

Break Even Analysis: A Glance



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Abstract :- The break even analysis is most widely known form of CVP analysis. The CVP relationship defines the manner in which profits from project vary with the changes in the levels of project activity. BEP analysis answers various questions like at least what quantity should be produced so that all the liabilities are met without incurring any losses. **Break-even** (or **break even**) is the point of balance between making *either* a profit or a loss

Keywords:- break even analysis, **Margin of safety** , **CVP**.

INTRODUCTION

: [Break-even \(economics\)](#)

The break-even level or break-even point (BEP) represents the sales amount—in either unit or revenue terms—that is required to cover total costs (both fixed and variable). Total profit at the break-even point is zero. Break-even is only possible if a firm's prices are higher than its variable costs per unit. If so, then each unit of the product sold will generate some "contribution" toward covering fixed costs.

In [economics](#) and [business](#), specifically [cost accounting](#), the **break-even point** (BEP) is the point at which total cost and total revenue are equal: there is no net loss or gain, and one has "broken even." A profit or a loss has not been made, although [opportunity costs](#) have been "paid," and

capital has received the risk-adjusted, expected return. In short, all costs that needs to be paid are paid by the firm but the profit is equal to 0.

For example, if a business sells fewer than 200 tables each month, it will make a loss; if it sells more, it will make a profit. With this information, the business managers will then need to see if they expect to be able to make and sell 200 tables per month.

If they think they cannot sell that many, to ensure viability they could:

1. Try to reduce the fixed costs (by renegotiating rent for example, or keeping better control of telephone bills or other costs)
2. Try to reduce variable costs (the price it pays for the tables by finding a new supplier)
3. Increase the selling price of their tables.

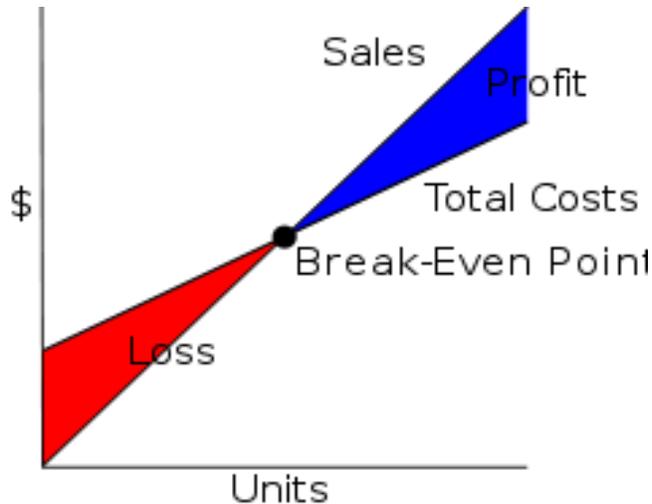
Any of these would reduce the break-even point. In other words, the business would not need to sell so many tables to make sure it could pay its fixed costs.

In Finance

The accounting method of calculating **break-even point** does not include cost of [working capital](#). The [financial](#) method of calculating break-even, called **value added break-even analysis**, is used to assess the feasibility of a project. This method not only accounts for all costs, it also includes the [opportunity costs](#) of the [capital](#) required to develop a project.

The operational strategy is concerned with the interplay of project operating costs and operating revenues. It can be evaluated in terms of cost volume profit (CVP) relationship and operational leverage. The CVP relationship defines the manner in which profits from project vary with the changes in the levels of project activity. The operational leverage on the other hand defines the manner in which the project fixed costs offset these changes.

The break even analysis is most widely known form of CVP analysis. Break even point or BEP analysis answers various questions like at least what quantity should be produced so that all the liabilities are met without incurring any losses. How much sales are required (in rupees) to break even (i.e. no profit no loss), what prices should be charged for break even at this quantity, how much should be sold, at what price if we want to profit of Rs.1, 00,000p.a there are many other questions arise not only at the formulation stage of the project but also at the later stage when the entrepreneur plans for the survival and growth of his enterprise.



