

## Chapter 20

# Breakeven analysis and short-term decision making

### REAL WORLD CASE

This case study shows a typical situation in which management accounting can be helpful. Read the case study now but only attempt the discussion points after you have finished studying the chapter.

*Flying Brands is a company which delivers goods to customers. The business began some years ago by flying flowers from the Channel Islands to the UK mainland.*

The Group has continued to drive profits forward with profit before tax up by 24%, and profit before tax and before all exceptional items up by 10%. The business is focused on profitable growth, and although sales in 2003 showed a fall on 2002 of 3%, the temptation to chase marginal customers was resisted, and a greater emphasis was placed on increasing customer spend and improving operational efficiency. This is reflected in the contribution margin for the two main brands improving to 35% compared to 32% in 2002 . . . Overheads increased during the year by 5%, slightly above inflation, as the marketing team was considerably strengthened. Corporate overheads comprise the costs of the chief executive, the finance director, the non-executive directors and the legal, professional and other fees connected with the running of a public company . . . By driving increasing volumes of orders through our existing operations, we will see economies of scale and substantially improved recovery of fixed overheads.



Source: Flying Brands Limited, Annual report 2004, pp. 10 and 11. [www.fagl.co.uk](http://www.fagl.co.uk), [www.flyingflowers.com/](http://www.flyingflowers.com/)

### Discussion points

- 1 How did the company improve its contribution to fixed overheads and profit?
- 2 What was the alternative strategy for improving contribution which the company rejected?

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## Learning outcomes

After reading this chapter you should be able to:

- Explain how the accountant's view of cost behaviour differs from that of the economist.
- Define and calculate contribution and breakeven point, and prepare a breakeven chart and a profit–volume chart.
- Use breakeven analysis to explore the effect of changing unit selling price, unit variable cost or fixed cost.
- Explain the limitations of breakeven analysis.
- Explain applications of cost–volume–profit analysis.
- Show how calculation of contribution can be applied in short-term decision making.
- Explain how pricing decisions may be related to cost considerations.

## 20.1 Introduction

In Chapter 16 the role of management accounting was explained in terms of **directing attention, keeping the score** and **solving problems**. This chapter turns to the problem-solving aspect of the management accountant's work and in particular to the use of management accounting information to help with decisions in the short term (where the short term is typically a period of weeks or months, extending to 12 months at the most, in which some costs are fixed and others are variable, depending on the level of activity). Chapter 23 explains the use of management accounting in making decisions about the longer term.

### Activity 20.1

*The classification of costs was explained at length in Chapter 17. If you have any doubts about that chapter, go back and work through it again. It is essential that Chapter 17 is understood before this chapter is attempted.*

This chapter will first explain how **costs** and **revenues** behave in the short term as the volume of activity increases. This is called **cost–volume–profit analysis**. It makes use of graphs which will help you follow the analysis of costs, revenues and profits. The chapter explains the calculation of **contribution** and shows how it is used to identify the **breakeven point** of neither profit nor loss.

The chapter will then show how the distinction between **variable cost** and **fixed cost** may be used in short-term decision making in situations of special orders, abandonment of a product line, and the existence of limiting factors. They are set out as case studies so that you will see that each problem, while using the same principles of cost–volume–profit analysis, requires some adaptability in using the analysis in the specific circumstances.

Pricing decisions will often require management accounting information about how the price charged for a product or service matches up to the cost of that product or service. Note, however, that the price which consumers are willing to pay may be decided by economic forces rather than by the costs incurred. You will see in this chapter the main approaches to pricing and the role of costs in those approaches.

## 20.2 Cost behaviour: fixed and variable costs

Chapter 17 explained that the cost classification systems are as varied as the businesses they serve. Types of cost classification system were identified in that chapter by reference to questions which needed answers. Chapter 17 also provided definitions of variable cost and fixed cost, while Exhibits 17.2, 17.5 and 17.7 showed different types of cost behaviour as activity increased.

### Definitions

A **variable cost** is one which varies directly with changes in the level of activity, over a defined period of time.

A **fixed cost** is one which is not affected by changes in the level of activity, over a defined period of time.

This chapter now moves on from that starting point outlined in Chapter 17 to ask more questions about the relationships between cost, volume of output and profit.

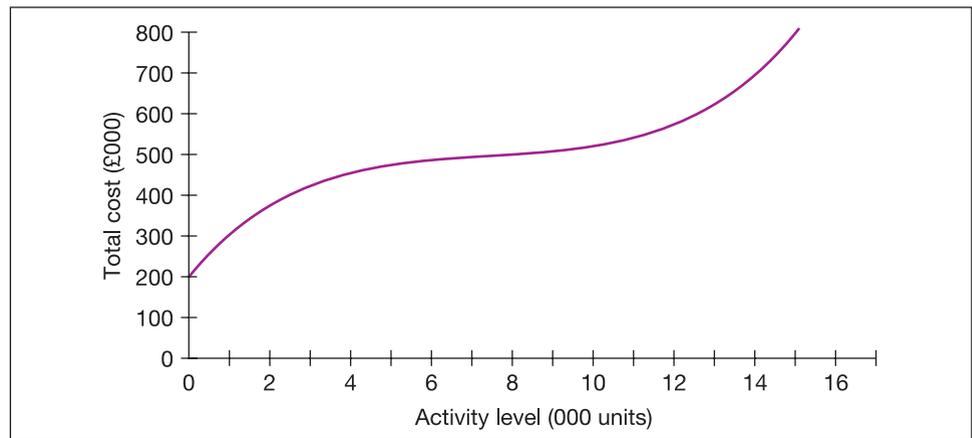
There are two ways of viewing the behaviour of cost in relation to **activity** level. One is referred to as *the economist's view* and the other is referred to as *the accountant's*

*view*. Each is discussed here, and the use of the accountant's view is then justified as a reasonable short-term approximation.

### 20.2.1 The economist's view

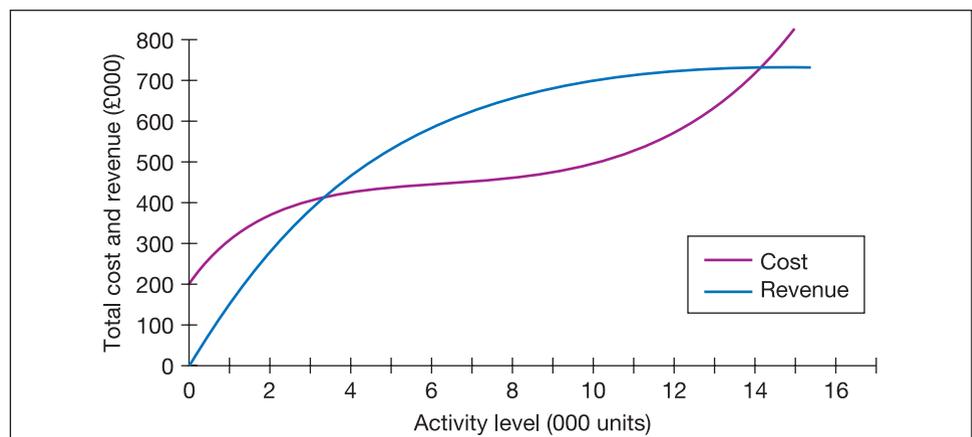
Exhibit 20.1 shows total cost related to activity level over a wide range of activity within a business. Starting at zero activity, there is a total cost of £200,000 shown representing the fixed cost of the operations, including items such as rent of premises, business rates, administration salaries and any similar costs incurred to allow operations to commence. Initially, the slope of the graph rises relatively steeply because high levels of costs are incurred as activity begins. Then the slope becomes less steep as the business begins to enjoy the economies of scale, sharing fixed costs over a wider range of activity so that the marginal cost of producing an extra item becomes progressively less. At the extreme right-hand side of the graph the slope begins to rise more steeply again as further fixed costs are incurred. Perhaps high rental has to be paid for new premises at this point to allow expansion, or labour resources become more scarce and higher labour rates have to be paid to employ staff.

**Exhibit 20.1**  
Total cost varying with activity



To calculate profit, a business must compare its cost with its revenue. The economist's portrayal of revenue is superimposed on the cost line in Exhibit 20.2. The total revenue

**Exhibit 20.2**  
Revenue and costs: the economist's view



starts at zero when there is zero activity. It rises rapidly when supply begins and customers are willing to pay relatively high prices for the goods. Then, as supply increases, the marginal selling price of each item decreases progressively as it becomes more difficult to sell larger volumes of output. Where the total revenue line is below the total cost line the business is making a loss, and where the total revenue line is above the total cost line the business is making a profit. The business represented by the graph in Exhibit 20.2 shows losses at the left-hand and right-hand sides of the diagram and a profit in the centre. Successful businesses aim to stay in the profit-making region.

