4.3 Cost-volume-profit (breakeven) analysis

We saw earlier that **contribution** is the difference between sales revenue and the *variable cost* of sales. Another way of putting this is to say that it is the amount of selling price left over after variable costs have been paid for. It is this amount which must be sufficient to cover fixed costs and, perhaps, to make a profit. (In fact, 'contribution' is a short-hand expression for: 'contribution to covering fixed costs and making a profit'.)

Suppose that the unit selling price of a widget is $1.00, and its variable cost is $0.40. Every time we sell a widget, we earn a contribution of $0.60 towards covering fixed costs and making a profit.

- If we sell only a few widgets, our total contribution will not be sufficient to cover fixed costs and we will make a loss.
- If we sell very many widgets our total contribution will more than cover fixed costs and we will make a profit.
- Somewhere in between there is a sales level such that our total contribution exactly matches our fixed costs. In this case we make neither profit nor loss: we break even.

Breakeven point is the point at which a supplier sells a sufficient volume of product to cover its costs exactly: it 'breaks even', neither making a loss nor a profit. Any additional sales will tip the balance over into profit.

Suppose that our widget maker has annual fixed costs of $60,000. If each widget earns a contribution of $0.60, the business needs to sell $60,000/$0.60 = 100,000 widgets per year, to cover its fixed costs. For each additional widget sold, the company will be making a profit of $0.60.

Instead of giving the monetary amount of $0.60, we could have expressed contribution as a percentage of the selling price: $0.60 = 60% of $1.00. We could then have calculated the breakeven point (in $) as $60,000 ÷ 60% = $100,000. At a selling price of $1.00 per unit, this equates to a breakeven sales volume of 100,000 widgets per year.

If asked to calculate a breakeven point from data given, we plug the data into the following cost-volume-profit formula.

$$\text{Breakeven point (in units)} = \frac{\text{Fixed costs}}{\text{Selling price minus variable cost per unit}}$$

You can then multiply this number of units by selling price (per unit) to get a breakeven point in sales revenue terms.

Worked example

Let's consider a supplier which produces a single product. The normal selling price for the product is $15 per unit and the variable costs of production are $6 per unit: a contribution of $9 for every unit sold. Again for simplicity, let's say that all the supplier's other costs are fixed and amount to $630,000 per annum.

The table below shows the supplier's position on different assumptions regarding sales volumes.

Sales volume in units	50,000	75,000	100,000
	$000	*$000*	*$000*
Fixed costs	630	630	630
Variable costs @ $6 per unit	300	450	600
Total costs	930	1,080	1,230
Sales revenue @ $15 per unit	750	1,125	1,500
(Loss)/profit per annum	(180)	45	270

The position is fairly clear: if sales of only 50,000 units are achieved, the supplier expects to make a loss of around $180,000; at a sales volume of 75,000 units a small profit is earned; and at a higher sales volume, profit increases quite nicely.

For this company to break even, it must earn sufficient contribution each year to cover its annual fixed costs of $630,000: a target sales volume of ($630,000/$9) = 70,000 units.

Once the company has covered fixed costs, any contribution earned on additional sales volume represents clear profit. A sales volume 5,000 in excess of breakeven point leads to a profit equal to the excess contribution 5,000 x $9 = $45,000 (as borne out by our calculations in the table.)

As a practice exercise, use similar reasoning to check what profit the company should make if a sales volume of 100,000 units is achieved. Check your answer by reference to the table above.

4.4 Margin of safety

The margin of safety is the difference between the planned sales volume and the breakeven sales volume.

For example, if the company in our worked example plans to achieve a sales volume of 100,000 units, the margin of safety is 30,000 units: sales volume can fall short of the target by as many as 30,000 units and the company will still break even (at 70,000 units).

Planned sales volume – breakeven sales volume = margin of safety
100,000 units – 70,000 units = 30,000 units

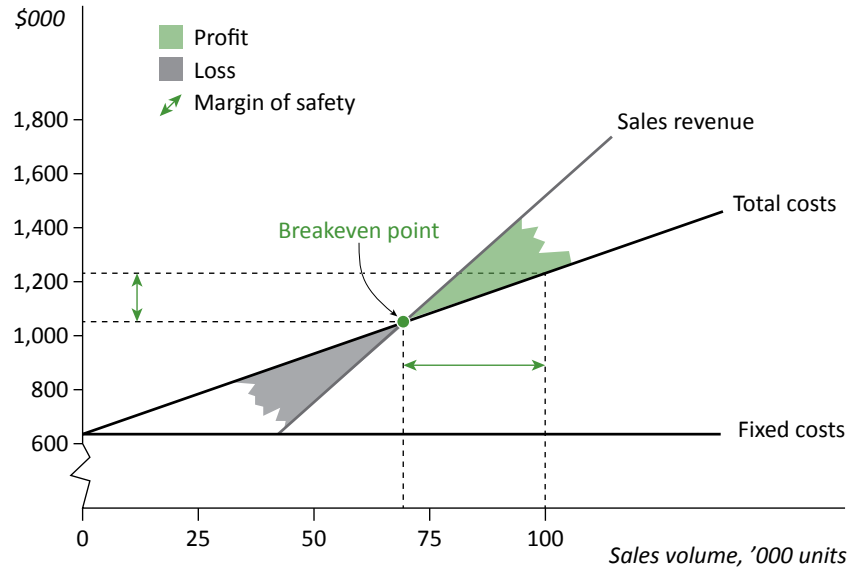
The margin of safety is often expressed as a percentage of the planned sales. A loss will result if there is a shortfall of more than 30% from the planned sales volume.

$$\text{Margin of safety} = \frac{30{,}000}{100{,}000} = 30\% \text{ of planned sales}$$

4.5 Breakeven analysis using charts

To show how breakeven analysis can be illustrated graphically we will again use the figures from our worked example: Figure 4.3.

Figure 4.3 *Breakeven analysis*



The diagram can be interpreted as follows.

- The vertical axis is for sales and costs in monetary terms, and the horizontal axis for sales volume in units. The vertical axis is broken at the beginning to allow us to concentrate on the interesting part of the graph.
- Fixed costs are represented by a horizontal line at the level of $630,000, reflecting the fact that these costs are unchanged no matter what sales volume is achieved.
- Sales revenue rises in a straight line as sales volume increases.
- Total costs also rise in a straight line. For a zero sales volume, total costs consist of fixed costs of $630,000; for a sales volume of 100,000 units, fixed costs remain the same, but variable costs of $600,000 must be added, a total of $1,230,000.

The **breakeven point** can be read off the graph as the intersection of the **sales revenue** and **total costs** lines: in other words, the point where total sales revenue is equal to total costs. This is the point on the horizontal axis representing 70,000 units of sales. This in turn corresponds to the point on the vertical axis representing $1,050,000 of sales revenue and total costs.

As a practice exercise, use the graph to estimate what sales level (in both volume and monetary terms) our company would have to achieve in order to make a profit of $180,000. Check your reading by using the arithmetical approach. (You should arrive at an answer of 90,000 units or $1,350,000.)