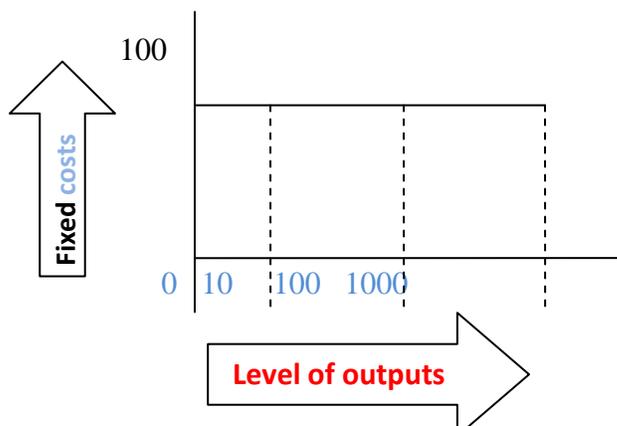
IN ACCOUNTING

Before determining the BEP the company expenses must be separated into fixed costs and variable costs.

- **Fixed costs** Fixed costs are those costs which do not change with the level of output. Various costs like rent, interest on fixed capital, wages to watchman, salary of manager etc. paid irrespective of the level of production.

Example

Units of output	fixed cost (in Rs)
0	10000
1	10000
10	10000
100	10000
1000	10000

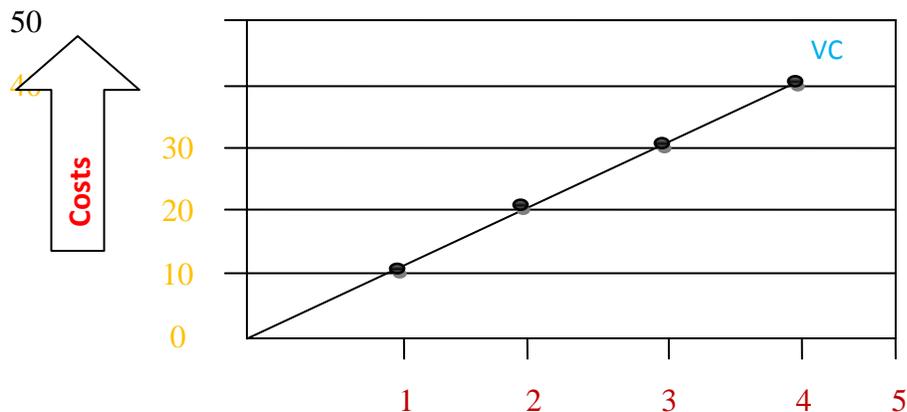


➤ Variable Costs

Those costs which change with the level of output e.g. raw material, power, packing, packing material etc. these costs are zero if nothing is produced and increases as the level of production increases.

Example

Units of output	Variable cost (in Rs.)
0	0
1	10
2	20
3	30
4	40



No. of units

➤ Semi-variable Costs

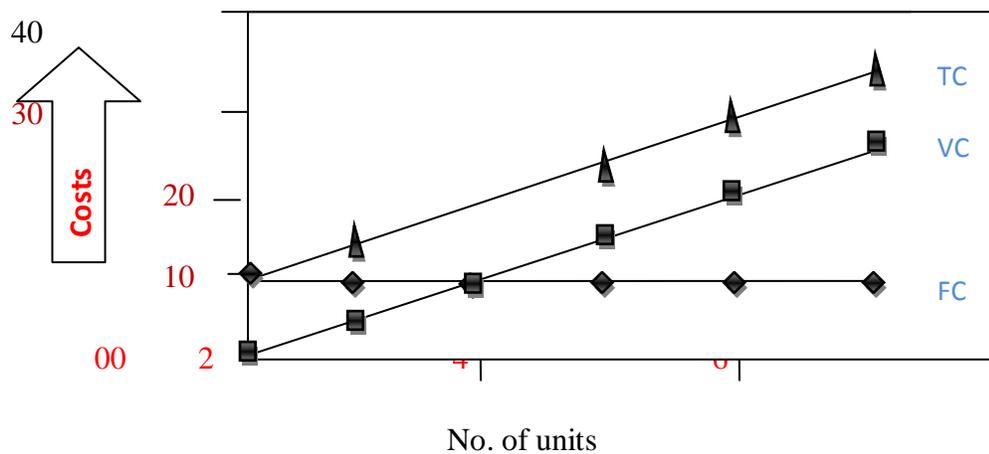
There are such costs in which a part is fixed and rest is dependent upon the level of production usage e.g. for a small scale unit, minimum charges on electricity water, telephone etc. is fixed even if we do not make a single call or use electricity. Beyond this fixed minimum level you will be charged for use or consumption. This variable amount is treated as variable cost.

