# Revenue, costs and break-even analysis

## Revenue

**Revenue** is the money a business makes from sales. In other words, it is the value of the sales and is also referred to as turnover. The total amount of money a business receives from its sales is called total revenue.

**Total revenue = quantity sold x selling price**

By calculating the total revenue a business can then work out if they have made a profit or a loss.

**Profit = total revenue – total costs**

Of course, all businesses want to make a profit. However, if total costs are greater than total revenue then the business will make a loss.

## Fixed costs

In every business some costs will remain the same whatever the level of output produced or products sold. For a shop, even if no customers visit, the rent or mortgage will have to be paid. There will still be business rates to pay, and the electricity for lighting, fridges etc. will still have to be paid. A software business will find that the value of its hardware depreciates (falls in value) even if it is not being used. An ice cream salesman in his van will have to pay insurance and road tax even if no ice creams are sold. These are all **fixed costs**. Fixed costs are costs that do not vary with output. No matter how much is made or how little is sold, fixed costs still have to be paid.

## Variable costs

**Variable costs** behave quite differently from fixed costs. Variable costs vary in direct proportion to output – as output increases variable costs increase, as output falls variable costs fall. Using the example of a tailor's shop, variable costs would include cloth, cotton, buttons etc. None of these raw materials of the suits or dresses made would be used if no goods were produced. So when output or sales are nil, then variable costs are nil. However, as soon as output starts, then these raw materials start being used. As more and more suits and dresses are made, so more and more cloth, buttons and cotton are used. We can therefore say that at output zero, variable costs are zero; but as output increases variable costs also rise.

We assume that there is a constant relationship between output and variable costs, but in most cases this constant relationship does not hold true. Businesses who produce more often benefit from purchasing economies of scale, so as output increases variable costs per unit produced start to fall.

Not all costs can be defined as fixed or variable. Some costs, such as labour, could be fixed (a permanent member of staff working a 38 hour week) or variable (the member of staff being asked to work 5 hours overtime due to increased demand). These types of costs are called **semi-variable**.

## Total costs

**Total costs** are found by adding together fixed costs and variable costs. At every level of output (apart from nil), a business's costs will be a combination of fixed and variable costs – the two added together make total costs. At zero output the business only has fixed costs, there are no variable costs. So at zero output, fixed costs = total costs. However, once the business starts production or starts making sales then total costs will be made up of fixed and variable costs.

Average total costs are the average cost of producing each unit of output. Because total costs consist of fixed and variable costs, as output increases then **average total costs** start to fall. This fall in average total costs will continue until a point is reached where diseconomies of scale force variable costs to rise sufficiently to push up the average total costs of production.

It is important for managers to be able to judge profitability. Decisions need to be made on continuing or discontinuing production – whether to make an investment in developing a product, whether to start training programmes or input more human resources. Without information on profitability, or lack of profitability, effective decisions cannot be made. To enable these decisions to be made businesses must have a method of allocating costs to each product, department, branch or factory. One method of implementing this cost allocation is to divide a business's costs into **direct costs and overheads**.

**Direct costs** are costs that arise specifically from the production of a product or the provision of a service. Examples of direct costs include:

- rent on a shop;
- materials or components;
- direct labour;
- expenses such as copyright payments on a published book, or licence fees for use of patents.

These direct costs can be totalled to give the direct costs of producing the product. However, revenue minus direct costs does not indicate profitability. The business must also apportion **overheads** or **indirect costs** to the product.

The production of any product results in a business paying costs not directly related to production or service provision. For example, a factory producing 10 different goods, to each of which managers allocate direct costs, will employ a secretary or receptionist. The overhead cost of employing the secretary or receptionist needs to be apportioned or allocated to the products to gain a picture of true profitability. For retailers, advertising is an overhead; the cost of advertising should be shared out amongst retail outlets to better judge profitability. So the true profitability of a product, factory, outlet etc. can only be judged if we take from revenue both direct costs and overheads. Overheads are therefore costs not directly related to production.