### 20.2.2 The accountant's view

The economist's view of costs covers a very wide range of output. In any particular period, especially in the short term, the actual range of output will be relatively narrow. Looking at Exhibit 20.2 the lines close to the breakeven point are close to being straight lines over a narrow range either side. Accounting assumes that at any point in time this relatively narrow range is available in practice and so the cost and revenue curves are approximately straight lines.

The data in Exhibit 20.3 is used in this section to illustrate the accountant's view of how costs change with levels of activity.

#### Exhibit 20.3

Table of data showing variable and fixed costs

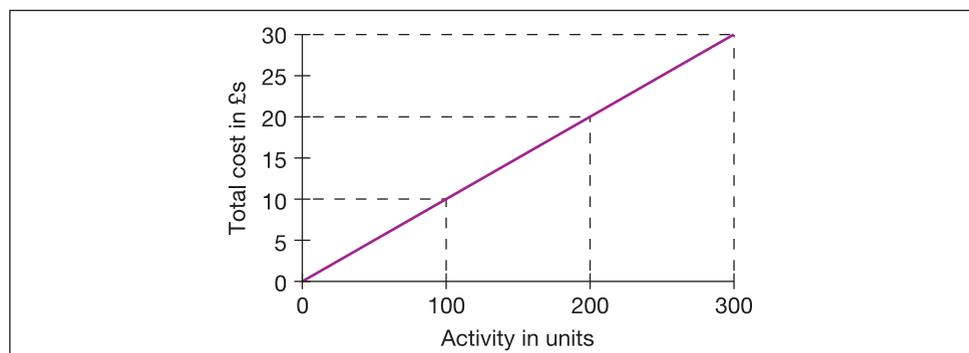
Activity level	0 units	100 units	200 units	300 units
	£	£	£	£
Variable cost	0	10	20	30
Fixed cost	20	20	20	20
Total cost	20	30	40	50

The graph in Exhibit 20.2 represents activity level changes which could take some time to achieve as the business grows. The accountant takes a much shorter time perspective and looks at a relatively limited range of activity that might be achieved within that time period. In those circumstances, it may be reasonable to use straight-line graphs rather than curves, although great care is needed before assuming it is safe to use straight lines.

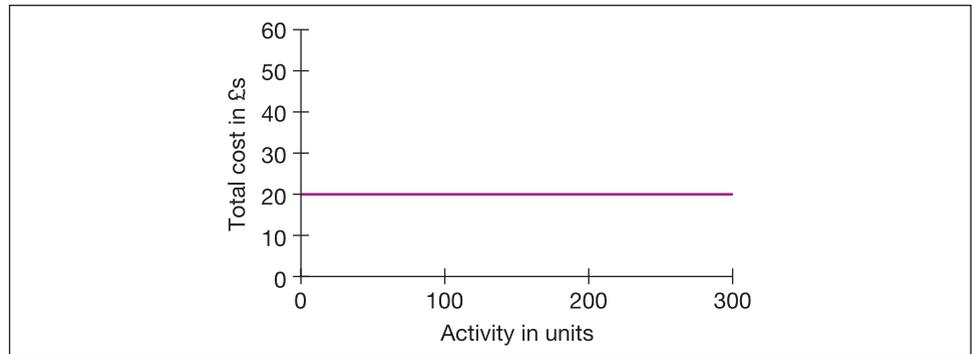
Using the data of Exhibit 20.3, a graph of variable cost is shown in Exhibit 20.4 and a graph of fixed cost is shown in Exhibit 20.5.

#### Exhibit 20.4

Variable cost

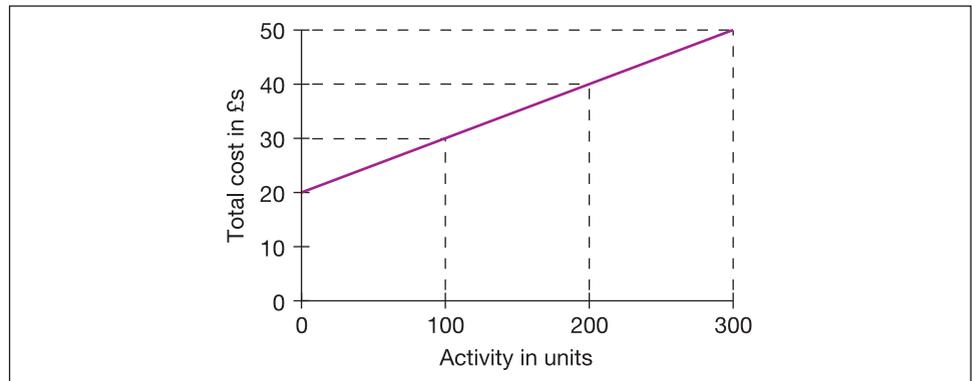


**Exhibit 20.5**  
**Fixed cost**



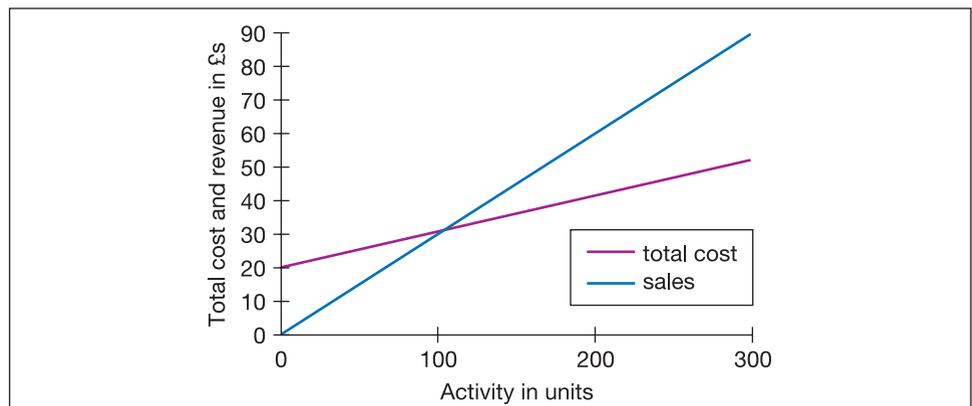
In Exhibit 20.6, these two graphs are added together to give a graph of total cost. The total cost starts at £20 and increases by £10 for every 100 units of activity. The total cost line meets the vertical axis at the fixed cost amount of £20. The slope of the total cost line gives a picture of how fast the variable costs are rising as activity level increases.

**Exhibit 20.6**  
**Total cost**



The profit of the business is measured by comparing costs with revenues. Here again, the accountant takes the view that it may be reasonable, over a short time-scale and relatively limited range of activity, to use a straight line. In Exhibit 20.7, a sales line

**Exhibit 20.7**  
**Total cost and total sales**



is added based on a selling price of 30 pence per unit, so that total sales are £30 for 100 units, £60 for 200 units and £90 for 300 units.

The sales line is below the cost line at the left-hand side of the graph, crossing the cost line when the activity is 100 units. This shows that for activity levels below 100 units the business will make a loss. At 100 units of activity the business makes neither profit nor loss. This is called the **breakeven point**. Beyond 100 units of activity the business makes a profit and the amount of profit is measured by the vertical difference between the sales and cost lines.

### Definition

The **breakeven point** is that point of activity (measured as sales volume) where total sales and total cost are equal, so that there is neither profit nor loss.

The graph shown in Exhibit 20.7 is more commonly called a **breakeven chart**. It shows the activity level at which total costs equal total sales and at which the business makes neither a profit nor a loss. It also shows what happens to costs and revenues on either side of this breakeven point. If activity falls below the breakeven level, then the amount of loss will be measured by the vertical distance between the cost and sales line.

If activity rises above the breakeven level then the amount of profit will be measured by the vertical distance between the sales and cost line. If the business is operating at an activity level higher than the breakeven point, the distance between these two points is called the **margin of safety**. The margin of safety indicates how much activity has to fall from its present level before profit becomes zero.

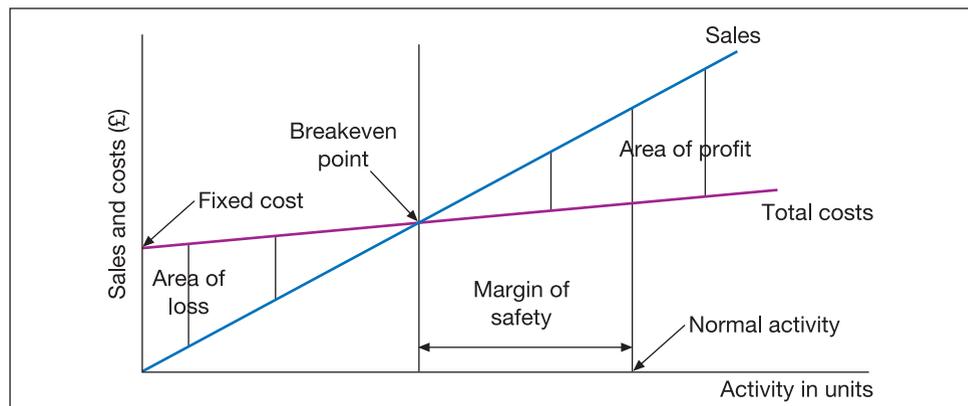
### Definition

The **margin of safety** is the difference between the breakeven sales and the normal level of sales (measured in units or in £s of sales).

