		
2	Net cash flow, Year 2	8,000	0.826	6,608
				<u>(40,664)</u>
	Annuity factor at 10%, Years 1 – 2			1.736
	Equivalent annual cost			<u>\$(23,424)</u>

(c) **Replace every three years**

Year		Cash flow	Discount factor at 10%	PV
		\$		\$
0	Purchase cost	(40,000)	1.000	(40,000)
1	Running costs	(8,000)	0.909	(7,272)
2	Running costs	(12,000)	0.826	(9,912)
3	Running costs	(20,000)		
3	Disposal value	10,000		
3	Net cash flow, Year 3	(10,000)	0.751	(7,510)
				<u>(64,694)</u>
	Annuity factor at 10%, Years 1 – 3			2.487
	Equivalent annual cost			<u>\$(26,013)</u>

(d) **Replace every four years**

Year		Cash flow	Discount factor at 10%	PV
		\$		\$
0	Purchase cost	(40,000)	1.000	(40,000)
1	Running costs	(8,000)	0.909	(7,272)
2	Running costs	(12,000)	0.826	(9,912)
3	Running costs	(20,000)	0.751	(15,020)
4	Running costs	(25,000)	0.683	(17,075)
				<u>(89,279)</u>
	Annuity factor at 10%, Years 1 – 4			3.170
	Equivalent annual cost			<u>\$(28,164)</u>

Recommendation

The machine should be replaced every two years, because this replacement policy gives the lowest equivalent annual cost.

22 Capital rationing

(a) Assume that all the investments are divisible

Total NPV is maximised by maximising the NPV per \$1 invested.

Investment	Capital investment	NPV	NPV per \$1 invested	Ranking
	\$	\$	\$	
A	60,000	12,000	0.20	3rd
B	80,000	21,600	0.27	1st
C	50,000	8,500	0.17	5th
D	45,000	10,800	0.24	2nd
E	55,000	9,900	0.18	4th

Investments to maximise NPV

Investment	Capital investment	NPV
	\$	\$
B	80,000	21,600
D	45,000	10,800
	125,000	
A (balance)	25,000	5,000
Total	150,000	37,400

- (b) Assume that all investments are indivisible

The combination to maximise total NPV is found by identifying possible combinations of investments within the \$150,000 investment limit and calculating the total NPV from that combination.

Investments		Capital investment	Total NPV
		\$	\$
A + B	(60,000 + 80,000)	140,000	33,600
C + D + E	(50,000 + 45,000 + 55,000)	150,000	29,200
B + D	(80,000 + 45,000)	125,000	32,400

(B + D) is clearly better than (B + C) or (B + E).

Conclusion

If the projects are indivisible, the combination of investments to maximise total NPV is investment in A and B.

23 Misteri Company**Workings****WACC**

$$\begin{aligned} \text{WACC} &= (70\% \times 10\%) + [(30\%) \times (8.9\%)(1 - 0.25)] \\ &= 7\% + 2\% = 9\%. \end{aligned}$$

Capital allowances

Year		Tax WDV	Capital allowance	Tax saved at 25%	Year of saving
		\$	\$	\$	
1	Allowance	1,200,000 (300,000)	300,000	75,000	2
2	Allowance	900,000 (225,000)	225,000	56,250	3

		675,000			
3	Allowance	(168,750)	168,750	42,188	4
		506,250			
4	Disposal value	(200,000)			
4	Balancing allowance	306,250	306,250	76,562	5

	Year 1	Year 2	Year 3	Year 4
Sales (units)	400,000	600,000	700,000	700,000
Contribution per unit: \$2				
	\$	\$	\$	\$
Total contribution	800,000	1,200,000	1,400,000	1,400,000
Fixed costs (cash)	(500,000)	(520,000)	(540,000)	(560,000)
Cash profit	300,000	680,000	860,000	880,000
Tax at 25%	(75,000)	(170,000)	(215,000)	(220,000)

Project cash flows

	Year 1	Year 2	Year 3	Year 4	Year 5
	\$	\$	\$	\$	\$
Cash profits	300,000	680,000	860,000	880,000	
Tax on profits		(75,000)	(170,000)	(215,000)	(220,000)
Tax benefit of cap. allowances		75,000	56,250	42,188	76,562
Disposal of machine				200,000	
Net cash flow	300,000	680,000	746,250	907,188	(143,438)

NPV calculation

Year	Net cash flow	Discount factor at 9%	Present value
	\$		\$
0	(1,200,000)	1.000	(1,200,000)
1	300,000	0.917	275,100
2	680,000	0.842	572,560
3	746,250	0.772	576,105
4	907,188	0.708	642,289
5	(143,438)	0.650	(93,235)
NPV			+ 772,819

Recommendation

The NPV of the project is + \$772,819.

The project would appear to provide a DCF return well in excess of the WACC, and on financial considerations (assuming that the estimates of costs and revenues are reasonably reliable) the project should be undertaken.

24 Valuation model

$$(a) \quad \text{Expected share price} = \frac{\$0.24}{0.08} = \$3.00$$

$$(b) \quad \text{Expected share price} = \frac{\$0.24(1.03)}{(0.08 - 0.03)} = \$4.94$$

$$(c) \quad \text{Expected growth rate in dividends} = 60\% \times 9\% = 5.4\%.$$

$$\text{Expected share price} = \frac{\$0.24(1.054)}{(0.08 - 0.054)} = \$9.73$$

25 Rights

(a)

		\$
4 shares	have a current market value of (× \$5.50)	22.00
1 new share	- issue price	4.50
5 shares	Have a theoretical value of	26.50

$$\text{Theoretical ex-rights price} = \$26.50/5 = \$5.30 \text{ per share.}$$

(b)

Value of rights	\$
Current market price	5.50
Theoretical ex-rights price	5.30
Value of rights	0.20

This is the theoretical value of the rights, for each existing share.