## Calculating costs

| Output | Fixed costs | Variable costs | Total costs | Average total costs |
|--------|-------------|----------------|-------------|---------------------|
| 0 | 1016 | | 1016 | |
| 10 | 1016 | 600 | 1616 | 161.60 |
| 20 | 1016 | 1150 | 2166 | 108.30 |
| 30 | 1016 | 1650 | 2666 | 88.87 |
| 40 | 1016 | 2100 | 3116 | 77.90 |
| 50 | 1016 | 2450 | 3466 | 69.32 |
| 60 | 1016 | 2800 | 3816 | 63.60 |
| 70 | 1016 | 3300 | 4316 | 61.66 |
| 80 | 1016 | 3850 | 4866 | 60.83 |
| 90 | 1016 | 4450 | 5466 | 60.73 |
| 100 | 1016 | 5100 | 6116 | 61.16 |
| 110 | 1016 | 6000 | 7016 | 63.78 |

In the above table we see the business has fixed costs (per week) of £1016. At zero output, variable costs are zero. As output increases, variable costs start to increase, as do total costs. However, the increase is not constant, i.e. not in direct proportion to output.

To find the average total costs we simply divide total costs by output.

## Break-even analysis

To gain an understanding of calculating break-even we will use the example of a young entrepreneur wishing to start up a business delivering packages of fruit and veg.

He knows that the last local shop in his area closed last year. Sensibly, he has carried out market research which indicates that there will be a good level of demand, but before he begins he needs to know how profitable the business might be. He has also fully researched the costs of starting up as a deliveryman and the costs of purchasing supplies. The costs he has researched are as follows:

- cost of delivery van purchase £6000;
- insurance and road tax £100 per month;
- petrol £10.00 per day;
- average cost of fruit and veg box £5.00;
- wages (the amount the owner draws from the business) £1150 per month;
- loan repayment to cover the cost of the van £500 per month for twelve months.

**His market research indicates that the fruit and veg boxes will have an average sales price of £9.00.**

The question then is how many boxes will he need to sell to cover all his costs, i.e. to break even? He decides to calculate break-even on a monthly basis.

## Calculating the break-even point

The first step is to calculate his monthly costs. We separate costs into fixed costs and variable costs. **This division into fixed and variable costs is very important in break-even analysis.** So the first stage in our deliveryman's calculation of his monthly break-even sales level is the division of his costs into fixed and variable costs. The loan must be repaid each month, no matter how many boxes he sells. So this is a fixed cost. As he intends to follow the same route each day, the petrol cost will not vary with sales, therefore this is another fixed cost. He will still need his £1150 per month to live on no matter how many boxes he sells; this is therefore a fixed cost.

The fruit and veg is to be ordered from the wholesaler on a daily basis. He will order what he needs, therefore cost will vary with sales – this is a variable cost.

We can now prepare a monthly cost table:

| Fixed costs | Total fixed costs £2000 per month | Loan repayment £500 per month | Petrol costs £250 per month | Insurance and road tax £100 per month | The amount the owner draws from the business £1150 per month |
|---|---|---|---|---|---|
| Variable costs | £5.00 per box | | | | |
| Sales revenue | £9.00 per box | | | | |

# Calculating break-even point using the contribution method

Once we have calculated costs, the next step in calculating break-even output or sales is finding out how much **contribution** each item sold produces for the business.

> Every product made has a variable cost and a selling price (which must obviously be higher). The difference between the selling price per unit and the variable cost per unit is known as the CONTRIBUTION towards covering the business's fixed costs. There is a simple formula for calculating break-even output.
>
> **Break-even output = Fixed costs divided by the contribution per unit**

In the above case the selling price is £9, the variable cost is £5 – the contribution is therefore £4 per unit sold.

Fixed costs are £2000 per month and his contribution is £4 per box. If we divide fixed costs per month by contribution we will find out how many fruit and veg boxes must be sold to break even:

£2000/£4 = 500 boxes

**We can now see that to break even our deliveryman must sell 500 fruit and veg boxes per month.**

- If he sells more than 500 boxes he will make a profit.
- If he sells less than 500 boxes he will make a loss.
- At break-even point the total contribution (contribution per item X number sold) equals the total fixed costs.