Exhibit 20.8 summarises the various features of a breakeven chart. The use of a chart of this type to depict the behaviour of costs and sales over a range of activity in the short term has been found extremely helpful in presenting management accounting information to non-financial managers who are involved in making decisions which have financial consequences.

### Exhibit 20.8

#### The features of a breakeven chart



### 20.2.3 Cost–volume–profit analysis

Cost–volume–profit analysis is based on the idea that in the short run it is possible to survive in business providing sales revenue covers variable cost. The contribution from a product is the amount by which its selling price exceeds its variable cost. The excess of selling price over variable cost makes a contribution to covering fixed costs and then making a profit. In the short run it may be worth continuing in business if the selling price is greater than variable cost, so that there is a contribution to fixed costs, even where some part of the fixed costs is not covered. In the long term it is essential to earn sufficient sales revenue to cover *all* costs.

#### Definition

**Contribution per unit** is the selling price per unit minus the variable cost per unit. It measures the contribution made by each item of output to the fixed costs and profit of the organisation.

## 20.3 Breakeven analysis

**Breakeven analysis** is a technique of management accounting which is based on calculating the breakeven point and analysing the consequences of changes in various factors calculating the breakeven point. The idea of **contribution** is central to breakeven analysis in evaluating the effects of various short-term decisions.

This section explains ways of finding the breakeven point. It uses the information in Exhibit 20.9 to compare different approaches.

#### Exhibit 20.9

##### Illustration: market trader

A market trader rents a stall at a fixed price of £200 for a day and sells souvenirs. These cost the trader 50 pence each to buy and have a selling price of 90 pence each. How many souvenirs must be sold to break even?

#### Activity 20.2

*Hopefully, you will find the case study so easy to solve that you will already have computed the answer. If so, then analyse how you arrived at the answer before you read the next paragraphs and compare your method with the descriptions given there. It is always better to work out a method for yourself, if it is a good one, than to try remembering something from a book.*

### 20.3.1 Calculating the break-even point

#### Calculating contribution

The **contribution** from a product is the amount by which its selling price exceeds its variable cost. The idea of contribution is central to breakeven analysis in evaluating the effects of various decisions.

Once the **contribution per unit** is known it can be compared with the **fixed costs**. The business does not begin to make a profit until the fixed costs are covered, so the formula is applied as:

<b>Breakeven point</b>	equals	$\frac{\text{Fixed costs}}{\text{Contribution per unit}}$
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Taking the data from the illustration in Exhibit 20.9, the contribution is 40 pence per souvenir (selling price 90 pence minus variable cost 50 pence) and the fixed costs are £200:

$$\text{Breakeven point} = \frac{200}{0.40} = 500 \text{ units}$$

### Algebraic method

The equation for the breakeven point is:

<b>Sales</b>	equals	<b>Fixed costs + Variable costs</b>
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If the number of souvenirs sold at the breakeven point is  $n$ , then the total sales revenue is  $0.9n$  and the total variable cost is  $0.5n$ :

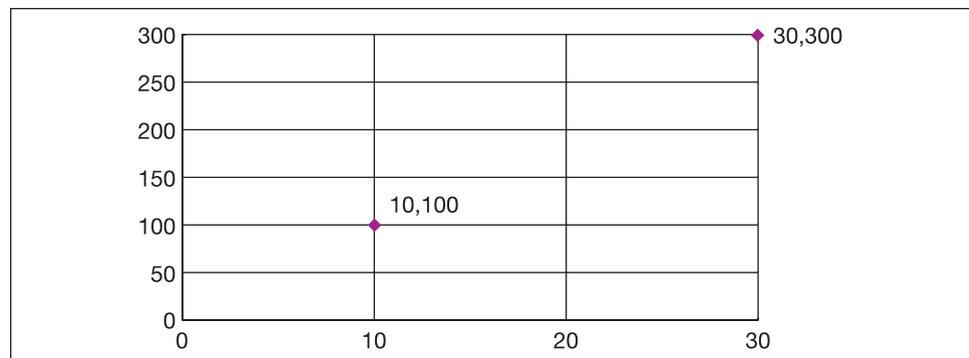
$$\begin{aligned} 0.9n &= 200 + 0.5n \\ 0.4n &= 200 \end{aligned}$$

Solving the equation,  $n = 500$  souvenirs need to be sold to break even.

### 20.3.2 Breakeven chart

The general appearance of a breakeven chart has already been shown in Exhibit 20.8. To plot the graph some points on each line are necessary. Because they are all straight lines only two points are needed, together with a ruler and pencil to join them. Points on a graph may be defined by specifying two co-ordinates in the form  $(x, y)$ . A point defined as  $(10, 100)$  means that it lies at the intersection of a line up from 10 on the horizontal ( $x$ ) axis and a line across from 100 on the vertical ( $y$ ) axis. In Exhibit 20.10, two points are plotted, namely,  $(10, 100)$  and  $(30, 300)$ . These may then be joined by a straight line.

**Exhibit 20.10**  
Plotting points for a graph



The graph needs to cover an activity scale wide enough to show both sides of the breakeven point, so it is a useful idea to work round the breakeven point by choosing one point which is loss making and one point which is profit making. The point of zero activity will usually be loss making because there is nil revenue but there are fixed costs. So the start of the sales line can be plotted at  $(0, 0)$  and the start of the cost line at  $(0, £200)$ . For a position of profit, the sales and total cost must be calculated for a higher activity level, which in this case might be 900 souvenirs:

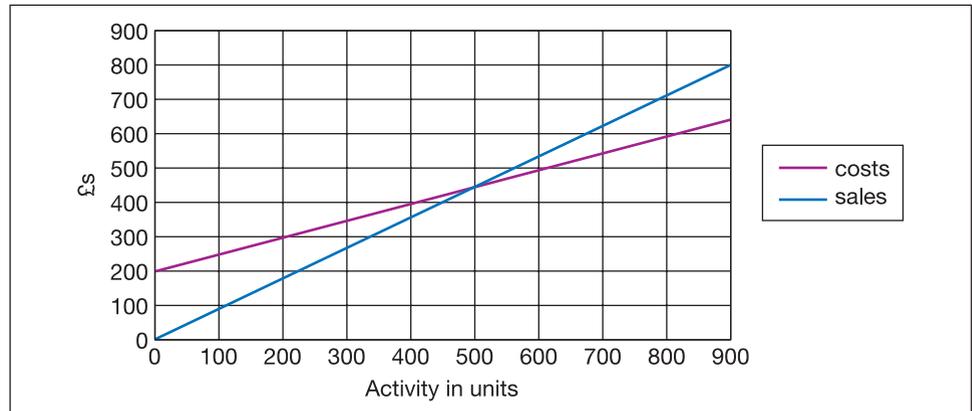
$$\text{Sales of 900 souvenirs at 90 pence each} = £810$$

The sales line will therefore join the points (0, £0) and (900, £810):

	£
Variable cost of 900 souvenirs at 50 pence each	= 450
Fixed cost	= <u>200</u>
Total cost	<u>650</u>

The total cost line joins (0, £200) and (900, £650). Exhibit 20.11 shows the breakeven chart with a breakeven point at 500 units sold. Gridlines are added to show the points plotted.

**Exhibit 20.11**  
Breakeven chart



### 20.3.3 Profit-volume graph

#### Defining the profit-volume ratio

Profit is an important aspect of most management accounting reports. However, the breakeven chart does not show directly the amount of profit. It has to be estimated by measuring the vertical distance between the sales and total cost lines. There is another form of graph used in management accounting called a **profit-volume chart**. On the horizontal axis is plotted the volume, measured by activity level in £s of sales, and on the vertical axis is plotted the profit at that activity level.