26 Rights issue

(a)

$$(i) \quad \text{Number of shares in issue} = \text{total earnings/EPS} \\ = \$1,200,000/\$0.15 = 8,000,000$$

		\$m
Value of the existing shares = 8,000,000 × \$2.70		21.6
Cash raised from new shares		3.8
Total		25.4

$$\text{Number of shares issued} = \$3,800,000/\$1.90 \text{ per share}$$

$$= 2,000,000 \text{ shares}$$

The rights issue is therefore a 1 for 4 rights issue (2,000,000:8,000,000)

The number of shares after the issue = 10 million

		\$
Current value of 4 existing shares	(× \$2.70)	10.80
Rights issue price of 1 share		1.90
Theoretical value of 5 shares		12.70
Theoretical ex-rights price	(12.70/5)	\$2.54

(ii)

	\$
Current market value of existing share	2.70
Theoretical ex-rights price	2.54
The value of a right	0.16

(iii) Existing P/E ratio = $\$2.70/\$0.15 = 18.0$

The revised profit after tax = \$1.8 million

The revised total market value = $18 \times \$1.8 \text{ million} = \32.4 million

Therefore, the market value per share =

$$\frac{\$32.4 \text{ million}}{10 \text{ million shares}} = \$3.24$$

(b) The shareholder can do any of the following:

- Buy all the shares offered to him in the rights issue. This would maintain his percentage shareholding in the company.
- Sell the rights. Rights can be sold on the stock market. The theoretical market price is \$0.16 for the rights attached to one existing share.
- Buy some of the shares offered to him in the rights issue and sell some rights.
- Do nothing. This is a bad choice. Shareholders will see a fall in the value of their shares because the new shares will be issued at a discount to the current market price. The company may try to sell any rights that are not taken up on behalf of the shareholder, but the shareholder should not rely on getting any money from the company.

27 Convertible bonds

Earnings = profit after interest and tax.

	\$	\$
Current total annual earnings (2,000,000 × \$0.25)		500,000
On conversion:		
Reduction in interest cost (\$1,000,000 × 4%)	40,000	
Minus increase in taxation (30%)	<u>(12,000)</u>	
Increase in annual earnings		<u>28,000</u>
Total annual earnings after conversion		<u>528,000</u>
		Shares
Shares currently in issue		2,000,000
New shares on conversion of the bonds (\$1,000,000 × 40/\$100)		<u>400,000</u>
		<u>2,400,000</u>

EPS after conversion = \$528,000 / 2,400,000 shares = \$0.22 per share.

There will be dilution in EPS from \$0.25 to \$0.22 per share.

28 Warrants and convertibles**(a) Convertibles**

Share price	Value of equity if converted per \$100 of bonds (20 shares)	Value as debt if not converted	Value of convertibles	Convert?
\$4.40	\$88	\$105	\$105	No
\$5.20	\$104	\$105	\$105	No
\$6.00	\$120	\$105	\$120	Yes
\$6.80	\$136	\$105	\$136	Yes

Warrants

Share price	Exercise price	Value of warrant	Exercise?
\$4.40	\$5	\$0	No
\$5.20	\$5	\$0.20	Yes
\$6.00	\$5	\$1.00	Yes
\$6.80	\$5	\$1.80	Yes

(b) Convertibles

	Before conversion	After conversion
	\$000	\$000
Profit before interest	1,200	1,200
Interest (\$2.5 million × 12%)	300	-
	900	1,200
Tax at 50%	450	600
Earnings (profit after tax)	450	600
Number of shares	2,000,000	2,500,000
Earnings per share	\$0.225	\$0.24

Warrants

	Before exercise	After exercise
	\$000	\$000
Profit before interest	1,200	1,200
Plus return on additional funds raised: 10% × \$2,500,000	-	250
	1,200	1,450
Tax at 50%	600	725
	600	725
Number of shares	2,000,000	2,500,000
Earnings per share	\$0.30	\$0.29

29 Gearing

(a)

	Company A		Company B	
	\$	% increase	\$	% increase
Sales	100,000	25%	100,000	25%
Variable costs	12,500		75,000	
Contribution	87,500		25,000	
Fixed operating costs	60,000		10,000	
Earnings before interest and tax	27,500	175%	15,000	50%
Interest costs	7,000		0	
Profit before tax	20,500		15,000	
Tax at 20%	4,100		3,000	
Earnings after interest and tax	16,400	583.3%	12,000	50%

(b)

	Company A		Company B	
Operational gearing = Increase in earnings before interest and tax/increase in sales	(175/25)	7.0	(50/25)	2.0
Financial gearing = Increase in earnings after interest and tax/increase in earnings before interest and tax	(583.3/175)	3.3	(50/50)	1.0
Combined gearing effect = Increase in earnings after interest and tax/increase in sales	(583.3/25)	23.3	(50/25)	2.0

The combined gearing effect is the operational gearing effect multiplied by the financial gearing effect.

For company A, a combination of high operational gearing and high financial gearing will result in a 583% increase in earnings for shareholders, as a consequence of a 25% increase in sales.