## Calculating profit and loss

Break-even analysis also allows us to calculate the profit or loss a business will make at different levels of output. This will always be important – after all our grocery seller may wish to go into business only if his profits are likely to be at a certain level.

First of all calculate the break-even output, in the above case we know it is 500 boxes per month.

As a result of his market research he believes that he can sell 650 boxes a month. He now wants to know what his profit will be at that level of sales. To find out how much profit will be made, we again use the idea of contribution.

In this case predicted sales are 650. Break-even sales are 500.

We then take the difference between predicted sales and the break-even point and multiply this by the contribution. This will give us the profit figure.

150 x £4 contribution = £600. His profits per month on sales of 650 boxes will be £600.

## The break-even graph

For our grocery delivery business we are asked to calculate the break-even output per month. Therefore, as with the mathematical method, we must divide our costs into fixed and variable costs. Using the information above, our costs have already been broken down. We can now draw the **fixed costs line** on the break-even chart.
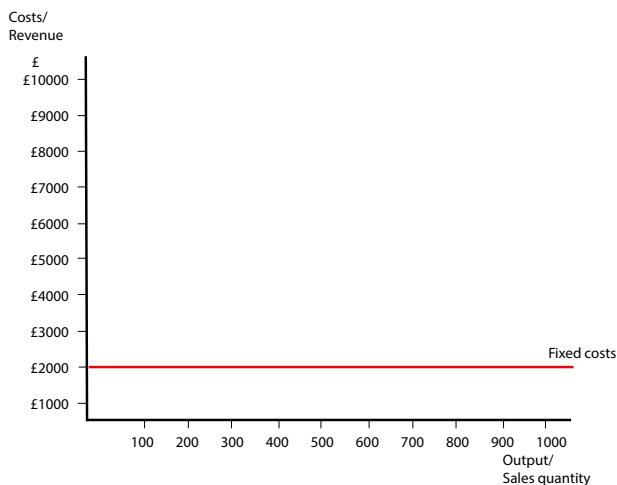


On the graph you can see that the vertical axis shows the level of costs and revenue, while the horizontal axis shows the level of output and sales. We can also see on the chart the fixed costs line which has been drawn at a level of £2000 for all levels of output. *As fixed costs remain unchanged at all levels of output*, the fixed costs line will always be horizontal.

The next step is to add **the variable costs line**. When calculating variable costs we must work out the variable cost per unit made or sold. The units in this case are the boxes of fruit and veg. To draw the variable costs line we mark three points. We know that at output zero variable costs are zero, so we have our first point: the point where the axes meet. The second and third point can be marked on the graph. For the second point we have selected an output level of 400 (we could just have easily chosen 500 or 600). We then calculate variable costs at this output level. To do this just multiply variable costs per unit by the chosen output level. So in this case we have 400 x £5 = £2000. For the third point we select an output level of 1000. So, 1000 x £5 = £5000. The variable cost line can now be drawn by joining the three points.

At every level of output (apart from zero), the business's costs will be a combination of fixed and variable costs – the two added together make total costs.