The activity level is measured in £s of sales in order that the slope of the graph matches the **profit/volume ratio**, a slightly confusing name for the ratio which calculates contribution as a percentage of sales value:

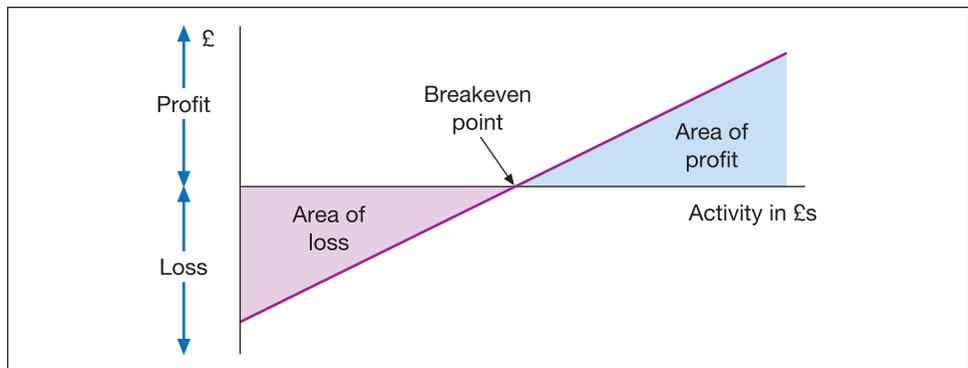
Profit/volume ratio	equals	$\frac{\text{Contribution per unit}}{\text{Selling price per unit}} \times 100$
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Exhibit 20.12 sets out a diagram showing the main features of a profit-volume chart.

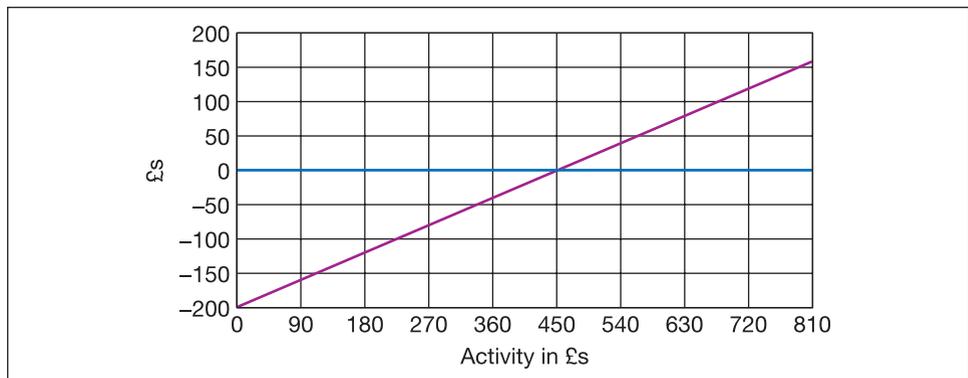
#### Illustration of a profit-volume chart

Taking the data used in preparing Exhibit 20.10, the preparation of a profit-volume graph requires only the profit line to be drawn. When sales are zero, there will be a loss equal to the fixed cost, which gives the first point to plot at (£0, -£200). When 900 units are sold the sales are £810 and the profit is £160, giving the second point to plot at (£810, £160). The result is shown in Exhibit 20.13. The gridlines are included to show where the profit line has been plotted. The breakeven point of zero profit

**Exhibit 20.12**  
**Profit-volume chart**



**Exhibit 20.13**  
**Profit-volume chart using data from the 'market trader' case study**



or loss is at a sales level of £450. The graph rises by £40 of profit for every £90 increase in sales activity, giving a slope of 44.4%.

The profit/volume ratio is calculated by formula as:

$$\frac{\text{Contribution per unit}}{\text{Sales price per unit}} = \frac{40 \text{ pence}}{90 \text{ pence}} = 44.4\%$$

## 20.4 Using breakeven analysis

**Breakeven analysis** is a very useful tool. It may be used to answer questions of the following type:

- What level of sales is necessary to cover **fixed costs** and make a specified profit?
- What is the effect of **contribution per unit** beyond the breakeven point?
- What happens to the **breakeven point** when the selling price of one unit changes?
- What happens to the **breakeven point** when the variable cost per unit changes?
- What happens to the **breakeven point** when the fixed costs change?

Each of these questions is now dealt with in this section by an illustration and an explanation following the illustration.

### 20.4.1 Covering fixed costs and making a profit

To find the level of sales necessary to cover fixed costs and make a specified profit requires a knowledge of selling price per unit, variable cost per unit, and the fixed costs together with the desired profit. These are set out in the data table.

<i>Data</i>	
Selling price per unit	80 pence
Variable cost per unit	30 pence
Fixed cost	£300
Desired level of profit	£400

The contribution per unit is 50 pence (80 pence – 30 pence). To find the breakeven point, the fixed costs of £300 are divided by the contribution per unit to obtain a breakeven point of 600 units.

To meet fixed costs of £300 and desired profit of £400 requires the contribution to cover £700 in all. This is achieved by selling 1,400 units.

$$\text{Volume of sales required} = \frac{700}{0.5} = 1,400 \text{ units}$$

#### Activity 20.3

*Check that 1,400 units at a contribution of 50 pence each gives a total contribution of £700. It is always a useful precaution to check the arithmetic of a calculation as a safeguard against carelessness.*

### 20.4.2 Beyond the breakeven point

Beyond the breakeven point the fixed costs are covered and the sales of further units are making a contribution to profit. The higher the contribution per unit, the greater the profit from any particular level of activity. The data table sets out some information on selling prices, variable costs and fixed costs of two products.

*Data*  
A dry-cleaning shop takes two types of clothing. Jackets cost £6 to clean and the customer is charged £9 per garment. Coats cost £10 to clean and the customer is charged £12 per garment. The monthly fixed costs are £600 for each type of garment (representing the rental costs of two different types of machine). The shop expects to clean 500 jackets and 500 coats each month.

#### Activity 20.4

*Before reading the analysis following Exhibit 20.13, calculate the contribution made by each product, work out the breakeven point of each, and then explore the effect on the breakeven point of:*

- changes in the price charged to customers;*
- changes in the variable costs; and*
- changes in the fixed costs.*

*If you have access to a spreadsheet package this is the kind of problem for which spreadsheets are highly suitable.*

The calculations set out in Exhibit 20.14 show that, although both products have the same fixed costs, the jackets have a lower breakeven point because they make a higher contribution per unit. Beyond the breakeven point they continue to contribute more per unit. The profits at any given level of activity are therefore higher for jackets.

**Exhibit 20.14****Calculation of breakeven point and of sales beyond the breakeven point**

	<i>Jackets</i> £	<i>Coats</i> £
Selling price	9	12
Variable cost	<u>6</u>	<u>10</u>
Contribution per item	3	<u>2</u>
Fixed costs	£600	£600
Breakeven point	200 units	300 units
Profit for sales of 500 units	900	400

**20.4.3 Margin of safety**

The **margin of safety** has been defined as the difference between the **breakeven sales** and the normal level of sales, measured in units or in dollars of sales. In the case of the dry-cleaning shop, the margin of safety for jackets is 300 jackets (500 – 200) when 500 jackets are cleaned each month. The margin of safety for coats is 200 coats (500 – 300) when 500 coats are cleaned each month. The margin of safety is interpreted by saying that cleaning of jackets may fall by 300 per month before the breakeven point is reached but cleaning of coats will reach the breakeven point after a reduction of only 200 in coats cleaned. Cleaning coats is therefore riskier than cleaning jackets, if expected output is compared to breakeven volume.

**20.4.4 Change in selling price**

If the selling price per unit increases and costs remain constant, then the contribution per unit will increase and the breakeven volume will be lower. Take as an example the dry-cleaning business of the previous illustration. If the selling price of cleaning a coat rises to £15, then the contribution per unit will rise to £5. That will require cleaning only 120 coats to break even. The risk of raising the price is that customers may move elsewhere, so that while it may not be difficult to exceed the breakeven point at a selling price of £12 it may be extremely difficult at a selling price of £15.

**20.4.5 Change in variable cost**

The effect of a change in variable cost is very similar to the effect of a change in selling price. If the variable cost per unit increases, then the contribution per unit will decrease, with the result that more items will have to be sold in order to reach the breakeven point. If it is possible to reduce variable costs, then the contribution per unit will increase. The enterprise will reach the breakeven point at a lower level of activity and will then be earning profits at a faster rate.

**20.4.6 Change in fixed costs**

If **fixed costs** increase, then more units have to be sold in order to reach the breakeven point. Where the fixed costs of an operation are relatively high, there is a perception of greater risk because a cutback in activity for any reason is more likely to lead to a loss. Where an organisation has relatively low fixed costs, there may be less concern about margins of safety because the breakeven point is correspondingly lower.