30 Financial and operating gearing

(a) Existing earnings per share =

$$\frac{\text{Netprofitaftertax}}{\text{Numberofequityshares}} = \frac{\$344,000/800,000}{1} = \$0.43$$

Earnings per share with new production process:

	\$000	\$000
Sales		1,800
Minus:		
Variable costs: (60,000 × \$5)	300	
Fixed costs: (360 + 120)	480	
		780
Net profit before interest and taxation		1,020
Interest payable [190 + (12.5% × \$2 million)]		440
Net profit before taxation		580
Tax at 35%		203
Net profit after taxation		377

$$\text{EPS} = \frac{\$377,000}{800,000} = \$0.4713$$

There is an increase in EPS of \$0.0413

(b) (i) The degree of operating gearing

$$= \frac{\text{Contribution}}{\text{Profit before interest and tax}}$$

$$= \frac{1800 - 300}{1020}$$

$$= 1.47 \text{ times}$$

(ii) The degree of financial gearing

$$= \frac{\text{Profit before interest and tax}}{\text{Profit after interest but before tax}}$$

$$= \frac{1020}{1020 - 440}$$

$$= 1.76 \text{ times}$$

(iii) The combined gearing effect = $1.47 \times 1.76 = 2.59$

31 Financing schemes

(a) Projected income statements for the year ended 30th November

	Financing method		
	i	ii	iii
	\$m	\$m	\$m
Profit before interest and tax: (17.9 + 5.0)	22.9	22.9	22.9
Interest payable	1.5	2.1	2.1
Profit before tax	21.4	20.8	20.8
Taxation (25%)	5.4	5.2	5.2
Profit after tax	16.0	15.6	15.6
Preference dividend	0.0	1.4	0.0
Profit available to equity	16.0	14.2	15.6
Number of shares	(20.0 + 9.0)		(20.0 + 6.0)
Earnings per share =	29.0m \$0.552	20.0m \$0.71	26.0m \$0.60

	\$m	\$m	\$m
Accumulated profit at beginning of the year	17.8	17.8	17.8
Profit available to equity for the year	16.0	14.2	15.6
Dividend payments (\$0.30 per share)	<u>(8.7)</u>	<u>(6.0)</u>	<u>(7.8)</u>
Accumulated profit at end of the year	25.1	26.0	25.6
Equity shares	14.5	10.0	13.0
Share premium	13.5	0.0	9.0
General reserve	<u>4.6</u>	<u>4.6</u>	<u>4.6</u>
Total share capital and reserves	57.7	40.6	52.2
Fixed rate long-term capital:			
10% debentures	15.0	21.0	21.0
Preference shares	0.0	12.0	0.0
Total long-term capital	<u>72.7</u>	<u>73.6</u>	<u>73.2</u>
Gearing	15.0/72.7	33.0/73.6	21.0/73.2
=	<u>20.6%</u>	<u>44.8%</u>	<u>28.7%</u>

Other methods of calculating the gearing ratio would be acceptable.

- (b) Financing scheme (i) produces the lowest EPS of the three options. This EPS is also lower than the current EPS of \$0.615.

Financing scheme (ii) produces the highest EPS. It is also the only option that produces a higher EPS than the current EPS. However the gearing ratio is substantially higher than the current gearing ratio or the gearing ratios of the other options. The projected income statements show a high level of coverage for interest payments under this option and therefore the relatively high level of gearing is unlikely to be a problem.

Financing option (iii) produces an EPS that is lower than the current EPS and lower than the EPS of option (ii). However the gearing ratio is fairly low, indicating a relatively low level of financial risk.

32 Free cash flow

	\$ million
Profit before interest and tax	3.00
Interest	(0.40)
Taxation	(0.60)
Depreciation charges	0.55
Essential capital expenditure	<u>(1.00)</u>
Free cash flow	<u>1.55</u>

33 Valuation

The dividend growth model:

$$800 = \frac{38(1+g)}{(0.10-g)}$$

$$800(0.10 - g) = 38(1 + g)$$

$$80 - 800g = 38 + 38g$$

$$838g = 42$$

$$g = 0.05 \text{ or } 5\%.$$

An expected dividend growth rate of 5% per year is required to achieve a share price of 800.

34 Valuation of bonds

(a) $(7.5/9.0) \times 100 = 83.33$. (\$83.33 market value for each \$100 nominal value of bonds.)

(b)

Year	Item	Cash flow	Discount factor at 9%	PV
1 – 3	Interest	6	2.531	15.19
4	Interest plus capital	106	0.708	75.05
				<u>90.24</u>

The market value of the bonds should be 90.24.

(c)

Period	Item	Cash flow	Discount factor at 4.4%	PV
1 – 7	Interest	5	5.914	29.57
8	Interest plus capital	105	1/(1.044) ⁸	74.40
				<u>103.97</u>

The market value of the bonds should be 103.97.

(d)

Year	Item	Cash flow	Discount factor at 9%	PV
1 – 3	Interest	5	2.531	12.66
3	Value of shares acquired	140	0.708	99.12
				<u>111.78</u>

The market value of the bonds should be 111.78.