Total cost = Fixed cost + Variable cost

TC = FC + VC

Example

No. of units	FC (In Rs.)	VC (In Rs.)	TC (In Rs.)
0	10	0	10
1	10	5	15
2	10	10	20
3	10	15	25
4	10	20	30
5	10	25	35



TC=TOTAL COST , VC= VARIABLE COST, FC=FIXED COST

➤ **Sales volume**

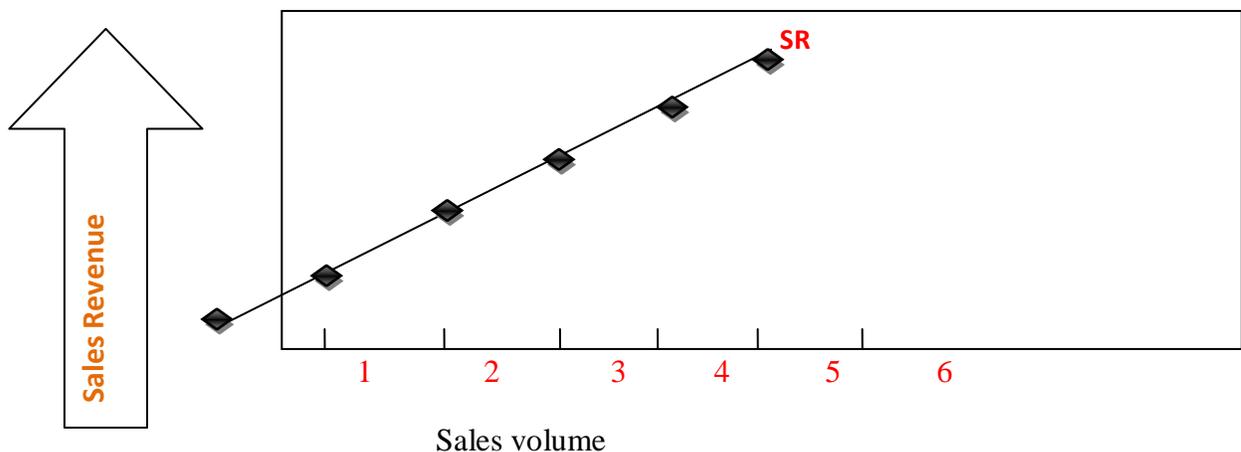
Sales line shows total revenue generated by sales at different volumes (quantity sold=q).

When nothing is sold, sales revenue is zero and when X units are sold at 'p' price then total revenue is XP.

Total sale = No. Of units x price per unit

S = XP

Units Sold	Price per unit (Rs.)
0	10
1	10
2	10



In other fields

In [nuclear fusion](#) research, the term break-even refers to a [fusion energy gain factor](#) equal to unity, this is also known as the [Lawson criterion](#).

The notion can also be found in more general phenomena, such as [percolation](#), and is rather similar to the [critical threshold](#). In energy, the break-even point is the point where usable energy gotten from a process exceeds the input energy.

In [computer science](#), the (less usual) term refers to a point in the life cycle of a [programming language](#) where the language can be used to code its own [compiler](#) or [interpreter](#). This is also called [self-hosting](#).

In music and media it is a [song](#) by the band [The Script](#).

In [medicine](#), it is a postulated state when the advances of medicine permit every year an increase of one year or more of the life expectancy *of the living*, therefore leading to medical immortality(barring accidental death).

In [Gambling](#), when one has gained and then lost, or lost and then gained, returning to the amount of money they had upon commencement and walks away, they are said to have broken even.

Break-Even Analysis and Forecasting

This site is a part of the JavaScript [E-labs](#) learning objects for decision making. Other JavaScript in this series are categorized under different areas of applications in the [MENU](#) section on this page. *Professor HosseinArsham*

The following JavaScript calculates the break-even point for a firm based on the information you provide. A firm's break-even point occurs when at a point where total revenue equals total costs.

Break-even analysis depends on the following variables:

1. **Selling Price per Unit:** The amount of money charged to the customer for each unit of a product or service.
2. **Total Fixed Costs:** The sum of all costs required to produce the first unit of a product. This amount does not vary as production increases or decreases, until new capital expenditures are needed.
3. **Variable Unit Cost:** Costs that vary directly with the production of one additional unit.

Total Variable Cost The product of expected unit sales and variable unit cost, i.e., expected unit sales times the variable unit cost.

4. **Forecasted Net Profit:** Total revenue minus total cost. Enter Zero (0) if you wish to find out the number of units that must be sold in order to produce a profit of zero (but will recover all associated costs)

Each of these variables is interdependent on the break-even point analysis. If any of the variables changes, the results may change.