## 20.5 Limitations of breakeven analysis

Breakeven analysis is a useful tool for problem solving and decision making, but some of the limitations should be noted:

- 1 The breakeven analysis assumes that cost and revenue behaviour patterns are known and that the change in activity levels can be represented by a straight line.
- 2 It may not always be feasible to split costs neatly into variable and fixed categories. Some costs show mixed behaviour.
- 3 The breakeven analysis assumes that fixed costs remain constant over the volume range under consideration. If that is not the case, then the graph of total costs will have a step in it where the fixed costs are expected to increase.
- 4 Breakeven analysis, as described so far in this book, assumes input and output volumes are the same, so that there is no build-up of stocks and work-in-progress.
- 5 Breakeven charts and simple analyses can only deal with one product at a time.
- 6 It is assumed that cost behaviour depends entirely on volume.

These limitations may be overcome by modifying the breakeven analysis. However, that would involve considerably more computation work and is beyond the scope of this book.

## 20.6 Applications of cost–volume–profit analysis

Breakeven analysis is a particular example of the more general technique of cost–volume–profit analysis. This analysis emphasises the relationship between sales revenue, costs and profit in the short term. In this context the short term is a period of time over which some costs are fixed, whatever the level of output within a range limited by the existing capacity of the business. In the longer term, all costs become variable because the capacity of a business can be altered by acquiring new premises, hiring more employees or investing in more equipment.

### Definition

**Cost–volume–profit analysis** evaluates the effects of forecast changes in sales, variable costs and fixed costs, to assist in decision making.

In using **cost–volume–profit analysis**, management accounting is meeting the needs of **directing attention** and **solving problems**. In the short term, decisions have to be made within the existing constraints of the capacity of the business and the aim of that decision making will be to maximise short-term profit. Typical decision-making situations requiring cost–volume–profit analysis would be:

- accepting a special order to use up spare capacity
- abandoning a line of business
- the existence of a limiting factor
- carrying out an activity in-house rather than buying in a service under contract.

Each of these situations is now considered in turn.

### Activity 20.5

*Those who comment on the applications of cost–volume–profit analysis always emphasise that it is a short-run decision-making tool. Write a 200-word note explaining this view.*

### 20.6.1 Special order to use up spare capacity

In the short term, a business must ensure that the revenue from each item of activity at least covers variable costs and makes a contribution to fixed costs. Once the fixed costs are covered by contribution, the greater the level of activity, the higher the profit. When the business reaches full capacity there will be a new element of fixed cost to consider should the business decide to increase its capacity. If there is no increase in capacity, then the business should concentrate on those activities producing the highest contribution per unit or per item.

But supposing the business is *not* operating at full capacity. Should it lower its sales price in an attempt to increase the volume of activity? The question may arise in the form of a request from a customer for a special price for a particular order. (Customers may well know that the business is not operating at full capacity and may therefore try to use their bargaining power to force a lower sales price.) Should the business accept the special order? Cost–volume–profit analysis gives the answer that the special order is acceptable provided the sales price per item covers the variable costs per item and provided there is no alternative use for the spare capacity which could result in a higher contribution per item.

### 20.6.2 Abandonment of a line of business

The management of a business may be concerned because one line of business appears not to be covering all its costs. This situation may arise particularly where costs are being used for score-keeping purposes and all fixed costs have been allocated to products. As was shown in Chapter 18, the allocation of fixed costs to products is a process which is somewhat arbitrary in nature, and is not relevant to decision making because the fixed costs are incurred irrespective of whether any business activity takes place.

When a line of business comes under scrutiny as to its profitability, cost–volume–profit analysis shows that in the short term it is worth continuing with the line if it makes a contribution to fixed costs. If the line of business is abandoned and nothing better takes its place, then that contribution is lost but the fixed costs run on regardless.

### 20.6.3 Existence of a limiting factor

In the short term, it may be that one of the inputs to a business activity is restricted in its availability. There may be a shortage of raw materials or a limited supply of skilled labour. There may be a delivery delay on machinery or a planning restriction which prevents the extension of a building on the business premises. There may then be a need to choose from a range of possible activities so as to maximise short-term profit. The item which is restricted in availability is called the **limiting factor**.

Cost–volume–profit analysis shows that maximisation of profit will occur if the activity is chosen which gives the highest **contribution per unit of limiting factor**.

### 20.6.4 In-house activity versus bought-in contract

For a manufacturing business, there may be a decision between making a component in-house as compared with buying the item ready-made. For a service business there may be a decision between employing staff in-house and using the services of an agency which supplies staff as and when required. Cost–volume–profit analysis shows that the decision should be based on comparison of variable costs per unit, relating this to the difference in fixed costs between the options.

## 20.7 Cases in short-term decision making

Cost–volume–profit analysis is particularly well suited to management needs in short-term decision making. Fiona McTaggart now discusses four cases she has come across where cost–volume–profit analysis has been relevant. The first relates to a decision about taking on a special order to fill a gap where the business was not running at full capacity. The second relates to a potential abandonment of a line of business, the third deals with a limiting factor causing scarcity of an input to the production process, and the fourth relates to buying in services.

### 20.7.1 Decisions on special orders



*FIONA: My first story is about a car hire business in a holiday resort which was experiencing a temporary fall in activity in the run-up to the start of the tourist season. Their normal charge was £3.00 per mile, to cover all costs including the driver's wages. A telephone installation company offered a three-month contract to run engineers between two towns on a return journey of 100 miles, at a fixed price of £180 per journey. The car hire company asked my advice about accepting this offer of £1.80 per mile.*

*I asked the company what the drivers and cars would be doing each day if the contract was not taken up and the answer was that they would not be doing anything other than waiting at the depot and cleaning their cars. My advice was that, on that basis, the contract would be worth undertaking if it covered the variable costs of each journey and made a contribution to fixed costs and profit.*

*We sat down to look at the fixed costs and produced the statement shown Exhibit 20.15. Quite deliberately I did not write any amounts against the separate items of fixed costs because I wanted to emphasise that these are the unavoidable element which will arise whether or not the contract is taken up.*

*From the data provided, I calculated the variable cost per mile as 20 pence for petrol and 8 pence for tyres, giving 28 pence in all. The normal charge of £3.00 per mile is intended to cover this 28 pence per mile plus the fixed cost per mile, amounting to £2.10 per mile using the average annual mileage per car. That total cost of £2.38 per mile leaves a profit of 62 pence per mile or £24,800 per annum if the average mileage is achieved.*

*It is clear that to cover all costs the charge of £3.00 is probably about right, but if the drivers and cars are otherwise unoccupied, extra journeys on the special contract contribute £1.52 per mile (£1.80 – £0.28) to fixed costs and profit. I advised them to take up the contract on two conditions:*

- 1 they must be as sure as they could be that there will not be an upturn in business during the hire period which would mean they were turning down the possibility of carrying passengers who would pay £3.00 per mile; and*
- 2 if the journeys involve extra payments to drivers for overtime or late-night work, those extra payments should be regarded as part of the variable cost of the contract and the costings recalculated on that basis.*

*They took my advice and carried out the contract. It fitted perfectly into the quiet period of business and the company realised later that the contract had made a useful contribution to profit at a time when drivers and cars would otherwise have been inactive.*

In Fiona's example, the company made use of the idea that, in the short term, any contract is worth taking on if it covers variable costs and makes some contribution to fixed costs and profit. Care needs to be taken that the special order does not create a precedent for future work, particularly if existing customers find that special treatment is being given which appears to undercut the price they are paying. The company may

**Exhibit 20.15****Analysis of variable and fixed costs of car hire firm**

<i>Variable costs:</i>	
Petrol	£1.20 per litre
Fuel consumption	6 miles per litre
Tyre costs	£1,600 per set of four tyres
Tyre replacement	every 20,000 miles
<i>Fixed costs:</i>	
	£84,000
<i>These covered:</i>	
Driver's wages	
Insurance	
Licence fee for airport waiting	
Licence fee to town council	
Depreciation of vehicle	
Annual testing	
Radio control membership	
<i>Average annual mileage per car:</i>	40,000 miles

find it difficult in future to return to the price which covers all costs. In the long term, the company must charge a price which covers fixed costs as well as variable costs if it is to survive.

Fiona's second illustration relates to a decision on abandoning a line of activity.