35 Annuities and bond prices

Tutorial note

You might be required in the examination to remember and use the formula for the present value of an annuity. This is:

$$\text{PV of annuity} = \text{Annuity} \times \frac{1}{r} \left[1 - \frac{1}{(1+r)^n} \right]$$

(a) (i) Value of zero coupon bond = $100 \times \frac{1}{(1.05)^{10}}$

$$= 100 \times 0.6139$$

$$= 61.39.$$

- (ii) PV of interest payments to maturity of the bond: interest = 4 every 6 months for 10 years.

$$\text{PV of annuity} = 4 \times \frac{1}{0.025} \left[1 - \frac{1}{(1.025)^{20}} \right]$$

$$= 160 \times [0.3897]$$

$$= 62.35$$

Period		Cash flow	Discount factor at 2.5%	PV
1 – 20	Interest	4	See above	62.35
20	Redemption	100	$1/(1.025)^{20}$	61.03
	Value of bond			<u>123.38</u>

- (b) When interest yields rise, bond prices fall. Edit: the below boxes needs the 'x' replaced

(i) Value of zero coupon bond = $100 \times \frac{1}{(1.06)^{10}}$

$$= 100 \times 0.5584$$

$$= 55.84.$$

(ii) PV of annuity = $4 \times \frac{1}{0.03} \left[1 - \frac{1}{(1.03)^{20}} \right]$

$$= 133.33 \times [0.4463]$$

$$= 59.51$$

Period		Cash flow	Discount factor at 3%	PV
1 – 20	Interest	4	See above	59.51
20	Redemption	100	$1/(1.03)^{20}$	55.37
	Value of bond			<u>114.88</u>

36 Efficient markets**(a) Weak form efficiency**

The share price will not react to the announcement by the directors. Share prices in a market with weak-form efficiency react to historical data, not future expectations.

(b) Semi-strong form efficiency

If investors believe the estimate of an NPV of + \$4,000,000, the value of the company's shares will increase by this amount (\$0.08 per share) and rise to \$4.08 on 12th May – the date that the announcement is made to the market.

(c) Strong form efficiency

If investors believe the estimate of an NPV of + \$4,000,000, the value of the company's shares will increase by this amount (\$0.08 per share) and rise to \$4.08 on 1st May – the date that the investment decision is taken and before it is formally announced to the market.

37 WACC

$$\text{Cost of equity} = \frac{18(1.03)}{155} + 0.03$$

$$= 0.1496 \text{ or } 14.96\%$$

$$\text{WACC} = \left[\frac{350}{(1,200 + 350)} \times 7.8(1 - 0.30) \right] + \left[\frac{1,200}{(1,200 + 350)} \times 14.96 \right]$$

$$= 1.23 + 11.58$$

$$= 12.81\%$$

38 Optimal WACC

The optimal WACC is the lowest WACC, because this will maximise the value of the company and the wealth of shareholders.

Step 1

Calculate the geared beta for equity at each level of gearing.

Gearing	Geared beta	
20%	$0.90 \times \frac{80 + 20(1 - 0.30)}{80}$	= 1.0575
30%	$0.90 \times \frac{70 + 30(1 - 0.30)}{70}$	= 1.170
40%	$0.90 \times \frac{60 + 40(1 - 0.30)}{60}$	= 1.320

$$50\% \quad 0.90 \times \frac{50 + 50(1 - 0.30)}{50} = 1.530$$

$$60\% \quad 0.90 \times \frac{40 + 60(1 - 0.30)}{40} = 1.845$$

Step 2

Use the geared beta value and the CAPM to calculate a cost of equity at each gearing level.

Gearing	Cost of equity (4% + β (9 - 4)%
20%	$4 + 1.0575 \times 5 = 7.17\%$
30%	$4 + 1.170 \times 5 = 7.51\%$
40%	$4 + 1.320 \times 5 = 7.96\%$
50%	$4 + 1.530 \times 5 = 8.59\%$
60%	$4 + 1.845 \times 5 = 9.54\%$

Step 3

Calculate the WACC at each level of gearing, and identify the gearing level with the lowest WACC.

Gearing	WACC
20%	$[20\% \times 5.0(1 - 0.30)] + [80\% \times 7.17] = 6.44\%$
30%	$[30\% \times 5.4(1 - 0.30)] + [70\% \times 7.51] = 6.39\%$
40%	$[40\% \times 5.8(1 - 0.30)] + [60\% \times 7.96] = 6.40\%$
50%	$[50\% \times 6.5(1 - 0.30)] + [50\% \times 8.59] = 6.58\%$
60%	$[60\% \times 7.2(1 - 0.30)] + [40\% \times 9.54] = 6.84\%$

Conclusion

The optimal gearing level is 30%, because the WACC is lowest at this gearing level. However, the WACC is almost as low at a gearing level of 40%.

39 MM, gearing and company valuation

Value of geared company = Value of company ungeared + (Value of debt \times Tax rate)

$$V_g = V_u + Dt$$

$$V_g = (4,000,000 \times \$10) + (\$15,000,000 \times 30\%)$$

$$= \$44,500,000$$

	\$ million
Total value of geared company (equity + debt)	44.5
Value of debt	(15.0)
Therefore value of equity in geared company	<u>29.5</u>

The total value of the equity in the geared company is lower than when the company was geared, but there are fewer shares left in issue and the value per share will be higher.

40 Geared beta

- (a) The current proportion of equity in the capital structure is $1,500/(1,500 + 500) = 0.75$ or 75%.

The current proportion of debt in the capital structure is $500/(1,500 + 500) = 0.25$ or 25%.

Cost of equity = $5\% + 1.126(11 - 5)\% = 11.756\%$.

Since the beta factor of debt is 0, the debt must be risk-free, with a pre-tax cost of 5%.

WACC = $[0.25 \times 5.0(1 - 0.30)] + [0.75 \times 11.756] = 9.692\%$, say 9.7%

- (b) The asset beta of a company is a measure of the systematic business risk in the company's business operations. This is a measure of systematic risk assuming that the company is all-equity financed.

