

Calculating break-even

In this section, you will use the same cost and revenue figures for the coffee used in [Subtopic 3.3 \(/study/app/y12-business-management-a-hl-may-2024/sid-351-cid-174702/book/the-big-picture-id-39300\)](#) to explain the break-even point. Recording costs and revenues in a table (as shown in **Table 1**) is one way to find the break-even point.

Making connections

The concepts of fixed costs, variable costs, total costs and total revenues will be used in this section. You learned about costs and revenues in [Subtopic 3.3 \(/study/app/y12-business-management-a-hl-may-2024/sid-351-cid-174702/book/the-big-picture-id-39300\)](#).



Figure 1. Like all businesses, a coffee shop needs to find the break-even point to determine whether the business is viable.

Credit: Yagi-Studio, Getty Images

Table 1. Cost and revenue estimates for the coffee shop.

Quantity of cups of coffee	Variable costs (\$)	Fixed costs (\$)	Total costs (\$)	Sales revenue per month (\$) (Price per cup = \$4)
0	0	7000	7000	$(0 \times 4) = 0$
500	500	7000	7500	$(500 \times 4) = 2000$
1000	1000	7000	8000	$(1000 \times 4) = 4000$
1500	1500	7000	8500	$(1500 \times 4) = 6000$
2000	2000	7000	9000	$(2000 \times 4) = 8000$
2500	2500	7000	9500	$(2500 \times 4) = 10\,000$
3000	3000	7000	10000	$(3000 \times 4) = 12\,000$

In **Table 1**, you can see various output levels for the coffee shop for one month, ranging from 0 to 3000. The variable cost of one cup of coffee is \$1. Variable costs include the ingredients for the coffee, such as coffee beans, water and milk. So if the coffee shop produces 500 cups of coffee in the month, then the variable costs will be \$500.

The fixed costs do not change depending on output. Fixed costs include the rent for the coffee shop, salaries for the workers, and some utilities (amongst other overheads). In the case of this coffee shop, fixed costs are \$7000 per month. Adding together the variable costs and fixed costs gives the total costs at each level of output. So if the coffee shop produces 500 cups of coffee, the total costs are \$7500.

Total revenue is the price of the cup of coffee multiplied by the number of cups sold. In this case, each cup sells for \$4. So if the coffee shop sells 500 cups of coffee, then it would earn \$2000 in sales revenue. The sales revenue increases as the number of sales

increases, as you can see in **Table 1**. **Figure 2** shows the same data in a chart, which you also saw in [Section 3.3.2 \(/study/app/y12-business-management-a-hl-may-2024/sid-351-cid-174702/book/revenues-and-revenue-streams-id-39302\)](#).