Total Cost: The sum of the fixed cost and total variable cost for any given level of production, i.e., fixed cost plus total variable cost.

Total Revenue: The product of forecasted unit sales and unit price, i.e., forecasted unit sales times unit price.

Break-Even Point: Number of units that must be sold in order to produce a profit of zero (but will recover all associated costs). In other words, the break-even point is the point at which your product stops costing you money to produce and sell, and starts to generate a profit for your company.

One may use the JavaScript to solve some other associated managerial decision problems, such as:

- setting price level and its sensitivity
- targeting the "best" values for the variable and fixed cost combinations
- determining the financial attractiveness of different strategic options for your company

The graphic method of analysis (below) helps you in understanding the concept of the break-even point. However, the break-even point is found faster and more accurately with the following formula:

$$Q = F_C / (U_P - V_C)$$

where:

Q = Break-even Point, i.e., Units of production (Q),

F_C = Fixed Costs,

V_C = Variable Costs per Unit

U_P = Unit Price

Therefore,

$$\text{Break-Even Point } Q = \text{Fixed Cost} / (\text{Unit Price} - \text{Variable Unit Cost})$$

Purpose

The main purpose of **break-even analysis** is to determine the minimum output that must be exceeded in order to make profit. It also is a rough indicator of the earnings impact of a marketing activity.

The break-even point is one of the simplest yet least used analytical tools in management. It helps to provide a dynamic view of the relationships between sales, costs, and profits. For example, expressing **break-even sales** as a percentage of actual sales can give managers a chance to understand when to expect to break even (by linking the percent to when in the week/month this percent of sales might occur).

The break-even point is a special case of [Target Income Sales](#), where Target Income is 0 (breaking even). This is very important for financial analysis.

BREAK EVEN ANALYSIS

Break even analysis can be carried out in two ways:

- (a) Algebraic method
- (b) Graphic method

ASSUMPTIONS OF BREAK EVEN ANALYSIS

Both the methods are based upon certain assumptions, which are rarely found in practice.

Some of the assumptions are as follows:

- (i) All costs can be classified in fixed, variable and semi-variable.
- (ii) While variable costs vary proportionately with volume and fixed costs remain same.
- (iii) Selling price remains constant despite volume changes.
- (iv) In case of multiple products, sales mix also remains constant.
- (v) Productivity per worker and efficiency of plant etc. remains mostly unchanged.

A. Algebraic Method of break Even Analysis

Break even point (BEP) is that point where the enterprise neither suffers any loss nor makes any profit. break even point is no loss no profit where total sales is equal to total costs(fixed as well as marginal costs) or total contribution is equal to fixed costs.

Let us explain the concept with equations:

1. Profit = Zero or $P = 0$
2. Profits = Total Sales – Total costs or $P = S - c = 0$
3. Total costs = Fixed costs + variable cost or $TC = FC + VC$
4. $P = [S - (Fq - Vq)] = 0$
5. Total sales = Quantity Sold * Sales Price per Unit or $TS = S * Q$
6. $P = [Sq - (Fq + Vq)] = 0$ (If V is variable cost per unit of output then Total VC is equal to Vq)
7. Now open the brackets

$$Sq - Fq = Vq = 0$$

$$Sq - Vq = F$$

$$q(S-V) = F$$

$$q = \frac{F}{S-V}$$

Thus, BEP (in quantity) is given by

$$\text{BEP}_{\text{quantity}} = \frac{F}{S - V} \quad \text{or} \quad \frac{\text{Fixed cost}}{\text{Sales Price} - \text{Variable Cost per Unit}} \quad S - V$$

$$\text{BEP (in rupees)} = \frac{F}{1 - V/s} = \frac{F}{S - V} \quad S - V$$

$$\text{Or, BEP (rupees)} = \frac{\text{Fixed cost}}{1 - \frac{\text{Total Variable Cost}}{\text{Total sales revenue}}}$$

When we divide total variable cost with sales we get variable cost ratio and if we subtract cost ratio from one we get Profit/volume ratio. Thus

$$\text{Profit/ Volume} = \frac{\text{Total Variable Cost}}{1 - \frac{\text{Total sales revenue}}{\text{Total sales revenue}}}$$

$$\text{Or, } p/v \text{ ratio} = 1 - \frac{V}{S}$$

$$\text{Or, } P/V \text{ ratio} = \frac{\text{contribution}}{TS}$$

As, **Contribution = Sales – Marginal Cost or Variable Cost**

P/v ratio also called contribution ratio.