To convert the current geared beta into an asset beta given that debt capital is risk-free:

$$\beta_A = \beta_E \times \left[\frac{E}{E + D(1 - T)} \right]$$

$$\beta_A = 1.126 \times \left[\frac{75}{75 + 25(1 - 0.30)} \right]$$

$$\beta_A = 0.913$$

- (c) If the company is geared differently, its equity beta will not be 1.126 because its financial risk will be different. A **geared beta** can be calculated for the new gearing level.

$$0.913 = B_{\text{geared}} \times \frac{60}{60 + 40(1 - 0.30)}$$

$$B_{\text{geared}} = \frac{0.913}{0.6818} = 1.339$$

This geared beta factor can now be used to calculate the **cost of equity** at this gearing level.

Cost of equity = $5\% + 1.339(11 - 5)\% = 13.03\%$.

WACC at this gearing level. It is assumed that the cost of debt remains risk-free.

WACC = $(60\% \times 13.03\%) + [40\% \times 5\%(1 - 0.30)] = 9.218\%$, say 9.2%

41 Diversify

The first step is to use the equity betas of the three chemical manufacturing companies (proxy companies) to estimate an asset beta for the business risk in chemicals manufacturing.

Company	Estimated asset beta	
A	$2.66 \times [40/40 + 60(1 - 0.25\%)]$	$= 2.66 \times 0.4706 = 1.25$
B	$1.56 \times [75/75 + 25(1 - 0.25\%)]$	$= 1.56 \times 0.80 = 1.25$
C	$1.45 \times [80/80 + 20(1 - 0.25\%)]$	$= 1.45 \times 0.8421 = 1.22$

It is assumed that the asset beta is a simple average of these three values:
 $(1.25 + 1.25 + 1.22)/3 = 1.24$.

This asset beta can be used to calculate an equity beta for Bustr, for the investment in chemicals manufacturing:

$$1.24 = \beta_E \times \left[\frac{60}{60 + 40(1 - 0.25)} \right]$$

$$0.667 \beta_E = 1.24$$

$$\beta_E = 1.86$$

If an appropriate equity beta for Bustr in chemicals manufacturing is 1.86, the **cost of equity** (using the CAPM) is:

$$5\% + 1.86(9 - 5)\% = 12.44\%$$

If the cost of equity is 12.44%, the pre-tax cost of debt is 5% (= risk-free rate) and tax is 25%, a **suitable discount rate** for evaluating the proposed investment would be:

$$(60\% \times 12.44\%) + [40\% \times 5(1 - 0.25)\%]$$

$$= 8.964\%, \text{ say } 9\%.$$

42 Acquisition

- (a) The earnings of Little next year are expected to be \$86,000. A forward P/E multiple of 8.0 could be applied to this estimate, and the valuation of the equity shares in Little would be:

$$\$86,000 \times 8.0 = \$688,000.$$

- (b) The cost of equity of Big is expected to be:

$$6\% + 1.60(11 - 6)\% = 14\%.$$

The WACC of Big is expected to be:

$$[35\% \times 7.4(1 - 0.30)] + (65\% \times 14)$$

$$= 10.913\%.$$

- (c) Since Little is in the same industry as Big, it is probably appropriate to use the WACC of Big to obtain a DCF-based valuation of Little. The WACC of 10.913% will be rounded to 11%.

The cash flows from the acquisition of Little must be calculated.

	Year 1	Year 2	Year 3
	\$	\$	\$
Sales	200,000	280,000	320,000
Cash costs	(120,000)	(160,000)	(180,000)
	80,000	120,000	140,000
Capital allowances	(20,000)	(30,000)	(40,000)
Interest	(10,000)	(10,000)	(10,000)
Taxable profit	50,000	80,000	90,000
Tax at 30%	(15,000)	(24,000)	(27,000)
Profit after tax	35,000	56,000	63,000
Profit after tax	35,000	56,000	63,000
Add back capital allowances	20,000	30,000	40,000
	55,000	86,000	103,000
Asset replacement	(25,000)	(30,000)	(35,000)
Cash flow	30,000	56,000	68,000

Cash flows will increase by 4% each year from Year 4 onwards.

The dividend growth valuation model can be used to calculate the Year 3 value of these cash flows, using a growth rate of 4% and a cost of capital of 11%:

$$\text{Year 3 value of cash flows from Year 4} = \frac{\$68,000 (1.04)}{(0.11 - 0.04)}$$

$$= \$1,010,286$$

The expected cash flows can now be converted in to a present value:

Year	Cash flow	Discount factor at 11%	PV
	\$		\$
1	30,000	0.901	27,030
2	56,000	0.812	45,472
3	68,000	0.731	49,708
4 onwards	1,010,286	0.731	738,519
Total value			860,729

43 Interest rate parity

(a) $\text{GBP/USD} = 1.8000 \times (1.035/1.05) = 1.7743$

(Note: the interest rate is lower for the dollar than for sterling, therefore the dollar should increase in value over time against sterling.)

$$\text{GBP/EUR} = 1.5000 \times (1.025/1.05) = 1.4643$$

$$\text{EUR/USD} = 1.2000 \times (1.035/1.025) = 1.2117$$

(b) $\text{GBP/USD} = 1.8000 \times (1.035/1.05)^3 = 1.7240$

$$\text{GBP/EUR} = 1.5000 \times (1.025/1.05)^3 = 1.3954$$

$$\text{EUR/USD} = 1.2000 \times (1.035/1.025)^3 = 1.2355$$

44 Foreign exchange

- (a) A hedge against the risk can be obtained by entering into a forward rate agreement to buy \$750,000. The forward rate is the forward rate that favours the bank. This is 1.8535 (and not 1.8543).