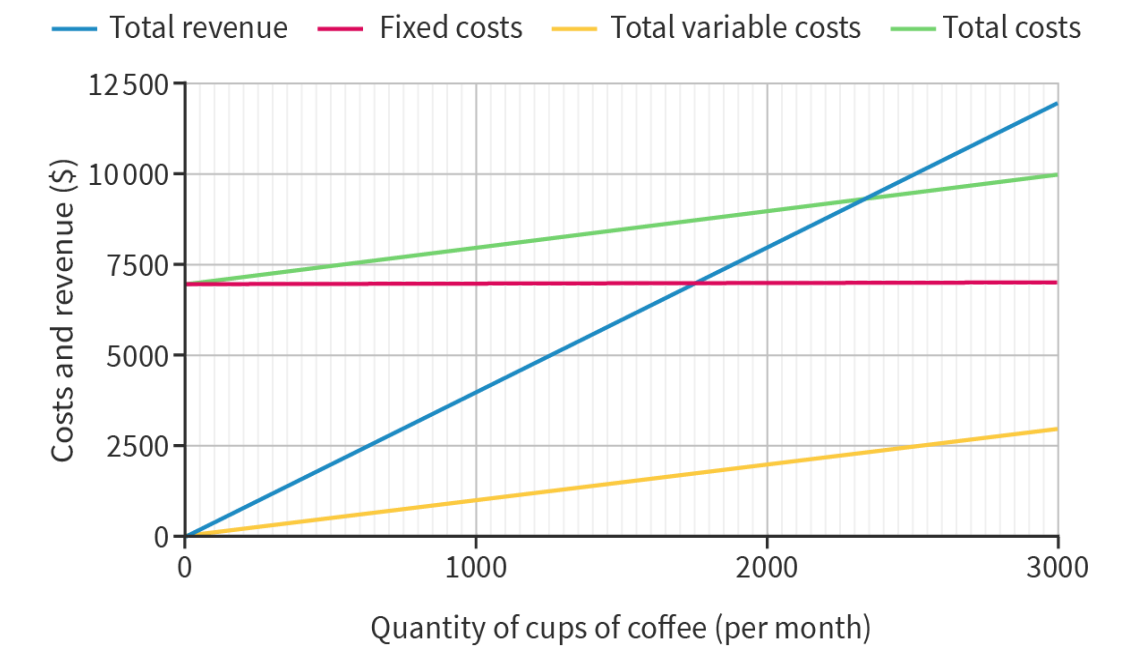


Figure 2. Total revenue, fixed costs, variable costs and total costs for a coffee shop with one coffee product.

With this information you can also calculate the profits or losses for the coffee shop at various levels of output. The final column of **Table 2** shows the profit or loss information. Remember that figures in brackets indicate a negative value; in this case, losses.

Table 2. Profits for the coffee shop, depending on the level of output or sales.

Quantity of cups of coffee	Total costs (\$)	Sales revenue per month (\$) (Price per cup = \$4)	Profit (\$)
0	7000	$(0 \times 4) = 0$	(7000)
500	7500	$(500 \times 4) = 2000$	(5500)
1000	8000	$(1000 \times 4) = 4000$	(4000)

Quantity of cups of coffee	Total costs (\$)	Sales revenue per month (\$) (Price per cup = \$4)	Profit (\$)
1500	8500	$(1500 \times 4) = 6000$	(2500)
2000	9000	$(2000 \times 4) = 8000$	(1000)
2500	9500	$(2500 \times 4) = 10\,000$	500
3000	10 000	$(3000 \times 4) = 12\,000$	2000

Table 2 shows that at lower levels of output or sales, the coffee shop is making losses. Only when the shop sells somewhere between 2000 and 2500 cups of coffee per month do the total revenues exceed the total costs. At somewhere between 2000 and 2500 cups of coffee, the shop reaches the break-even point.

Figure 3 shows this data drawn in a graph. You can see the break-even point (BEP), where the total cost and total revenue lines intersect, at the quantity Q_{BEP} . In fact, this is another way to find the break-even point, when total revenues are equal to total costs.