At output zero the business only has fixed costs, there are no variable costs. We must now draw the **total cost line** – this will always start where the fixed costs line meets the vertical (costs) axis. To mark the second point, choose a level of output and add together fixed and variable costs at that level. In this case, at an output of 400 boxes of fruit and veg, the fixed costs are £2000 and the variable costs are also £2000 (£5 x 400). So the total costs at an output of 400 = £2000 + £2000 = £4000.
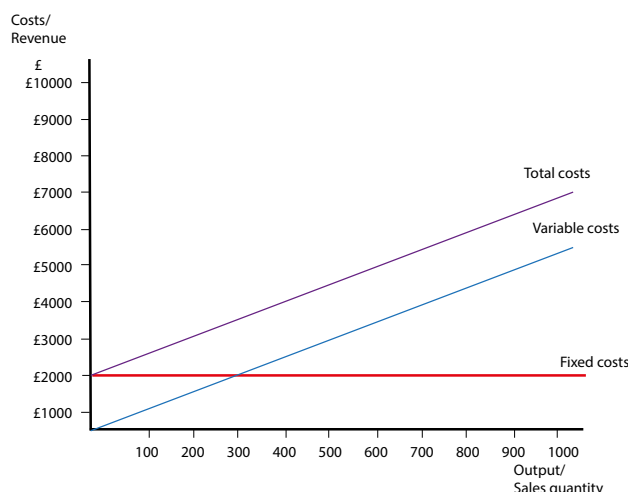
At the third point, at an output of 1000, the fixed costs are £2000 and the variable costs are (£5 x 1000). So the total costs at an output of 1000 = £2000 + £5000 = £7000. The total cost line can now be drawn by joining the three points.
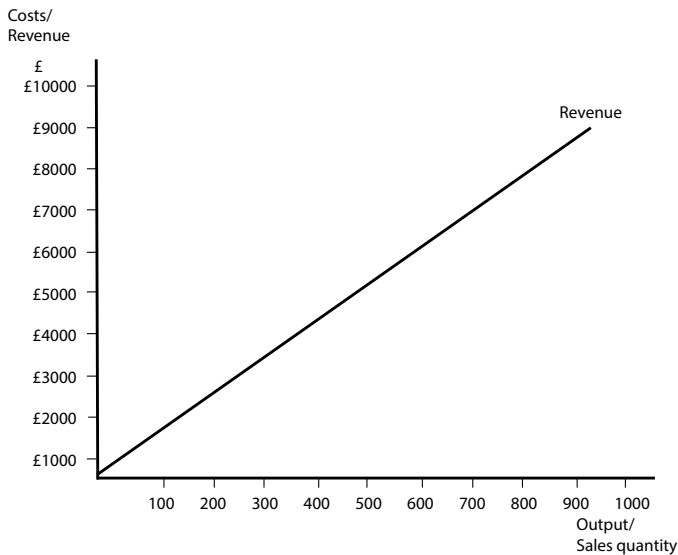


The last line that we need to add is the **revenue line**. This line tells us the revenue at any level of sales. Revenue is the number of sales multiplied by the selling price per unit. In this case the average sales price is £9. To draw the revenue line we again use three points. The first is straightforward. At sales zero, revenue is zero; so we can mark the start of our revenue line. To mark the second point we use a similar method to drawing the variable cost. If we choose sales of 600 units we have:- 600 (Sales) x £9.00 (revenue per unit) = £5400. To mark the third point at 1000 sales we have 1000 x £9.00 = £9000. Connect your points and you have the revenue line.



The point where the revenue line cuts the total costs line is break-even point. Draw a vertical line straight down from the break-even point; this will give you break-even output. A horizontal line drawn from break-even point to the costs/revenue axis will give you break-even costs/revenue.
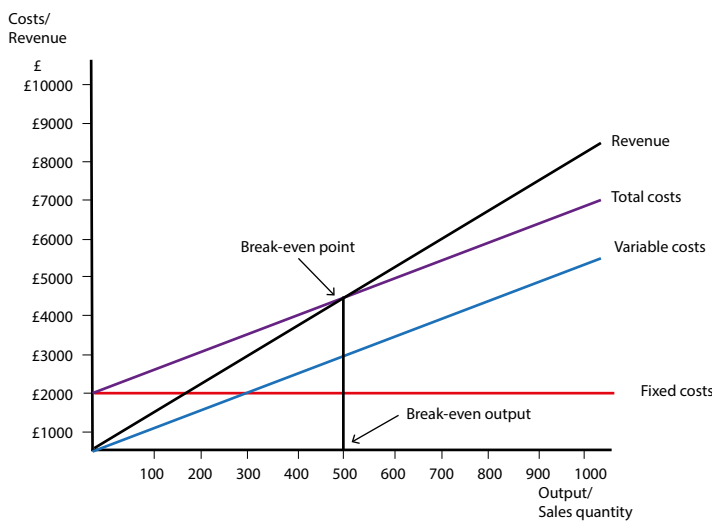
## Calculating profit and loss using a break-even chart