The cost of buying the dollars will be $\$750,000/1.8535 = \text{£}404,639.87$.

- (b) Subtract a premium, add a discount.

Spot rate	1.3025
Premium	<u>(0.0018)</u>
Forward rate	<u>1.3007</u>

The \$450,000 will be sold in exchange for $\text{€}345,967.56$ ($450,000/1.3007$).

- (c) Forward rates = $1.9757 - 1.9763$

The rate for a company to buy sterling (sell dollars) is 1.9763.

Cost of buying $\text{£}750,000 = 750,000 \times 1.9763 = \$1,479,750$.

45 Money market hedge

- (a) The company will receive \$600,000 in six months, and will want to receive sterling and pay dollars.

It can do this with a money market hedge by borrowing US dollars now. The interest rate for six months in dollars is $3.5\% \times 6/12 = 1.75\%$. It will need to borrow now:

$$\$600,000/1.0175 = \$589,680.59.$$

It can immediately exchange these dollars into sterling at the spot rate of 1.8800, to obtain:

$$\$589,680.59/1.8800 = \text{£}313,659.89.$$

After six months, the dollar loan will be repayable with interest. The total repayment will be \$600,000, and the payment can be made from the \$600,000 received from the customer.

- (b) The company can do anything with the sterling it receives now from the hedging transaction. If it chose to invest the cash for six months at 5% per year (2.5% for six months), the investment of £313,659.89 would increase to:

$$£313,659.89 \times 1.025 = £321,501.39.$$

To avoid opportunities for arbitrage between the money markets and the forward FX markets, the six-month forward exchange rate would therefore need to be:

$$\$600,000 / £321,501.39 = 1.8662.$$

46 Dunborgen

Forward exchange contract

The six-month forward rate is 1.566 – 1.574.

Dunborgen would need to buy \$500,000, and the bank would charge a rate of \$1.566.

The cost to Dunborgen in euros in six months' time = $500,000 / 1.566 = €319,285$.

Money market hedge

The spot exchange rate is 1.602 – 1.606

Dunborgen could borrow euros now, convert them into dollars and put the dollars on deposit for six months.

The six month interest rate for US dollar deposits = $2.0\% \times 6/12 = 1.0\%$.

To have \$500,000 in six months time, Dunborgen would need to deposit:

$$\$500,000 \times (1/1.01) = \$495,050.$$

The cost in euros of buying \$495,050 spot = $495,050 / 1.602 = €309,020$.

It is assumed that the euros to purchase the dollars spot would be obtained by borrowing for six months at 4.8%. Interest for six months would be $4.8\% \times 6/12 = 2.4\%$.

The cost in euros to Dunborgen of a money market hedge, for comparison with the cost of a forward contract, would therefore be:

$$€309,020 \times 1.024 = €316,436.$$

Comparison of hedging methods

A money market hedge would be less expensive in this case, and is therefore recommended as the method of hedging the currency risk exposure.

47 FRA

- (a) The company wants to borrow in three months' time for a period of six months; therefore to create a hedge with an FRA, it must buy a 3v9 FRA.

The interest rate for the FRA is 3.97%.

- The company will borrow in three months' time at the current LIBOR rate plus 0.50%.
- The FRA will be settled in three months' time.
 - If the six-month LIBOR rate is higher than 3.97%, the company will receive a payment from the bank to settle the FRA. The amount of this payment is the value of the difference between the FRA rate of 3.97% and the LIBOR rate.
 - If the six-month LIBOR rate is lower than 3.97%, the company will make a payment to the bank to settle the FRA, for the value of the difference between the two rates.

The effect of the FRA is therefore to 'lock in an effective interest rate of 3.97% + 0.50% = 4.47%.

Tutorial note: For example, if the LIBOR rate in three months is 5.5%, the situation will be as follows:

	%
Company borrows at LIBOR + 0.50%	6.00
Company receives from settlement of FRA (5.50 – 3.97)	(1.53)
Effective interest cost	4.47

This is the FRA rate + 0.50%.

- (b) An FRA works on the same principles as an interest rate coupon swap. The main difference is that an FRA is for one interest period only, although a company can arrange a series of FRAs. A coupon swap is longer-term, and covers several settlement dates.

48 Swap

The company should enter into a four-year interest rate coupon swap in which it receives the floating rate and pays the fixed rate (5.25%).

The effective interest rate will change from floating rate to fixed rate, as follows:

	%
Bank loan interest (LIBOR + 1.25)	
Swap	
Pay	(5.25)
Receive	LIBOR
Effective rate	(6.50)

49 Credit arbitrage

	%
Entity A can borrow more cheaply at a fixed rate by (7.25 – 6.35)	0.90
Entity A can borrow more cheaply at a floating rate by (1.25 – 0.75)	0.50
Difference	0.40
Bank's profit	0.10
Net benefit to share between the two entities	0.30

If the entities share the benefit equally, each will be able to reduce its effective cost of borrowing by $(0.30/2)$ 0.15%.