Break-even point \rightarrow total revenue = total costs

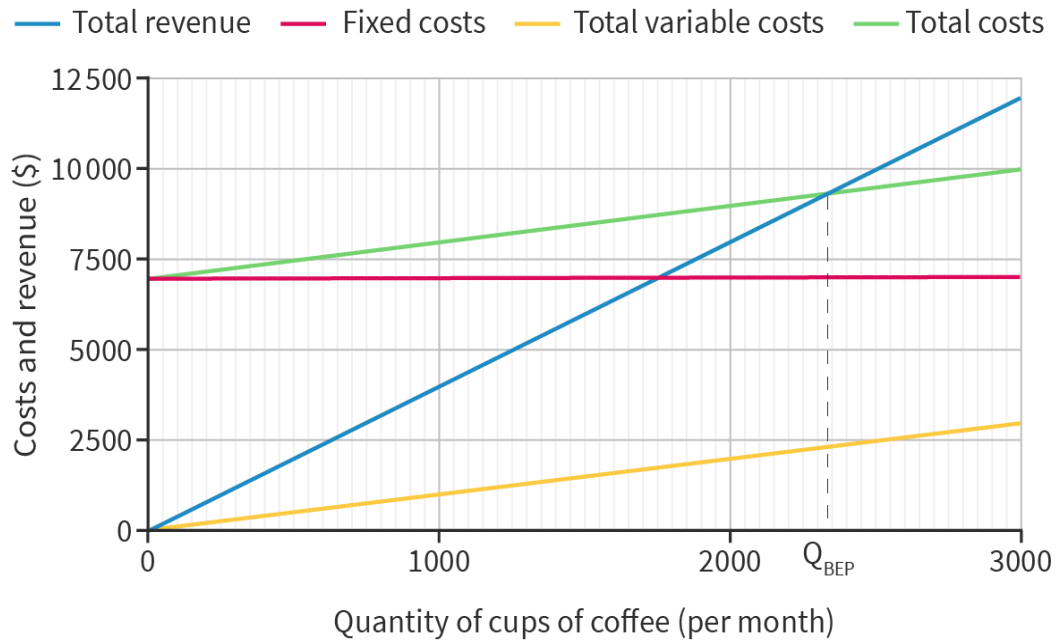


Figure 3. Total revenue, fixed costs, variable costs and total costs for a coffee shop with one coffee product.

Contribution per unit and total contribution

You should be aware that even at low levels of output, the assumption is that the coffee shop can cover the variable costs of the coffee with its revenues. Each cup of coffee has a variable cost of only \$1, but the shop charges customers \$4. This means that for each cup of coffee sold, the shop has \$3 that it can use to pay some of the \$7000 fixed costs. The \$3 ‘contributes’ to paying the fixed costs; it is called the contribution per unit. The total contribution refers to all the contributions summed at a certain level of output.

Contribution per unit and total contribution are calculated using the following formula:

$$\text{Contribution per unit} = \text{price per unit} - \text{variable cost per unit}$$

$$\text{Total contribution (at a certain quantity)} = \text{contribution per unit} \times \text{quantity (output)}$$

Reaching the break-even point requires the coffee shop to cover the fixed costs with its contributions from each cup of coffee. Once the shop has sold enough cups of coffee so that all the fixed costs have been covered by these contributions (total contribution), the

business will break even. In this case, it means that the shop needs to sell cups of coffee until the accumulated \$3 contributions are equal to the \$7000 fixed costs. Thus, the formula for break-even is:

Break-even quantity = fixed costs ÷ contribution per unit

= \$7000 ÷ \$3

= 2334 cups

(This is 2333.33 rounded up to the next whole number.)

Because it is not possible to produce a partial cup of coffee, the number is rounded up to the next cup. So the break-even point for the coffee shop is 2334 cups of coffee per month.

Once the total contribution is greater than the fixed costs, then the business has earned a profit of that amount. This will become important later when you learn about target profit calculations.

Exam tip

When you calculate the break-even point, you may find that you get a fraction of a product, as in the example above. In this case, always round up to the next whole number.

Of course, a business will not want to limit its output to the break-even point. This would be too risky, because even a small reduction in output, increases in costs of production, or lower revenues would immediately lead to losses. So businesses aim to produce far above the break-even point. This will increase their profits and also provide a buffer against changes that might increase costs, such as inflation, or changes that might reduce revenues, such as increased competition.

The margin of safety is the difference between the break-even quantity and the current level of output. It shows how far output can fall before the business would start to experience losses.

Imagine that the coffee shop is actually selling 3200 cups of coffee per month. The margin of safety is calculated as follows:

Margin of safety = actual output – break-even quantity

$$= 3200 - 2334$$

$$= 866 \text{ cups}$$

Target profit, target output and target price

Businesses will often have profit, output or price objectives and break-even analysis can help understand the implications of those objectives.

Target profit

Some businesses may have a specific profit objective ([Subtopic 1.3 \(/study/app/y12-business-management-a-hl-may-2024/sid-351-cid-174702/book/the-big-picture-id-36515\)\)](#) in mind and can use break-even analysis to determine the quantity or output necessary to reach their profit goals. These profit goals are known as the target profit.

Again, using the example of the coffee shop, imagine that you wanted to earn \$4000 in profits per month. You know from the previous work that when the total contribution is greater than the fixed costs, the business is earning a profit. Thus, one way of calculating profit is:

$$\text{Profit} = (\text{output} \times \text{contribution per unit}) - \text{fixed costs}$$

You already know the profit you want to achieve, however. So you can input the information you have and solve for the variable you do not have; the target output that would give you your desired profits.

$$\$4000 = (\text{output} \times \$3) - \$7000$$

$$\$11\,000 = \text{output} \times \$3$$

$$\$11\,000 \div 3 = \text{output}$$

$$\text{Target output} = 3667 \text{ cups}$$

(This is 3666.67 rounded up to the next whole number.)