Using the break-even chart we can calculate the break-even point and profit and loss at various levels of output.
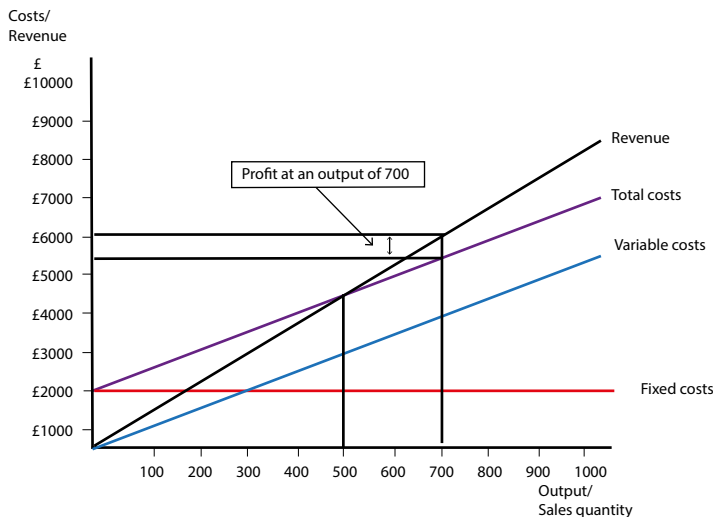


To find profit or loss at different outputs we must measure the difference between the revenue line and the total costs line at the given level of output. For example, to calculate profit at an output of 700 units you would firstly draw a vertical line up from the 700 output point. You would draw this so that it meets both the total costs and revenue lines (this has been done on the chart). At output 700 we are to the right of break-even point, so the business is making a profit. We can see this clearly because the revenue line is above the total costs line. To find out exactly how much profit is being made at this level of output (or any other output level), we measure the gap between the total revenue and total costs lines. In this case, profit is £700.

### The margin of safety

A business's margin of safety is the difference between output level and break-even output, when output is above break-even. So if output is 900 units and break-even is 500 units, then the margin of safety is 400 units. The margin of safety indicates the amount by which demand can fall before a business incurs losses. The margin of safety can be identified on the break-even chart by measuring the difference between the break-even point and the actual level of output. Businesses will want to ensure that they have a healthy margin of safety just in case an unexpected drop in sales affects their business. A small margin of safety could put the business at risk if they experience a drop in sales.

### Changes in costs and revenues

In business, costs and revenues are not fixed, and a break-even chart can be used to show the effect of an increase or drop in revenue and/or costs on the profitability of a business.
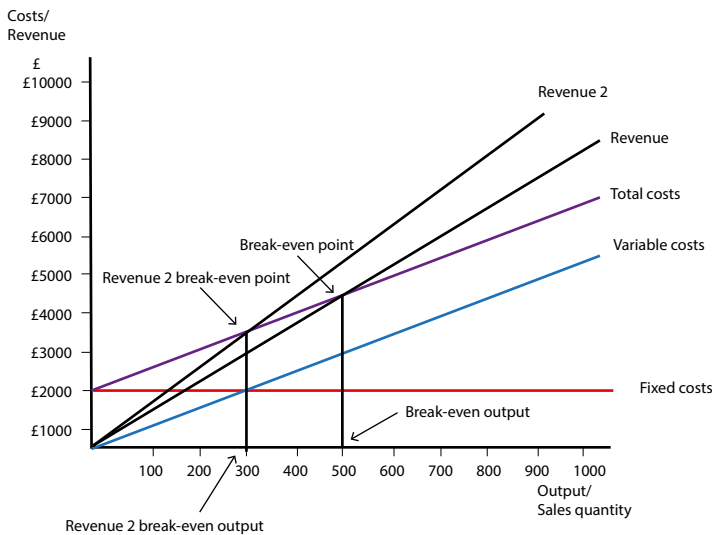
An increase in the price of the boxes from £9 to £11 will change the total revenue line (Revenue 2), it becomes steeper and will cut the total cost line sooner, resulting in break-even at a lower level of output. If the price was reduced then the opposite would happen and the break-even point would be at a higher level of output.