- Entity A wants to borrow at a floating rate. It can borrow directly at LIBOR + 0.75%. By borrowing at a fixed rate and swapping into a floating rate, its effective interest rate will be $\text{LIBOR} + 0.75\% - 0.15\% = \text{LIBOR} + 0.60\%$.
- Entity B wants to borrow at a fixed rate. It can borrow directly at 7.25%. By borrowing at a floating rate and swapping into a fixed rate, its effective interest rate will be $7.25\% - 0.15\% = 7.10\%$.

For Entity A, the arrangement could be as follows:

	%
Borrow at a fixed rate	(6.35)
Swap payments	
Pay	(LIBOR)
Receive (balancing figure)	5.75
Effective interest cost	(LIBOR + 0.60)

For Entity B, the arrangement would be as follows:

	%
Borrow at a fixed rate	(LIBOR + 1.25)
Swap payments	
Pay (balancing figure)	(5.85)
Receive	LIBOR
Effective interest cost	(7.10)

The bank's profit would come from the difference between the fixed rate received from Entity B (5.85%) and the fixed rate paid to Entity A (5.75%).

This assumes that the two Entities each arrange their swap with the bank, and not directly with each other.

50 Currency futures

- (a) The company must make a payment in US dollars in May. It must therefore buy dollars to make the payment.

Using futures, the company will therefore buy dollars and sell euros. It will therefore sell euro/US dollar futures, which are for €125,000 each.

At the futures price of 1.2800, the amount of euros to sell in exchange for \$640,000 is:

$$\$640,000 / 1.2800 = \$500,000.$$

The number of contracts to sell is therefore: $\$500,000 / \$125,000$ per contract = 4.0 contracts.

The company will sell 4 June contracts at 1.2800.

(b) It will close its position in May, when the futures price is 1.2690.

The value of 1 tick for this contract is $125,000 \times \$0.0001 = \12.50 .

Original selling price	1.2800
Buying price to close the position	<u>1.2690</u>
Gain per contract	<u>0.0110</u>

Total gain on futures position = 4 contracts \times 0.011 \times \$125,000 = \$5,500.

The French company must pay \$640,000 to its supplier. It has \$5,500 profit from closing the futures position. It therefore needs an additional $(\$640,000 - \$5,500) = \$634,500$.

It must buy these dollars at the spot rate of 1.2710. The cost in euros will be $\$634,500 / 1.2710 = \text{€}499,213$.

The effective exchange rate for the payment of \$640,000 is therefore: $\$640,000 / \text{€}499,213 = \text{US}\$1.2820 / \text{€}1$.

This is close to the price at which the futures were originally sold. However, the hedge is not perfect because the position was closed before the settlement date for the contract.

Appendix

Formula sheet and tables

Formula Sheet

Economic order quantity

$$= \sqrt{\frac{2C \circ D}{C_H}}$$

Miller – Orr Model

Return point = Lower limit + ($\frac{1}{3}$ × spread)

$$\text{Spread} = 3 \left[\frac{\frac{3}{4} \times \text{transaction cost} \times \text{variance of cash flows}}{\text{interest rate}} \right]^{\frac{1}{3}}$$

The Capital Asset Pricing Model

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

The asset beta formula

$$\beta_a = \left[\frac{V_e}{(V_e + V_d(1-T))} \beta_e \right] + \left[\frac{V_d(1-T)}{(V_e + V_d(1-T))} \beta_d \right]$$

The Growth Model

$$P_0 = \frac{D_0(1+g)}{(r_e - g)}$$

Gordon's growth approximation

$$g = br_e$$

The weighted average cost of capital

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

The Fisher formula

$$(1+i) = (1+r)(1+h)$$

Purchasing power parity and interest rate parity

$$S_1 = S_0 \times \frac{(1+h_c)}{(1+h_b)} \quad f_o = S_0 \times \frac{(1+i_c)}{(1+i_b)}$$