**20.7.2 Abandonment decisions**

*FIONA: A private tuition college was providing two types of secretarial training course. The first was teaching wordprocessing and the second was teaching office skills. The college had produced the profit and loss statement shown in Exhibit 20.16.*

*On the basis of this profit and loss statement the owners of the business were on the point of cancelling all further courses in office skills. I asked them how they had decided on the allocation of fixed overheads and they explained that these comprised primarily administrative staff costs and permanent teaching staff, plus items such as rent and business rates as well as depreciation of wordprocessors and of the equipment used in the cabin which had been set up to simulate the most up-to-date office conditions. The cabin itself was depreciated over 20 years. Fixed overhead which could be allocated directly to the relevant courses, such as depreciation of equipment, was allocated in its entirety to the relevant course type. This approach was also used for teaching costs where these were specific to one course type. Fixed overhead which could apply to each type of course, such as administrative staff salaries, was spread in proportion to the number of courses given.*

**Exhibit 20.16****Information for abandonment decision**

	<i>Wordprocessing</i> £000s	<i>Office skills</i> £000s	<i>Total</i> £000s
Tuition fee income	<u>485</u>	<u>500</u>	<u>985</u>
Variable costs	200	330	530
Fixed overhead	<u>120</u>	<u>220</u>	<u>340</u>
Total costs	<u>320</u>	<u>550</u>	<u>870</u>
Profit/(loss)	<u>165</u>	<u>(50)</u>	<u>115</u>

I pointed out to the owners that their profit and loss statement would be more informative if it were set out in the format shown in Exhibit 20.17.

### Exhibit 20.17

#### Revised data for abandonment decision

	Wordprocessing £000s	Office skills £000s	Total £000s
Tuition fee income	485	500	985
Variable costs	<u>200</u>	<u>330</u>	<u>530</u>
Contribution	285	170	455
Fixed overhead			<u>340</u>
Profit			<u>115</u>

From Exhibit 20.17 it is relatively straightforward to see that the office skills programme is making a contribution of £170,000 to fixed costs and profit, after covering its own variable costs. If the programme were not offered, then the business would have only the contribution of £285,000 from wordprocessing which would not cover the fixed overhead of £340,000. Far from abandoning the office skills programme, it was essential to retain it. The allocation of fixed overheads was, for short-term analysis purposes, irrelevant. The cabin and office equipment had already been purchased and would continue to depreciate whether used or not. If put up for sale, these assets would have a negligible value. Administrative and permanent staff were also in place and could not instantly be disengaged.

I advised them that while it was preferable in the short term to keep both programmes running, there were some questions they should ask themselves for longer-term planning:

- 1 To what extent do clients take up the wordprocessing courses because the office skills course may be studied at the same time and in the same place?
- 2 How much fixed cost could be avoided in the longer term if either course ceased to exist?
- 3 Would it be a more effective use of resources to concentrate only on one type of course so that the fixed costs are restricted to one type of equipment and perhaps relatively fewer administrative staff?

The answers might lead to reorganisation towards one type of course only. On the other hand, it might be found that the two programmes are so interrelated that each needs the other and the fixed costs are effectively essential to both, whatever the accounting allocation process.

Fiona's third story concerns a business where there was a restriction in the amount of a factor of input to the production process.

### 20.7.3 Existence of limiting factors



**FIONA:** A kitchen equipment service company had come across a problem of a shortage of trained engineers in a district because new oil exploration activity had attracted the best staff by making offers of high salaries.

On a short-term basis the company felt it could not continue to service washing machines, dishwashers and built-in ovens in that area and would prefer to concentrate on the most profitable use of its labour resource. Exhibit 20.18 shows the most recent annual data available, based on the situation before the employee shortage crisis arose. However, the total labour force now available was estimated in cost terms at £40,000 in total.

**Exhibit 20.18****Data for limiting factor problem**

	<i>Washing machines</i> £000s	<i>Dishwashers</i> £000s	<i>Built-in ovens</i> £000s
Sales	80	120	180
Direct materials	10	20	18
Direct labour	30	30	60
Variable overhead	<u>10</u>	<u>30</u>	<u>30</u>
Total variable cost	<u>50</u>	<u>80</u>	<u>108</u>
Contribution	<u>30</u>	<u>40</u>	<u>72</u>

I advised them that, in these circumstances, the limiting factor of labour should be used so as to maximise the contribution from every £ of labour used. First, I calculated the contribution per £ of scarce resource for each of the three types of service contract (see Exhibit 20.19).

**Exhibit 20.19****Calculation of contribution per £ of limiting factor**

	<i>Washing machines</i> £000s	<i>Dishwashers</i> £000s	<i>Built-in ovens</i> £000s
Contribution	30	40	72
Direct labour	30	30	60
Contribution per £ of labour	£1.00	£1.33	£1.20

The highest contribution per £ of labour is therefore provided by dishwashers, followed by built-in ovens. So I explained that it would be best to use the scarce labour resource first of all to service dishwashers. At the existing level of sales that would take up £30,000 worth of labour, leaving the balance of £10,000 worth of labour to service built-in ovens on a restricted basis. If more dishwasher work became available, that would be the preferred choice for profit generation.

This would be a short-term solution, but in the longer term it would be essential to consider whether the market could stand higher charges for servicing equipment, which would allow higher wage rates to be paid and thus permit all three types of work to continue.

Fiona has used in this example a particular case of a general principle that where limiting factors apply, profit is made as high as possible where the greatest contribution is obtained each time the scarce resource is used.

**20.7.4 Make or buy**

The management of a manufacturing business may have to decide whether to make a component in-house or buy the item ready-made.

Fiona McTaggart explains the problem:



**FIONA:** A car manufacturer has a problem regarding one quite small component used on a production line. The component may be purchased from an external supplier at £100 per item. It is currently being manufactured in-house at a cost of £110 per item, comprising fixed cost £30 per item and variable cost £80 per item. Annual output is currently 50,000 components and the trend of output is expected to be rising.

The external price looks attractive at first glance but, before I can advise the car manufacturer, I need to know more about the fixed cost. It is currently £1,500,000 per annum (£30 times 50,000 components). If the company can avoid the fixed cost by purchasing from the outside supplier, then I will compare the additional variable cost of £20 (£100 – £80) with the saving of £1,500,000. The company breaks even at 75,000 components (calculated as fixed cost saving of £1,500,000 divided by additional variable cost of £20). If demand is less than 75,000 then it is more cost effective to buy from the external supplier. If demand is more than 75,000 then it is more cost effective to manufacture in-house (provided fixed costs do not change at a higher level of output).

If the fixed cost of £1,500,000 cannot be avoided (perhaps it represents rent and property costs which would be incurred even if there were no production), then there is no advantage in buying from the external supplier. The relevant comparison in such a situation is between the variable cost of £80 and the external price of £100.

I would also advise the company that non-financial matters such as quality control and reliability of supply should be taken into consideration when deciding on external purchase rather than internal production.

### 20.7.5 In-house activity compared to bought-in services

In her final example, Fiona describes a situation where a company was considering buying in services rather than employing its own staff. Cost–volume–profit analysis implies that the decision should be based on the costs saved by not undertaking the activity in-house (the variable costs and any fixed costs that are avoidable) together with the costs incurred in buying the product or service from an external supplier (price multiplied by quantity purchased).



**FIONA:** A company had been employing its own legal department, comprising a qualified solicitor and two assistants. The solicitor was about to retire and the company had to decide whether to advertise for a replacement or to use a commercial law service as and when required. There would be no redundancy costs in respect of the two assistants because the younger one could be redeployed to a vacancy elsewhere in the organisation and the other would continue to be required as the internal contact with the commercial law service.

I showed the management that, because the commercial law service would charge on an hourly basis, the costs to be compared were the variable costs per hour charged by the commercial service and the fixed costs per annum of the in-house solicitor's salary. We compared the hourly charge rate of £400 with the solicitor's salary of £60,000 and the assistant's salary of £36,000 and worked out that the breakeven point would be 240 hours of the commercial law service each year. If more than 240 hours are requested next year, it would be worth continuing the in-house service.

### 20.7.6 Relevant costs

Throughout the examples above Fiona McTaggart has made use of the distinction between **fixed** and **variable** costs. She has also distinguished **relevant** from non-relevant costs. Generally the fixed costs have not been relevant to decision making but the variable costs have been relevant. Some fixed costs are relevant where they may be avoided by a specific course of action but others are not relevant because they may not be avoided.

#### Definition

**Relevant costs** are those future costs which will be affected by a decision to be taken. Non-relevant costs will not be affected by the decision.

## 20.8 Pricing decisions

One of the most important decisions taken by a business is that of pricing its product. If the price is too high, there will be no demand. If the price is too low, the organisation will be making a lower profit than could be achieved.

### 20.8.1 Economic factors affecting pricing

The method of arriving at a price depends on economic factors. If the business has a monopoly position (where one supplier has control of the market), it will be able to dictate its own price. However, the higher the price, the greater the attraction to incomers to break down the monopoly powers in seeking to share the benefits enjoyed by the monopolist.

Where the business is a market leader, it may be able to set its price by reference to covering its full costs and making a satisfactory profit. If there are only a few large sellers, each with a significant share of the market, the situation is described as an oligopoly. These few large sellers may compete with each other on price or they may prefer to set their prices at a level which covers all costs and to keep the price reasonably constant while competing on non-price factors such as quality of the product.