$$\text{So, BEP (rupees)} = \frac{FC}{P/v \text{ ratio}}$$

$$\text{And, } P/V \text{ ratio} = \frac{\text{contribution}}{\text{Total Sales}}$$

When we find **the capacity utilization at BEP**, i.e. what percent capacity should be utilized for breaking even?

$$\text{BEP (capacity)} = \frac{FC}{\text{Contribution}}$$

Construction

In the linear [Cost-Volume-Profit Analysis](#) model (where marginal costs and marginal revenues are constant, among other assumptions), the **break-even point (BEP)** (in terms of Unit Sales (X)) can be directly computed in terms of Total Revenue (TR) and Total Costs (TC) as:

$$\begin{aligned}
 TR &= TC \\
 P \times X &= TFC + V \times X \\
 P \times X - V \times X &= TFC \\
 (P - V) \times X &= TFC \\
 X &= \frac{TFC}{P - V}
 \end{aligned}$$

where:

- **TFC** is **Total Fixed Costs**,
- **P** is **Unit Sale Price**, and
- **V** is **Unit Variable Cost**.

The Break-Even Point can alternatively be computed as the point where [Contribution](#) equals [Fixed Costs](#).

The quantity, $(P - V)$, is of interest in its own right, and is called the [Unit Contribution Margin](#) (C): it is the marginal profit per unit, or alternatively the portion of each sale that contributes to Fixed Costs. Thus the break-even point can be more simply computed as the point where Total Contribution = Total Fixed Cost:

$$\begin{aligned}
 \text{Total Contribution} &= \text{Total Fixed Costs} \\
 \text{Unit Contribution} \times \text{Number of Units} &= \text{Total Fixed Costs} \\
 \text{Number of Units} &= \frac{\text{Total Fixed Costs}}{\text{Unit Contribution}}
 \end{aligned}$$

To calculate the break-even point in terms of revenue (a.k.a. currency units, a.k.a. sales proceeds) instead of Unit Sales (X), the above calculation can be multiplied by Price, or, equivalently, the Contribution Margin Ratio (Unit Contribution Margin over Price) can be

$$\text{Break-even(in Sales)} = \frac{\text{Fixed Costs}}{C/P}$$

calculated:

$R=C$, Where R is revenue generated, C is cost incurred i.e. Fixed costs + Variable Costs or $Q * P$ (Price per unit) = $TFC + Q * VC$ (Price per unit), $Q * P - Q * VC = TFC$, $Q * (P - VC) = TFC$, or, Break Even Analysis $Q = TFC/c/s$ ratio=Break Even

MARGIN OF SAFETY(M.O.S.)

Margin of safety means the excess of sales (planned or actual) over and above the break even sales volume. Higher the margin of safety, higher is the capacity of firm to withstand drop in sales without suffering losses. Margin of safety is calculated by subtracting BEP sales from budgeted sales.

Margin of safety = budgeted Sales – BEP (Sales)

Margin of Safety Ratio = $\frac{\text{Actual or Budgeted Sales} - \text{BEP (Rupees)}}{\text{Actual or Budgeted Sales}}$

BEP can give us the sales volume required for a given or desired level of profit, with the following formulae.

Sales with desired profits = $\frac{\text{FC} + \text{Desired profit}}{\text{P/v ratio}}$

New sales required to maintain profits with increased fixed costs can be calculated by following formulae.

New Sales (Rupees) = $\frac{\text{New fixed Cost} + \text{Existing Profits}}{\text{P/V ratio}}$

Additional sales required for proposed expenditure can be calculated by:

Additional Sales = $\frac{\text{Proposed Expenditure}}{\text{Contribution}}$

Margin of safety represents the strength of the business. It enables a business to know what is the exact amount it has gained or lost and whether they are over or below the break-even point. In break-even analysis, margin of safety is the extent by which actual or projected sales exceed the break-even sales.

Margin of safety = (current output - breakeven output)

Margin of safety% = (current output - breakeven output)/current output × 100

When dealing with budgets you would instead replace "Current output" with "Budgeted output." If P/V ratio is given then profit/PV ratio.

