Break-Even Charts

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Introduction

Cost volume profit (CVP) analysis provides important and useful information about a company's activities. Usually a series of formulas are used to calculate the company's break-even point (sales either in units or value to achieve a zero profit i.e. neither a profit nor a loss); its margin of safety (the amount in units or value by which sales may decrease before the company makes a loss) and the amount in units or value that the company must sell to achieve a target profit. However, this information may also be obtained by preparing and reviewing a break-even chart. A break-even chart is a graphical representation or visual image of the cost and profit relationships in an organisation. It is simple to prepare and easy to understand. This article explains how to construct and interpret a break-even chart. First, the steps in constructing a break-even chart are outlined. Next, a CVP question from a recent F2 Management Accounting examination paper is used as an example in constructing a break-even chart. Then, having created the break-even chart, a brief note is provided on how to interpret it. Finally, some limitations of break-even charts are described.

How to construct a Break-Even Chart

There are five steps in constructing a break-even chart and each of these is described below.

Step 1: Review all costs and classify them as either fixed or variable.

Step 2: Formulate equations for total revenue and total cost.

Step 3: Take two activity levels and substitute these into the total revenue equation to get two sets of x (activity) and y (total revenue) co-ordinates. Using the same activity levels substitute these into the total cost equation to get two sets of x (activity) and y (total cost) co-ordinates.

Step 4: Plot the two sets of co-ordinates for total revenue on the chart, join them to form a straight line and label it as total revenue. Plot the two sets of co-ordinates for total cost on the chart. Join them to form a straight line and label it as total cost.

Step 5: Identify the break-even point, where total revenue equals total cost and label it on the chart. Identify the loss and profit making areas, and the margin of safety.

Example:

Extract from Question 6 August 2015 Management Accounting Paper

Herald Sports Ltd commenced trading two months ago and will provide a range of fitness activities for customers. The company operates a large purpose built premises located on the outskirts of Kildare. Facilities include a 25 metre swimming pool, two squash courts, an outdoor soccer pitch, a large fully equipped gymnasium, a multi-purpose activity hall, and an aerobics studio. The company has already made bookings for most of its facilities but has not decided what activities to run in the aerobics studio. Two proposals have been put forward, a mixed ability circuits class or a dance fitness class. Details relating to both activities are as follows:

	Mixed ability circuits	Dance fitness
Price charged per class	€7	€8
Annual insurance	€12,000	€12,000
Music and royalty licence fees	€3.20 per class	€3.20 per class
Other facility costs (electricity, administration, etc.)	€2,536	€2,536
Instructor cost	€50 per class	€3,300 per year
Expected number of participants per class	25	20

In this question the company intends to use CVP analysis to assist with the decision relating to which activity it should offer to customers, a mixed ability circuits class or a dance fitness class. Assume that the company is hoping to offer 180 (of either) classes per year and can operate a maximum of 200 classes per year. Further assume that the question requires a break-even chart to be constructed for the mixed ability circuits class only.

Each of the steps outlined above are applied to the details in the question.

Step 1: Review and classify costs as fixed or variable.

Variable costs vary in direct proportion to the volume of activity (Drury, 2015:31)[i]. In this question activity relates to the classes that are offered by the company, Herald Fitness Ltd.

Variable costs	Per class €
Music and royalty licence fee	3.20
Instructor cost	50.00
Total variable costs	53.20

Fixed costs remain constant over wide ranges of activity for a specified time period (Drury, 2015:32)[i].

Fixed costs	€
Annual insurance	12,000
Other facility costs	2,536
Total fixed costs	14,536

Step 2: Formulate equations

To prepare the break-even chart two lines or equations are required, total revenue and total cost. The break-even point will be where these equations/lines intersect.

Total revenue equation

Total sales revenue depends on the price charged for each class (based on an expected number of participants) and the number of classes held. The price charged per class is €7 and 25 participants are expected to attend each mixed ability fitness class. If the number of classes held equals Q the total revenue equation (TR) is:

TR = (€7 x 25) x Q

TR = €175Q

Total cost equation

Total cost comprises fixed costs and variable costs. Total fixed costs (see above) are €14,536. Total variable costs depend on the variable cost per class and the number of classes held. The variable costs per class are €53.20. If the number of classes held equals Q the total cost equation (TC) is:

TC = €14,536 + €53.20Q

Step 3: Obtain co-ordinates

In order to plot these equations on a chart at least two co-ordinates or points must be obtained. The co-ordinates are obtained by selecting possible activity levels i.e. number of classes held.

Total revenue equation

First, assume that no classes are held, that Q = 0

TR = €175Q = €175 x 0 = 0 The first co-ordinate noted as (Quantity, Total Revenue) is (0, 0), the origin on the chart.

Next assume that the maximum number of classes are held, that Q = 200.

TR = €175Q = €175 x 200 = €35,000. The second co-ordinate is (200, €35,000).

Total cost equation

First, assume that no classes are held, that Q = 0

TC = €14,536 + €53.20Q = €14,536 + (€53.20 x 0) = €14,536

The first co-ordinate noted as (Quantity, Total Cost) is (0, €14,536)