Present value table

Present value of 1 i.e. $(1+r)^{-n}$

where r = discount rate

n = number of periods until payment

Periods (n)	Discount rate (r)										
	1%	2%	3%	4%	5%	6%	7%	8%	9%	10%	
1	0.990	0.980	0.971	0.962	0.952	0.943	0.935	0.926	0.917	0.909	1
2	0.980	0.961	0.943	0.925	0.907	0.890	0.873	0.857	0.842	0.826	2
3	0.971	0.942	0.915	0.889	0.864	0.840	0.816	0.794	0.772	0.751	3
4	0.961	0.924	0.888	0.855	0.823	0.792	0.763	0.735	0.708	0.683	4
5	0.951	0.906	0.863	0.822	0.784	0.747	0.713	0.681	0.650	0.621	5
6	0.942	0.888	0.837	0.790	0.746	0.705	0.666	0.630	0.596	0.564	6
7	0.933	0.871	0.813	0.760	0.711	0.665	0.623	0.583	0.547	0.513	7
8	0.923	0.853	0.789	0.731	0.677	0.627	0.582	0.540	0.502	0.467	8
9	0.914	0.837	0.766	0.703	0.645	0.592	0.544	0.500	0.460	0.424	9
10	0.905	0.820	0.744	0.676	0.614	0.558	0.508	0.463	0.422	0.386	10
11	0.896	0.804	0.722	0.650	0.585	0.527	0.475	0.429	0.388	0.350	11
12	0.887	0.788	0.701	0.625	0.557	0.497	0.444	0.397	0.356	0.319	12
13	0.879	0.773	0.681	0.601	0.530	0.469	0.415	0.368	0.326	0.290	13
14	0.870	0.758	0.661	0.577	0.505	0.442	0.388	0.340	0.299	0.263	14
15	0.861	0.743	0.642	0.555	0.481	0.417	0.362	0.315	0.275	0.239	15
(n)	11%	12%	13%	14%	15%	16%	17%	18%	19%	20%	
1	0.901	0.893	0.885	0.877	0.870	0.862	0.855	0.847	0.840	0.833	1
2	0.812	0.797	0.783	0.769	0.756	0.743	0.731	0.718	0.706	0.694	2
3	0.731	0.712	0.693	0.675	0.658	0.641	0.624	0.609	0.593	0.579	3
4	0.659	0.636	0.613	0.592	0.572	0.552	0.534	0.516	0.499	0.482	4
5	0.593	0.567	0.543	0.519	0.497	0.476	0.456	0.437	0.419	0.402	5
6	0.535	0.507	0.480	0.456	0.432	0.410	0.390	0.370	0.352	0.335	6
7	0.482	0.452	0.425	0.400	0.376	0.354	0.333	0.314	0.296	0.279	7
8	0.434	0.404	0.376	0.351	0.327	0.305	0.285	0.266	0.249	0.233	8
9	0.391	0.361	0.333	0.308	0.284	0.263	0.243	0.225	0.209	0.194	9
10	0.352	0.322	0.295	0.270	0.247	0.227	0.208	0.191	0.176	0.162	10
11	0.317	0.287	0.261	0.237	0.215	0.195	0.178	0.162	0.148	0.135	11
12	0.286	0.257	0.231	0.208	0.187	0.168	0.152	0.137	0.124	0.112	12
13	0.258	0.229	0.204	0.182	0.163	0.145	0.130	0.116	0.104	0.093	13
14	0.232	0.205	0.181	0.160	0.141	0.125	0.111	0.099	0.088	0.078	14
15	0.209	0.183	0.160	0.140	0.123	0.108	0.095	0.084	0.074	0.065	15

Annuity table

Present value of an annuity of 1 i.e. $\frac{1 - (1+r)^{-n}}{r}$

where r = discount rate
 n = number of periods

Periods (n)	Discount rate (r)										
	1%	2%	3%	4%	5%	6%	7%	8%	9%	10%	
1	0.990	0.980	0.971	0.962	0.952	0.943	0.935	0.926	0.917	0.909	1
2	1.970	1.942	1.913	1.886	1.859	1.833	1.808	1.783	1.759	1.736	2
3	2.941	2.884	2.829	2.775	2.723	2.673	2.624	2.577	2.531	2.487	3
4	3.902	3.808	3.717	3.630	3.546	3.465	3.387	3.312	3.240	3.170	4
5	4.853	4.713	4.580	4.452	4.329	4.212	4.100	3.993	3.890	3.791	5
6	5.795	5.601	5.417	5.242	5.076	4.917	4.767	4.623	4.486	4.355	6
7	6.728	6.472	6.230	6.002	5.786	5.582	5.389	5.206	5.033	4.868	7
8	7.652	7.325	7.020	6.733	6.463	6.210	5.971	5.747	5.535	5.335	8
9	8.566	8.162	7.786	7.435	7.108	6.802	6.515	6.247	5.995	5.759	9
10	9.471	8.983	8.530	8.111	7.722	7.360	7.024	6.710	6.418	6.145	10
11	10.37	9.787	9.253	8.760	8.306	7.887	7.499	7.139	6.805	6.495	11
12	11.26	10.58	9.954	9.385	8.863	8.384	7.943	7.536	7.161	6.814	12
13	12.13	11.35	10.63	9.986	9.394	8.853	8.358	7.904	7.487	7.103	13
14	13.00	12.11	11.30	10.56	9.899	9.295	8.745	8.244	7.786	7.367	14
15	13.87	12.85	11.94	11.12	10.38	9.712	9.108	8.559	8.061	7.606	15
(n)	11%	12%	13%	14%	15%	16%	17%	18%	19%	20%	
1	0.901	0.893	0.885	0.877	0.870	0.862	0.855	0.847	0.840	0.833	1
2	1.713	1.690	1.668	1.647	1.626	1.605	1.585	1.566	1.547	1.528	2
3	2.444	2.402	2.361	2.322	2.283	2.246	2.210	2.174	2.140	2.106	3
4	3.102	3.037	2.974	2.914	2.855	2.798	2.743	2.690	2.639	2.589	4
5	3.696	3.605	3.517	3.433	3.352	3.274	3.199	3.127	3.058	2.991	5
6	4.231	4.111	3.998	3.889	3.784	3.685	3.589	3.498	3.410	3.326	6
7	4.712	4.564	4.423	4.288	4.160	4.039	3.922	3.812	3.706	3.605	7
8	5.146	4.968	4.799	4.639	4.487	4.344	4.207	4.078	3.954	3.837	8
9	5.537	5.328	5.132	4.946	4.772	4.607	4.451	4.303	4.163	4.031	9
10	5.889	5.650	5.426	5.216	5.019	4.833	4.659	4.494	4.339	4.192	10
11	6.207	5.938	5.687	5.453	5.234	5.029	4.836	4.656	4.486	4.327	11
12	6.492	6.194	5.918	5.660	5.421	5.197	4.988	4.793	4.611	4.439	12
13	6.750	6.424	6.122	5.842	5.583	5.342	5.118	4.910	4.715	4.533	13
14	6.982	6.628	6.302	6.002	5.724	5.468	5.229	5.008	4.802	4.611	14
15	7.191	6.811	6.462	6.142	5.847	5.575	5.324	5.092	4.876	4.675	15



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