Edexcel

A Level

Accounts

CODE: (4AC1)

Unit 02 - Section 07

Break even analysis

Chapter 09 - Break even analysis

UNDERLYING ASSUMPTIONS USED IN BREAK-EVEN ANALYSIS

Before studying break-even analysis, it is important to understand the assumptions behind the analysis.

- All costs can be classified as fixed or variable.
- Fixed costs will remain constant over the level of output.
- Variable costs will change in direct proportion to output.
- Selling price will remain constant over all levels of output.
- All output will be sold.
- There is a single product or the product mix does not change.
- There will be no efficiency gains as output increases.

CLASSIFICATION OF COSTS

You will be aware of the different classifications for costs and the importance of the correct classification of a cost from your International Advanced Subsidiary studies. Only by classifying costs correctly will a company be able to accurately forecast its total costs, the level of output required to break even and ultimately its net profit.

CALCULATING FIXED AND VARIABLE COSTS USING THE HIGH-LOW METHOD

In cost accounting, the high-low method is a way of calculating fixed costs and variable costs from total costs and levels of output. It involves working backwards from the total cost to determine the fixed and variable costs.

Method

To find the variable cost per unit:

1 Calculate the difference in cost between the two levels of output.

2 Calculate the difference in the level of output.

3 Divide the difference in cost by the difference in the level of output.

To find the fixed cost:

1 Calculate the total variable cost for a given level of output.

2 Subtract the total variable cost from the given total cost (at the same level of output).

CALCULATION OF TOTAL REVENUE AND SELLING PRICE

Total revenue is the product of the selling price and the number of units sold:

$$\text{Total revenue} = \text{selling price} \times \text{quantity sold}$$

By rearranging the formula:

$$\text{Selling price} = \frac{\text{total revenue}}{\text{quantity sold}}$$

CALCULATION OF NET PROFIT

It is possible to calculate the net profit of a business using the four variables of:

- selling price per unit
- variable cost per unit
- fixed costs
- output or units produced (quantity).

The base formula is:

Profit = total revenue − total costs

where:

Total revenue = selling price per unit × output

Total costs = total variable cost + fixed costs

Total variable cost = variable cost per unit × output.

From this, we can arrange the profit formula as:

Profit = (price × quantity) − ((variable cost per unit × quantity) + fixed costs)

CONTRIBUTION, BREAK-EVEN POINT AND MARGIN OF SAFETY

Contribution

Contribution is a common and powerful accounting tool used in business to make several decisions, including the acceptance or rejection of new contracts and whether to manufacture or purchase a product. These will be covered in detail in Chapter 10. Contribution is also used in break-even analysis. Contribution is the difference between revenues and variable costs and is expressed by the formulae:

Unit contribution = selling price per unit − variable cost per unit

Total contribution = total revenue − total variable costs

The total contribution is the sum of all the unit contributions for a given level of output. Hence total contribution can be expressed as:

Total contribution = unit contribution × output

It is possible to calculate net profit using contribution by substituting the contribution in to profit formula.

Profit = total contribution − fixed cost

Profit = (unit contribution × output) − fixed cost

Break-even point

Break-even point is the level of output where the total revenue equals the total costs (TR=TC). As such, the business is not generating a profit, nor is it incurring losses.

The ability to break even is an important consideration for a business. If it fails to break even it will incur losses, and as a result the long-term future of the business will be in doubt.

The formula used is:

$$\text{Break-even point (number of units)} = \frac{\text{total fixed costs}}{\text{contribution per unit}}$$

$$\text{Break-even (£ revenue)} = \text{break-even quantity} \times \text{selling price}$$

It is important to remember that break-even is the point at which neither a profit nor a loss is made.

TARGET LEVEL OF PROFIT

It is also possible to use break-even analysis to determine the level of output required to earn a target level of profit. If you want to achieve a certain profit, you need to add the required profit figure to the total fixed cost and divide that total by the contribution. The formula becomes:

$$\text{Target profit (number of units)} = \frac{\text{total fixed costs} + \text{profit}}{\text{contribution per unit}}$$

Margin of safety

The **margin of safety** is the difference between the current production or sales level and the break-even quantity. The formula is:

$$\text{Margin of safety} = \text{current output} - \text{break-even output}$$

You may be asked to calculate the margin of safety as a percentage. If required, calculate the margin of safety using the formula above, then substitute your answer into the following equation:

$$\text{Margin of safety \%} = \frac{\text{margin of safety}}{\text{current output}} \times 100$$

MOVEMENTS IN BREAK-EVEN

The relationship between fixed and variable costs is crucial for any firm. High fixed costs can delay a firm's break-even point, especially for new firms or those seeking short-term loans or capital return. Once the break-even point is reached, profits should increase rapidly. However, a firm with high fixed costs may face difficulties and risk a loss more quickly, especially for highly automated manufacturing firms with high borrowings and fixed overheads.