Target output

A business may set a target output (or planned output). These plans could be related to the capacity of the business, such as seats in a restaurant, bicycles in a commercial bike park, or places in a school. A business might also set planned output in order to carry out sales forecasting or for another reason.

Break-even analysis will allow the business to determine what the profits or losses will be under different output scenarios. Using the data from **Table 1**, you can see that if the coffee shop plans to sell 3000 cups of coffee, it can anticipate \$2000 in profits at the current price of \$4 per cup. As was already discussed, when the planned output is above the break-even level, this provides the business a margin of safety.

You can also use the profit formula to determine the profits at the planned level of output:

Profit = (output x contribution per unit) – fixed costs

= (3000 × \$3) – \$7000

= \$2000

Target price

Sometimes a business needs to set a target price. For example, the coffee shop could face new competition that only charges \$3.50 for a cup of coffee. To be more competitive, the coffee shop may want to consider lowering the price of its own coffee. This would reduce the contribution per unit to \$2.50 and the break-even quantity would increase. Knowing that, the coffee shop may need to change its product, promotion or other elements of the marketing mix in order to achieve break-even. You will explore more implications of changes to costs and revenues in [Section 5.5.3 \(/study/app/y12-business-management-a-hl-may-2024/sid-351-cid-174702/book/impact-of-changes-in-price-or-costs-on-breakeven-id-39498\)](https://app.kognity.com/study/app/y12-business-management-a-hl-may-2024/sid-351-cid-174702/book/impact-of-changes-in-price-or-costs-on-breakeven-id-39498).

Table 3. Summary of equations related to break-even analysis.

Equation	Formula	Units	Comment
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Equation	Formula	Units	Comment
Contribution per unit	Selling price – variable cost per unit	Currency (for example € or \$)	
Total contribution	Contribution per unit × output	Currency (for example € or \$)	
Break-even point (BEP)	Fixed cost ÷ contribution per unit	Units of output	Always round decimals up. A low figure is desirable.
Margin of safety	Current level of output – break-even point	Units of output	A high figure is desirable.
Profit (at a certain level of output)	(Output × contribution per unit) – fixed costs	Currency (for example € or \$)	

Activity

Learner profile: Thinkers
Approaches to learning: Thinking skills (transfer)



Figure 4. Break-even at a pizza restaurant.

Credit: milanfoto, Getty Images

Imagine that you are thinking about opening a simple, takeaway pizza restaurant in a space that has recently become available to rent in your town. As a part of your business plan, you decide to carry out a break-even analysis in order to determine whether setting up the pizza restaurant is a good idea.

According to your research, the average variable costs of making one pizza are \$1.50. This would include flour, yeast, tomatoes, cheese and the pizza toppings. Fixed costs are much higher, at \$13000 per month. This would include salaries for multiple employees, rent, electricity and other utilities as well as other overheads. You are thinking about charging an average price of \$12.50 per pizza.

You would like to earn \$5000 in profit each month.

Questions

1. Calculate the contribution per unit.
2. Calculate the break-even quantity.
3. Calculate the target output for the desired level of profit.
4. Calculate the margin of safety at the target output.

Activity

Learner profile: Thinkers

Approaches to learning: Thinking skills (transfer)

Divia's Driving School

Last year, Divia took out a \$22000 loan to buy a car. Since then, she has decided to change careers and has set up her own business as a driving instructor.



Figure 5. Divia's Driving School.

Credit: Deepak Sethi, Getty Images

In addition to the monthly loan repayments, Divia has to pay insurance, tax and advertising costs. These are her fixed costs. Divia's fixed costs are \$800 per month.

Divia charges \$15 for each one-hour driving lesson. She estimates that each lesson costs her about \$3 in petrol.

In an average month, Divia will give around 80 driving lessons. This is her output.

Questions

1. Calculate the contribution per unit for Divia's driving lessons.
2. Calculate the break-even point for Divia's Driving School.
3. Calculate the total contribution for the actual monthly output.
4. Calculate the margin of safety.