In a perfectly competitive market, no one supplier is in a position to dictate prices. Economic theory shows that the optimal price will be achieved where marginal cost equals marginal revenue. In other words, the additional cost of producing one more item of output equals the additional revenue obtained by selling that item. While the additional revenue exceeds the additional cost, the economist argues that it is worth producing more. When the additional revenue is less than the additional cost, production will not take place in the perfectly competitive market.

Pricing policy therefore depends primarily on the circumstances of the business. In many situations there is strong competition and the organisation must accept the market price and try to maximise its profit by controlling cost. In that situation, the most efficient organisation will achieve the highest profit as a percentage of sales. Sometimes the organisation may be faced with pressure from customers to reduce selling price. The decision to do so will require an evaluation of the lower price against costs. In other cases, the organisation may have some ability to control price and therefore has to decide on a price related to what the market will bear and related to covering its costs.

There are therefore some situations in which a cost-based pricing formula may be appropriate. These are now considered.

### 20.8.2 Full cost pricing

**Full cost pricing** is also called **cost-plus pricing**. The manager who is setting the price for goods or services calculates the total cost per unit of output and adds a percentage to that cost called the **percentage mark-up on cost**.

Calculation of total cost requires allocation of **overhead costs**. It was shown in Chapter 18 that there is more than one method of allocating production overhead costs. The same variety of method may be found in allocation of non-production overhead. Different organisations will have different ideas on which costs they want to cover in a cost-based pricing approach. What really matters is that the organisation understands its cost structure and ensures that all overhead costs are covered in some way by revenue in the longer term.

When the company is a price taker and is asked to take a lower price, or not to raise its existing price, then cost-plus pricing is still important, but it is also important for

the organisation to ensure that it makes a decision using **relevant costs**. If the pricing decision is based on a short-term perspective, then the organisation may decide to accept any price provided that the additional revenue covers the variable costs. That is the accountant's version of the economist's rule that marginal cost should equal marginal revenue. In management accounting terms, the item should make a **contribution** to fixed costs but does not necessarily need to cover all fixed costs. In the longer term, the business must cover all costs, whether fixed or variable, but it is possible that some fixed costs may be avoidable. If, for example, a reduced price is forced upon the business, it may accept this in the short term but also take a long-term decision to cut back on permanent staff and rental of premises. Such a decision may be unpleasant to take, in terms of human consequences for staff, but may allow the business to survive in a harsher economic situation.

### 20.8.3 Mark-up percentages

The full cost approach to pricing requires a percentage to be added to cost. Where does this percentage come from? The answer is that it depends very much on the type of business and the type of product. Where the market is competitive, mark-up percentages will be low and the organisation relies for its success on a high volume of sales activity. This may be seen in the operation of supermarkets, which charge lower prices than the small shops and therefore have lower margins on the items sold, but customers take away their purchases by the car load rather than in small parcels. In the case of supermarket chains there is another aspect to pricing in that they themselves buy from suppliers. The supermarkets may use the strength of their position to dictate price terms to the suppliers, so that the margins are not as low as they would seem from the prices charged to the customers.

In some industries, or for some products, there appears to be a 'normal' mark-up which all companies apply fairly closely. This 'normal' mark-up may be so characteristic that it is used by the auditor as a check on how reasonable the gross profit amount appears and is also used by the tax authorities as a check on whether all sales and profit are being declared for taxation purposes.

For those businesses which are in a position to apply cost-plus pricing, it may encourage stability in the pricing structure because other businesses in the same industry may be in a position to predict the behaviour of competitors. Companies in an industry will know the mix of variable and fixed costs in the industry and will therefore have a good idea of how competitors' profits will be affected by a change of price.

### 20.8.4 Limitations of full cost pricing

**Full cost pricing**, if used without sufficient care, may not take into account the demand for the product. A business may charge a profit margin of 20% on sales when market research could have shown that the potential customers would have accepted up to 25% as a profit margin and still bought the goods or services.

Apportionment of fixed costs is an arbitrary process, with more than one approach being available. The profit estimated using the cost-plus basis will depend on the apportionment of fixed costs. If the price is distorted by the costing process, an optimal level of sales may not be achieved.

There may be a lack of benefit to customers where businesses are able to set prices on a cost-plus basis and, as a consequence, a group of companies works together to 'agree' a price. Such a situation is described in economics as a 'cartel', and in some situations a government will legislate against price fixing by cartels because it creates a monopoly position in a situation which appears at first sight to be competitive.

### 20.8.5 Marginal cost pricing

Chapter 9 showed that, in the short term, a business may decide to accept a price that is lower than full cost providing the price offered is greater than the variable cost, so that there is a **contribution** to fixed overhead costs. This reflects the economist's position that a business will continue to sell providing the marginal revenue exceeds the marginal cost. It is therefore called *marginal cost pricing*. The most likely situation is that a customer, knowing that the business has spare capacity, will offer a contract at a reduced price to take up some of the spare capacity. The manager will accept the offer provided there is a contribution to fixed costs and profits and providing no additional fixed costs are incurred because of the extra contract.

#### Activity 20.6

Write down two products or services where the pricing might be based on cost plus a percentage to cover profits. Write down two products or services where the prices are determined in a highly competitive market. Write a short explanation (200 words) for an employee newsletter in a soap manufacturing business explaining why your product price is always a few pence higher in the shops than that of other leading brands.

## 20.9 Summary

Key themes in this chapter are:

- The accountant's view of cost behaviour differs from that of the economist. The accountant assumes that total cost and total revenue vary on a straight-line basis as the volume of output and sales increases. The economist sees total cost varying in a non-linear manner due to economies of scale and sees total revenue gradually levelling off as customers reach the point where they do not wish to buy more of the item.
- **Contribution** is defined as sales minus variable cost. Contribution per unit is compared with fixed overhead cost to calculate breakeven point. A breakeven chart and a profit–volume chart are useful ways of showing how contribution and profit change as the volume of output and sales increases.
- **Breakeven analysis** can be used to explore the effect of changing unit selling price, unit variable cost or fixed cost.
- **Breakeven analysis** has limitations because it is only suitable for *short-term decision making* and can only focus on one product at a time.
- A **breakeven chart** is a graph that shows sales and costs over a range of activity, including the activity level at which total costs equal total sales and at which the business makes neither a profit nor a loss.
- **Cost–volume–profit analysis** means comparing sales revenue with variable cost and fixed cost to calculate profit or loss over a range of activity, to help with short-term decision making.
- A **profit–volume chart** is a graph on which the horizontal axis shows the volume, measured by activity level in £s of sales, and the vertical axis shows the profit at that activity level.
- The **profit/volume ratio** is calculated as contribution as a percentage of sales value:
- The calculation of **contribution** can be applied in the short-term for decisions such as:
  - *Decisions on special orders* (does a lower price leave a positive contribution?)
  - *Abandonment decisions* (is the product or service making a positive contribution?)

- *Limiting factors* (which product or service gives the highest contribution per unit of limiting factor?)
- *Make or buy* (How does the price of the external product or service compare with the internal variable cost and the fixed overheads that will be saved?)
- Pricing decisions may be related to cost if the market accepts **full-cost pricing** (e.g. with a professional business where customers or clients seek out the personal service).
- Pricing decisions may be related to **marginal cost** if there is heavy competition and manufacturers take whatever price they can get in the market.

## QUESTIONS

The Questions section of each chapter has three types of question. 'Test your understanding' questions to help you review your reading are in the 'A' series of questions. You will find the answers to these by reading and thinking about the material in the book. 'Application' questions to test your ability to apply technical skills are in the 'B' series of questions. Questions requiring you to show skills in problem solving and evaluation are in the 'C' series of questions. A letter [S] indicates that there is a solution at the end of the book.

### A Test your understanding

- A20.1** Define 'variable cost' and 'fixed cost'. (Section 20.1)
- A20.2** Contrast the economist's view of costs and revenues with that taken in management accounting. (Section 20.2)
- A20.3** Explain the algebraic method for determining the breakeven point. (Section 20.3.1)
- A20.4** Explain the formula method for determining the breakeven point. (Section 20.3.1)
- A20.5** Sketch, and explain the main features of, a breakeven chart. (Section 20.3.2)
- A20.6** Sketch, and explain the main features of, a profit–volume chart. (Section 20.3.3)
- A20.7** What happens to the breakeven point when the sales price per unit falls? (Section 20.4.4)
- A20.8** What happens to the breakeven point when the variable cost per unit falls? (Section 20.4.5)
- A20.9** What happens to the breakeven point when fixed overheads increase? (Section 20.4.6)
- A20.10** State the limitations of breakeven analysis. (Section 20.5)
- A20.11** Give three examples of applications of cost–volume–profit analysis. (Section 20.6)
- A20.12** Explain how cost–volume–profit analysis may help in:
- (a) decisions on special orders; (Section 20.6.1)
  - (b) abandonment decisions; (Section 20.6.2)
  - (c) situations of limiting factors; and (Section 20.6.3)
  - (d) a decision on buying in services. (Section 20.6.4)
- A20.13** Explain how economic factors usually dictate prices of goods and services. (Section 20.8.1)
- A20.14** Explain the situations where full cost pricing may be appropriate. (Section 20.8.2)
- A20.15** What are the limitations of full cost pricing? (Section 20.8.4)
- A20.16** Explain the situations where marginal cost pricing may be appropriate. (Section 20.8.5)

## B Application

### B20.1 [S]

Fixed costs are £5,000. Variable cost per unit is £3 and the unit selling price is £5.50. What is the breakeven volume of sales?