GRAPHICAL REPRESENTATION OF BREAK-EVEN ANALYSIS

It is possible to show the break-even point on a graph

by plotting the total revenue and total costs. Where they intersect will be the break-even point - expressed in terms of units from the horizontal axis and the break- even value from the vertical axis.

However, a graphical representation can show much more than just the break-even point. It can also be used to show:

- break-even quantity (units)
- break-even value (£)
- margin of safety (units)
- margin of safety value (£)
- the area of profit or loss.

To construct a break-even graph, you need to do the following:

1 Draw and label the axes. The horizontal axis is the level of output expressed in the correct units, the vertical axis is for costs and revenues expressed in £s.

2 Draw the fixed cost line. The fixed cost line will be parallel to the horizontal axis as fixed costs are constant over all levels of output. In the example below, the fixed costs are £1 500.

3 Draw the total cost line. The total cost line will start at the fixed cost value at zero output, as these costs will be incurred regardless of output. It will increase with the rate of variable cost. A simple method used to draw the total cost line is to select a level of output that is an easy number to calculate with (in Figure 9.1 we have used 1000 units, with variable costs of £5 per unit), then use the total cost formula:

Total cost = total variable cost + fixed cost

At zero output:

Total cost = 0 + 1 500
= £1 500

At 1 000 units of output:

Total cost = (£5.00 × 1 000) + £1 500
= £6 500

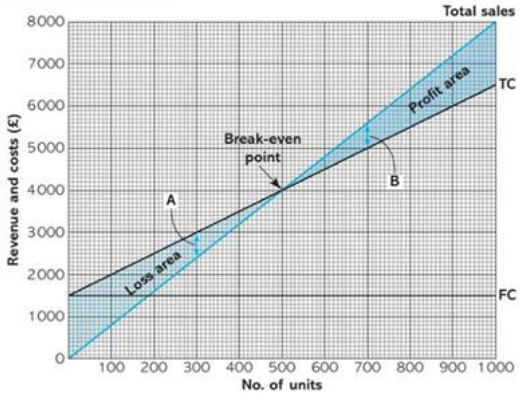
4 Draw the total revenue line. Use two values of output to calculate the revenue at these points: at zero output, total revenue will be £0, and at 1000 units, assuming a selling price of £8 per unit, it will be £8000.

Note: The total variable cost line has not been drawn in this example.

The graph in Figure 9.1 shows the following:

- the break-even quantity at 500 units
- the break-even value of output at £4000
- the areas of profit and loss

The loss at 300 units is shown by the arrow marked 'A' It is the vertical distance between the total revenue line and the total cost line: £2400 £3000 = £600 loss. The profit at 700 units is shown by the arrow marked 'B'. It is the vertical distance between the total cost line and the total revenue line, showing a profit of £5600 - £5000 = £600.



Cost sheet	£
Fixed costs (per month)	1500
Variable costs (per 100 units)	500
Sales (per unit)	8

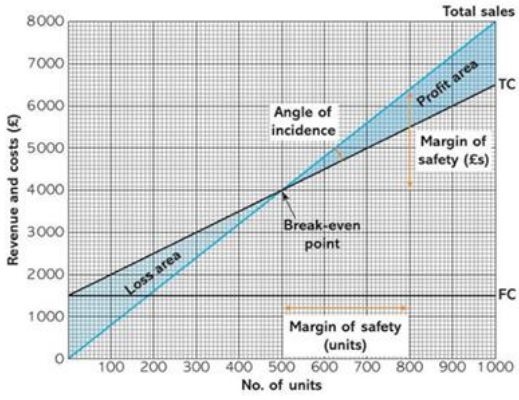
▶ Figure 9.1 Example of a break-even graph

Relationship between terms

In addition, it is possible to show the margin of safety on a break-even graph. If we assume that the current level of output is 800 units, then the margin of safety is shown in Figure 9.2 by the horizontal arrow between the current level of output and the break-even level of output.

Margin of safety = current output − break-even output
= 800 units − 500 units
= 300 units

The margin of safety by revenue can also be shown by a vertical arrow as in Figure 9.2.



▶ Figure 9.2 Example of a break-even graph showing margin of safety and angle of incidence

The angle of incidence

The **angle of incidence** is the angle between the total cost line and the total sales line.

If the angle is large, the business will be making profits at a high rate in terms of the level of sales. If the business has a high angle of incidence and a high margin of safety, it is trading very effectively.

If the angle of incidence is low and the margin of safety is small, it could indicate difficult trading conditions.

SUBJECT VOCABULARY

angle of incidence the angle formed at the break-even point between the total revenue line and the total cost line
break-even analysis the calculation of the level of output or level of revenue required for a business to make neither a profit nor a loss
break-even point the output at which point total revenue equals total costs
contribution the difference between the selling price and the variable costs
fixed costs costs that do not vary with the level of output
margin of safety the difference between the current level of output (or maximum output) and the break-even level of output
variable costs costs that change in proportion to the level of output