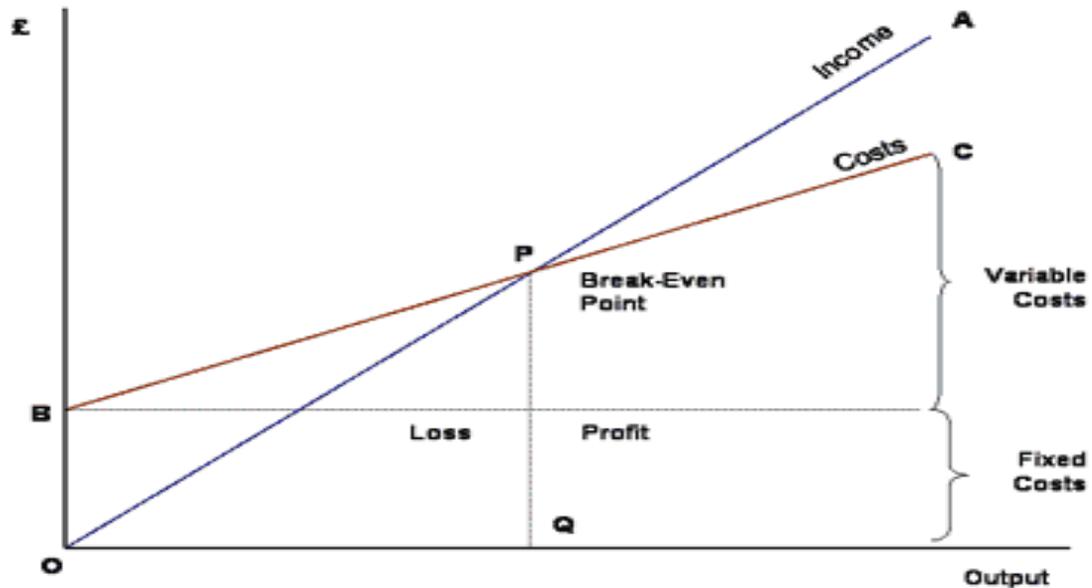
B. Graphical Method of Break Even Analysis

1-Break Even Chart

A break even chart portrays a pictorial view of the relationship between costs, volume and profit. The BEP indicated in the chart be one of which the total cost line total sales line intersect.

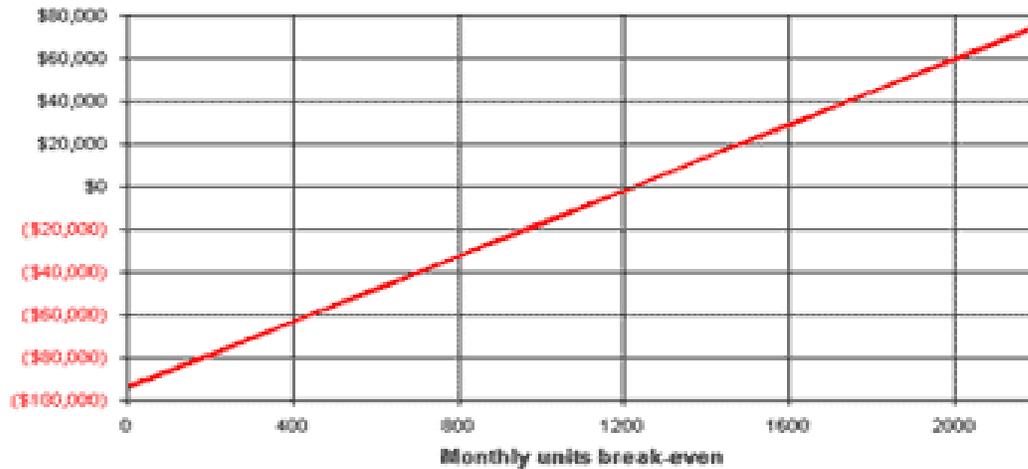
- **The Break-Even Chart**

In its simplest form, the break-even chart is a graphical representation of costs at various levels of activity shown on the same chart as the variation of income (or sales, revenue) with the same variation in activity. The point at which neither profit nor loss is made is known as the "break-even point" and is represented on the chart below by the intersection of the two lines:



In the diagram above, the line OA represents the variation of income at varying levels of production activity ("output"). OB represents the total fixed costs in the business. As output increases, variable costs are incurred, meaning that total costs (fixed + variable) also increase. At low levels of output, Costs are greater than Income. At the point of intersection, P, costs are exactly equal to income, and hence neither profit nor loss is made.

2: Break-even chart



The illustration shows that the company needs to sell approximately 1,222 units in order to cross the break-even line. This is a classic business chart that helps you consider your bottom-line financial realities. Can you sell enough to make your break-even volume?

The break-even analysis depends on assumptions made for average per-unit revenue, average per-unit cost, and fixed costs. These are rarely exact. We recommend that you do the break-even table twice: first, with educated guesses for assumptions, as part of the initial assessment, and later on, using your detailed Sales Forecast and Profit and Loss numbers. Both are valid uses.