### B20.2 [S]

Plot a breakeven chart based on the following data and label the features of interest on the chart:

Number of units	Fixed cost £	Variable cost £	Total cost £	Sales £
10	200	100	300	150
20	200	200	400	300
30	200	300	500	450
40	200	400	600	600
50	200	500	700	750

### B20.3 [S]

Montrose Glass Products Ltd manufactures three ranges of high-quality paper-weights – Basic, Standard and Deluxe. Its accountant has prepared a draft budget for Year 7:

	Basic £000s	Standard £000s	Deluxe £000s	Total £000s
Revenue	45	35	40	120
Material	<u>15</u>	<u>10</u>	<u>10</u>	<u>35</u>
Labour	20	15	5	40
Variable overhead	5	12	5	22
Fixed overhead	<u>9</u>	<u>5</u>	<u>6</u>	<u>20</u>
	<u>49</u>	<u>42</u>	<u>26</u>	<u>117</u>
Profit/(loss)	<u>(4)</u>	<u>(7)</u>	<u>14</u>	<u>3</u>

Fixed overheads are allocated to each product line on the basis of direct labour hours.

The directors are concerned about the viability of the company and are currently considering the cessation of both Basic and Standard ranges, since both are apparently making losses.

#### Required

- If the directors close down only the manufacture of Basic paperweights, what is the effect on total profit?
- If the directors close down only the manufacture of Standard paperweights, what is the effect on total profit?
- What is the best decision with regard to keeping profit as high as possible?

### B20.4 [S]

Chris Gibson Kitchenware Limited sells kitchen appliances to department stores. Product costs are ascertained using an absorption costing system from which the following statement has been prepared in respect of the business's three product lines:

	Dishwashers £000s	Fridges £000s	Ovens £000s	Total £000s
Sales	180	330	270	780
Less total costs	<u>(200)</u>	<u>(250)</u>	<u>(220)</u>	<u>(670)</u>
Profit/(loss)	<u>(20)</u>	<u>8</u>	<u>50</u>	<u>110</u>

It has been estimated that costs are 60% variable and 40% fixed.

**Required**

- (a) Restate the table distinguishing variable and fixed costs.  
 (b) Advise whether dishwashers should be dropped from the product range in order to improve profitability.

**B20.5 [S]**

Capital Tours Limited sells weekend tours of London for £200 per person. Last month 1,000 tours were sold and costs were £180,000 (representing a total cost per tour of £180). These costs included £60,000 which were fixed costs.

A local college wishing to send 200 students on an educational trip has offered Capital Tours £140 per tour.

**Required**

- (a) Explain with reasons whether Capital Tours should accept the offer.  
 (b) Explain the danger, in the long run, of Capital Tours using prices based on variable (marginal) costing.

## C Problem solving and evaluation

**C20.1 [S]**

Dairyproducts Ltd has recently developed sales of cream in aerosol dispensers which are sold alongside the company's traditional products of cartons of cream and packets of cheese. The company is now considering the sale of cream cheese in aerosol dispensers.

It is company policy that any new product must be capable of generating sufficient profit to cover all costs, including estimated initial marketing and advertising expenditure of £1,000,000.

Current weekly production, with unit costs and selling prices, is as follows:

	<i>Units of output</i>	<i>Variable cost (£)</i>	<i>Fixed cost (£)</i>	<i>Selling price (£)</i>
Cartons of cream	400,000	0.45	0.15	0.75
Aerosol cans of cream	96,000	0.50	0.25	1.05
Packets of cheese	280,000	1.00	0.20	1.30

Sales volume is equal to production volume. A 50-week trading year is assumed. Rates of absorption of fixed costs are based on current levels of output.

In order to produce cream cheese in aerosol dispensers, the aerosol machine would require modification at a cost of £400,000 which is to be recovered through sales within one year. Additional annual fixed costs of £500,000 would be incurred in manufacturing the new product. Variable cost of production would be 50 pence per can. Initial research has estimated demand as follows:

<i>Price per can (£)</i>	<i>Maximum weekly demand (cans)</i>
1.50	60,000
1.40	80,000
1.15	100,000

There is adequate capacity on the aerosol machine, but the factory is operating near capacity in other areas. The new product would have to be produced by reducing production elsewhere and two alternatives have been identified:

- (a) reduce production of cream cartons by 20% per annum; or  
 (b) reduce production of packet cheese by 25% per annum.

The directors consider that the new product must cover any loss of profit caused by this reduction in volume. They are also aware that market research has shown growing customer dissatisfaction because of wastage with cream sold in cartons.

#### Required

Prepare a memorandum to the board of directors of Dairyproducts Ltd showing the outcome of the alternative courses of action open to the company and make a recommendation on the most profitable.

#### C20.2

A company is able to sell four products and is planning its production mix for the next period. Estimated costs, sales and production data are as follows:

<i>Product</i>	<i>L</i>	<i>M</i>	<i>N</i>	<i>O</i>
	£	£	£	£
Selling price per unit	<u>60</u>	<u>90</u>	<u>120</u>	<u>108</u>
Less Variable costs				
Labour (at £6 per hour)	18	12	42	30
Material (at £3 per kg)	<u>18</u>	<u>54</u>	<u>30</u>	<u>36</u>
= Contribution per unit	<u>24</u>	<u>24</u>	<u>48</u>	<u>42</u>
Resources per unit				
Labour (hours)	3	2	7	5
Material (kg)	6	18	10	12
Maximum demand (units)	5,000	5,000	5,000	5,000

#### Required

- Based on the foregoing information, show the most profitable production mix under each of the following mutually exclusive assumptions:
  - if labour hours are limited to 50,000 in a period; or
  - if material is limited to 110,000 kg in a period.
- Write a short explanation, suitable for sending to the production director, explaining your recommendation in each case.

## Cases for study groups

### Case 20.1

Leisure Furniture Ltd produces furniture for hotels and public houses using specific designs prepared by firms of interior design consultants. Business is brisk and the market is highly competitive with a number of rival companies tendering for work. The company's pricing policy, based on marginal costing (variable costing) techniques, is generating high sales.

The main activity of Home Furniture Ltd is the production of a limited range of standard lounge suites for household use. The company also offers a service constructing furniture to customers' designs. This work is undertaken to utilise any spare capacity. The main customers of the company are the major chains of furniture retailers. Due to recession, consumer spending on household durables has decreased recently and, as a result, the company is experiencing a significant reduction in orders for its standard lounge suites. The market is unlikely to improve within the next year. The company's pricing policy is to add a percentage mark-up to total cost.

#### Required

Explain why different pricing policies may be appropriate in different circumstances, illustrating your answer by reference to Leisure Furniture Ltd and Home Furniture Ltd.

### Case 20.2

In groups of three, take the role of finance director, production director and sales director in a company manufacturing pressure die castings, gravity die castings and sand castings. The

three types of casting are manufactured in different locations but each is no more than 20 miles from either of the other locations. All castings are brought to central premises for finishing treatment. The costs of materials are around 56% of final sales price and the costs of labour are around 30% of sales price.

The finance director has been asked to explain to the production director and the sales director the effect of measuring profit using variable costing rather than absorption costing. It is important to keep separate the profit on each of the three product types. The finance director should provide a short explanation and the production director and sales director should ask questions about anything which is unclear or omitted from the explanation. After the discussion is completed (say, 30 minutes in all) the group should make a presentation to the class outlining the nature of their discussion and the conclusion reached as to how profit for each product should be measured.

### Case 20.3

Your company manufactures furniture units to customers' specifications. In groups of three, take the role of sales director, production director and finance director. You have met to decide on the price to be charged for each contract. The sales director aims to maximise revenue, the finance director seeks to maximise profit and the production director wishes to continue operating at full capacity. Discuss the approach you will take to deciding the company's pricing policy for the year ahead. Present to the rest of the class the arguments you will present to the entire board of directors.