An increase in the variable cost will change the total cost line (Total costs 2). It becomes slightly steeper and will cut the revenue line at a higher output level, resulting in break-even at a higher level of output. If the costs were reduced then the opposite would happen. If variable costs remained the same but fixed costs changed then this would result in a parallel shift in the total cost line.
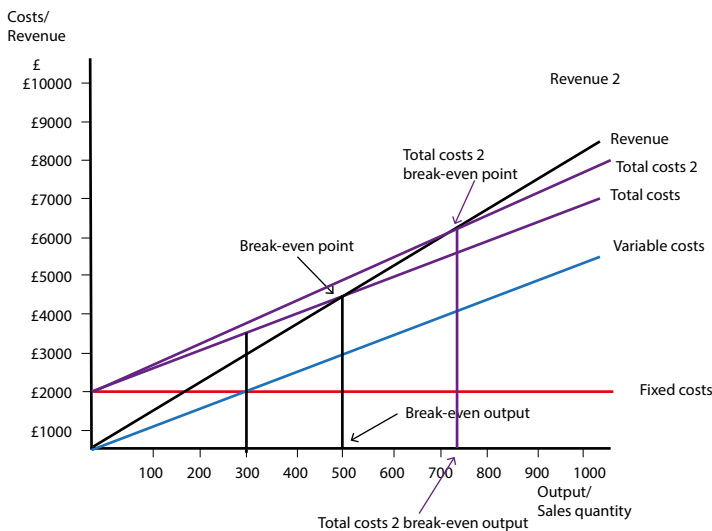
## How useful is break-even analysis?

- Break-even does provide a simple and easily understood representation of costs, revenue and potential profit.
- Break-even is also useful as part of a business plan and can help when seeking a loan.
- It also allows use of 'what-if' analysis. Using 'what-if' analysis, business owners can judge the impact on profitability of a number of costs and revenue variables. For example, the effect of an increase in fixed costs by 10% could be quickly judged, and the same applies to potential changes in variable costs and revenues. Using this method the impact of the changes on break-even output, margin of safety and profitability can be measured.
- However, the use of 'what-if' does not fully overcome the weaknesses of break-even. The first problem is that the method assumes only one product is produced and sold, but this simple situation is rarely repeated in the real world of business. This initial problem can be overcome if the business (e.g. a sandwich shop) sells a similar range of products: then an average cost and revenue per customer can be estimated.
- The method also assumes that all goods produced are sold, and sold at the same price. Most businesses have wastage through damaged stock, poor quality stock etc., and it is

likely that at least some products (end of line) will be discounted.
- The linear relationship of costs/revenue to output/sales can also be questioned. In each case economies of scale are likely to come into play, breaking down the relationship.
- Some fixed costs are stepped. This occurs when a business acquires more capacity, and costs, such as rent, may increase. This sharp rise in fixed costs makes it difficult to apply break-even analysis.

## Activities

1. A small family ice cream business sells boxes of cones (ten in each box) and has the following costs.

Rent £500 per month
Electricity £200 per month
Wages £1800 per month
Equipment loan £210 per month
Leasing charges £120 per month
Ice cream 11p per cone
Packing 30p per box of ten cones
Wafer 2p per cone
The revenue is £3.20 per box of 10 cones

Test Question.

a. What is the break-even output in boxes of cones, per month?

b. What will be the profit or loss at an output of 2100 boxes per month?

c. What will be the profit or loss at an output of 1550 boxes per month?

d. What would happen to the break-even output if wages increased by £300 per month?

Discussion themes

Define the terms fixed and variable costs.

What is a semi-variable cost?

How does a business calculate profit?

What is contribution? If a product sells for £15 and the variable costs are £12.50 what is the contribution per unit?

Discuss the usefulness of break-even analysis to a business.

Explain how a business can analyse changes in costs and/or revenue through break-even.

What happens to the margin of safety for a business if its costs remain the same but their price is reduced?

Discuss the following statement: 'The failings and weaknesses of break-even analysis make it barely useful in the real world.'