It is an important aid for profit planning.

- Select a scale for sales or production in units on horizontal axis.
- Select a scale of costs and revenue on vertical axis.
- Draw the fixed cost line parallel to horizontal axis.
- Draw the VC line starting from the point on vertical axis which represents fixed costs.
- Draw the sales line, for starting from the point of origin (zero) and finishing at the point of maximum sales.

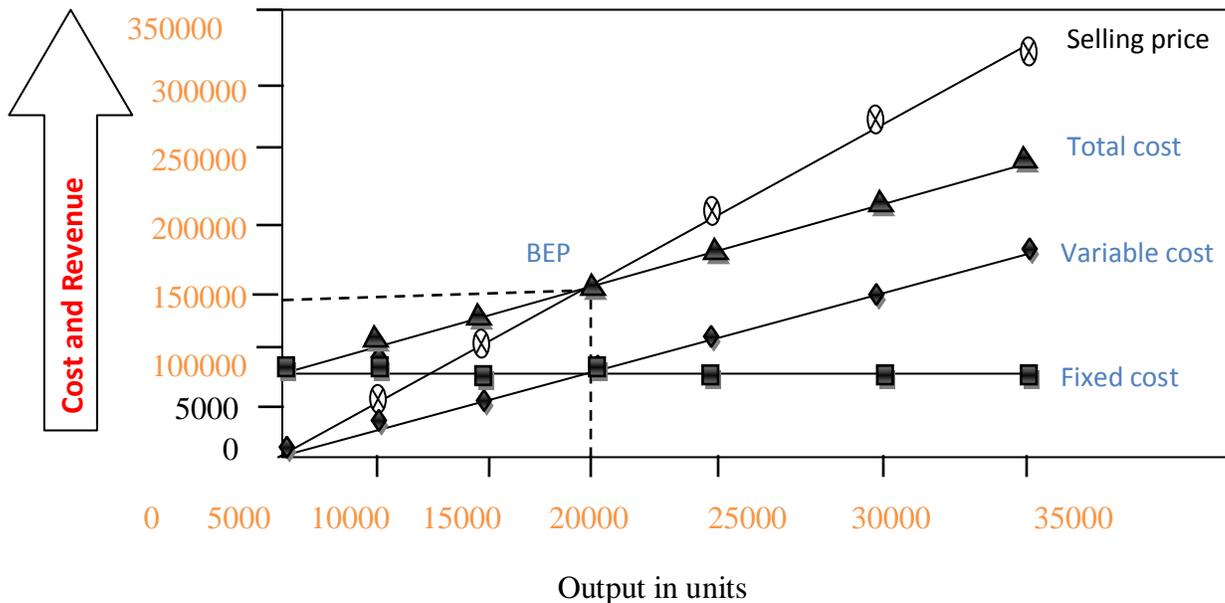
Example:

From the following data compute BEP both graphically and mathematically.

Output Units Rs. (In Rs.)(In Rs.)	VC (per unit) Cost (In Rs.)	Total variable Cost	Total Fixed Cost Price)	TC (In Rs.)	Selling Price Selling	TC (Units * Selling Price)
0	5	0	75000	75000	10	0
5000	5	25000	75000	100000	10	50000
10000	5	50000	75000	125000	10	100000
15000	5	75000	75000	150000	10	150000
20000	5	100000	75000	175000	10	200000
25000	5	125000	75000	200000	10	250000
30000	5	150000	75000	225000	10	300000

Solution

TC=TOTAL COST , VC= VARIABLE COST, FC=FIXED COST=

Graphically calculation of break Even analysis

Mathematically calculation of break even Analysis

$$\text{BEP} = \frac{\text{FC}}{\text{P/v ratio}}$$

$$\text{P/V} = \frac{\text{Contribution}}{\text{Sales}} = \frac{3 \text{ lac} - 1.5 \text{ lac}}{3 \text{ lac}}$$