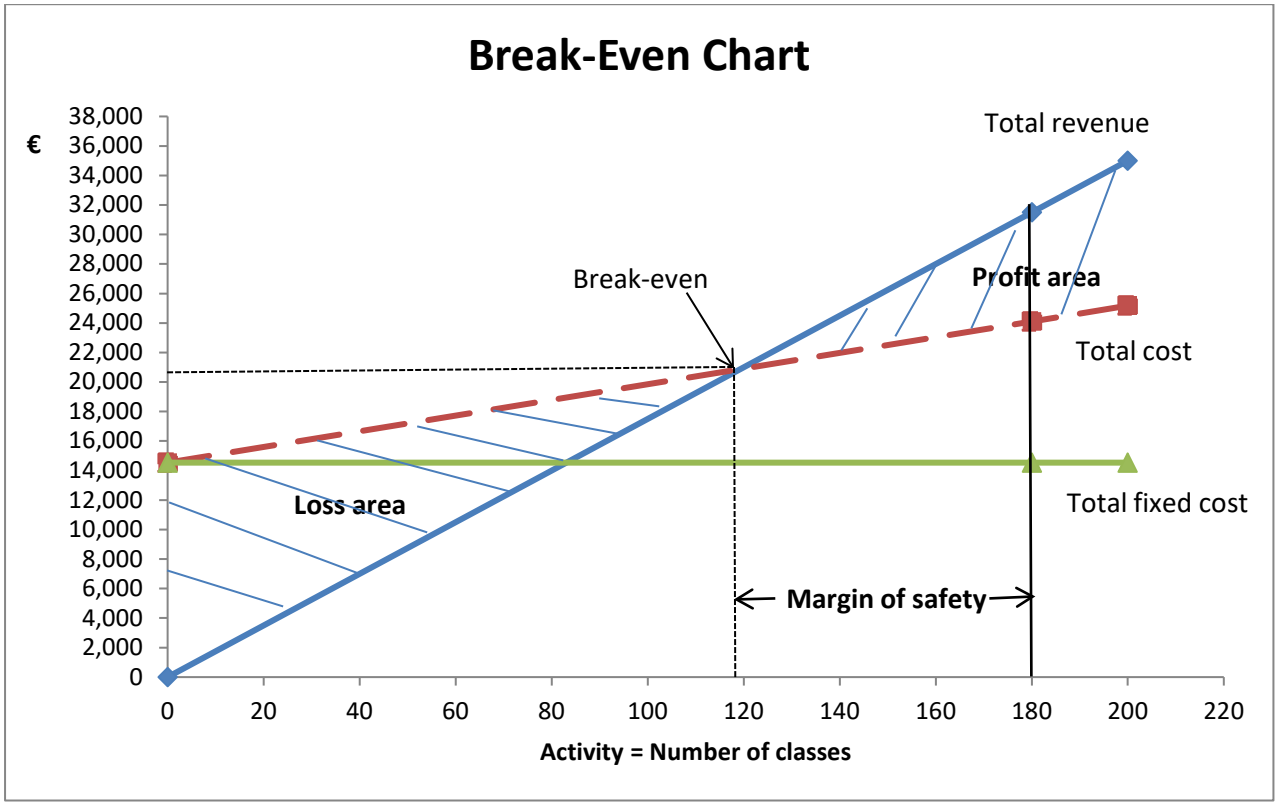
Next assume that the maximum number of classes are held, that Q = 200.

TC = €14,536 + €53.20Q = €14,536 + (€53.20 x 200) = €14,536 + €10,640 = €25,176

The second co-ordinate is (200, €25,176).

Step 4: Plot co-ordinates on the chart and add labels

Having obtained the co-ordinates for the Total Revenue and Total Cost equations, these are plotted on the graph as shown below. Total fixed cost of €14,536 is also included as a straight line across all levels of activity.



Step 5: Identify and label break-even point, loss and profit making areas, and margin of safety

Break-even point is where total revenue and total cost lines intersect i.e. where total revenue equals total cost i.e. TR = TC

€175Q = €14,536 + €53.20Q

€175Q - €53.20Q = €14,536

€121.80Q = €14,536

Q = €14,536/€121.80 = 119.34 classes i.e. approximately 120 classes

If Q = 120 classes then TR = €175 x 120 = €21,000

The break-even point is at approximately 120 classes providing total revenue of €21,000. This is marked on the chart.

If the company is hoping to offer 180 classes per year it is possible to plot the Margin of Safety area on the break-even chart.

Substituting Q = 180 classes the Total Revenue is €175 x 180 = €31,500, this is plotted as (180, €31,500). Total Cost is €14,536 + (€53.20 x 180) = €24,112. This is plotted as (180, €24,112).

The loss making area on the chart is marked as that area below total cost and the break-even point. The profit making area is the area above total cost and the break-even point.

Interpreting/reading a break-even chart

The break-even chart clearly shows the profit and loss making areas. To cover its costs and make a profit the company must hold more than 120 mixed ability fitness classes per year. If less than 120 classes are held the company will not cover all of its costs and will incur losses. The margin of safety area shows by how much the number of classes could fall before the company starts to make a loss. The number of classes could fall by up to 61 before the company would start to make losses.

The break-even chart also shows the significance of the fixed costs that remain constant over the range of activity for the year indicating that the company will incur these costs even if it does not hold any classes.

Limitations of break-even charts

There are a number of limitations of break-even charts and these are as follows:

- It is difficult to prepare break-even charts for more than one product or service; this is due to the problem of plotting different product/service mixes and different activity levels.

- Break-even charts are only accurate within narrow levels of output as if there was a significant change in the output/service level, the fixed costs may change.

- The total revenue equation is assumed to be a straight line, which implies that any volume may be sold at the same price. However, in reality companies often must reduce price to sell higher volumes. The total revenue function may curve upwards or downwards but is unlikely to be a straight line.

- The total cost equation is also assumed to be a straight line in relation to variable costs i.e. variable costs vary directly with output levels but this may not be true in reality.

- Break-even charts are often only valid for a limited time period as businesses operate in a dynamic environment where selling prices and unit costs may change frequently.

Having read this article and worked through the example, why not try to prepare a break-even chart using the details for the dance fitness class provided in the example question above.

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[i] Drury, C. (2015), *Management and Cost Accounting*, 9th Edition, Andover, Cengage Learning.