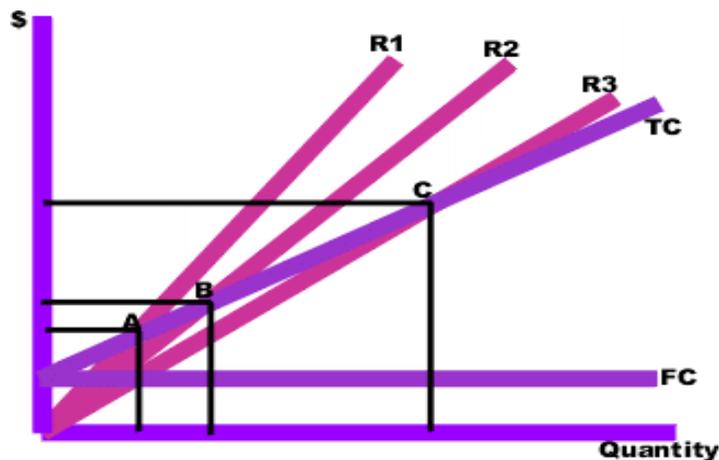
So, P/V ratio = 50%

$$\text{BEP} = 75000 \quad \text{50\%}$$

So. BEP in rupee = Rs. 1, 50,000

2-Break-even analysis

By inserting different prices into the formula, you will obtain a number of break-even points, one for each possible price charged. If the firm changes the selling price for its product, from \$2 to \$2.30, in the example above, then it would have to sell only $1000/(2.3 - 0.6) = 589$ units to break even, rather than 715.



To make the results clearer, they can be graphed. To do this, you draw the total cost curve (TC in the diagram) which shows the total cost associated with each possible level of output, the fixed cost curve (FC) which shows the costs that do not vary with output level, and finally the various total revenue lines (R1, R2, and R3) which show the total amount of revenue received at each output level, given the price you will be charging.

The break-even points (A,B,C) are the points of intersection between the total cost curve (TC) and a total revenue curve (R1, R2, or R3). The break-even quantity at each selling price can be read off the horizontal axis and the break-even price at each selling price can be read off the vertical axis. The total cost, total revenue, and fixed cost curves can each be constructed with simple formula. For example, the total revenue curve is simply the product of selling price times

quantity for each output quantity. The data used in these formula come either from accounting records or from various estimation techniques such as [regression analysis](#).

USES OF BREAK EVEN ANALYSIS

1. It is an effective tool as it provides an insight into the effects of an inter-relationship of factors which influence profits of the project.
2. Relationship between cost, volume and profit makes up the profit structures of project.
3. Useful for budgeting and profit planning.
4. Helps the entrepreneur to find most profitable combination of costs and volume.
5. Facilitates decision concerning installed capacity and its utilization.
6. Helps the entrepreneur in adopting profitable mix.
7. Profit potentialities can be judged.
8. Knowing the effect of increase and reduction of selling prices
9. Used to predict and evaluate the implications of its short run decisions about fixed costs, variable costs, sales volume and selling price for its profit plans on a continues basis.

APPRAISAL OF BREAK EVEN ANALYSIS

Break even point (BEP) defines when investment will generate a positive return to an entrepreneur. The fixed cost are not directly related to level of production and variable cost change in direct relation to volume of output and total fixed cost do not change as level of production increases while calculating BEP. Thus, BEP can be termed as when an investment will generate positive return and can be determined graphically and mathematically.

ADVANTAGE

The main advantage of Break Even Analysis is that, with its help the relationship between cost, production volume and returns be known. It also shows how changes in fixed cost-variable cost relationships, in commodity process, or in revenues, will affect profit levels and BEP.

BE analysis is most useful in capital budgeting techniques. It also indicates the lowest amount of business activity necessary to prevent losses.

APPLICATION

The break-even point is one of the simplest yet least used analytical tools in management. It helps to provide a dynamic view of the relationships between sales, costs and profits. A better understanding of break-even, for example, is expressing break-even sales as a percentage of

actual sales—can give managers a chance to understand when to expect to break even (by linking the percent to when in the week/month this percent of sales might occur).

The break-even point is a special case of Target Income Sales, where Target Income is 0 (breaking even). This is very important for financial analysis.

LIMITATIONS

- 1- Break-even analysis is only a supply side (*i.e.* costs only) analysis, as it tells you nothing about what sales are actually likely to be for the product at these various prices.
- 2- It assumes that fixed costs (FC) are constant. Although, this is true in the short run, an increase in the scale of production is likely to cause fixed costs to rise.
- 3- It assumes average variable costs are constant per unit of output, at least in the range of likely quantities of sales. (*i.e.* linearity)
- 4- It assumes that the quantity of goods produced is equal to the quantity of goods sold (*i.e.*, there is no change in the quantity of goods held in inventory at the beginning of the period and the quantity of goods held in inventory at the end of the period).
- 5- In multi-product companies, it assumes that the relative proportions of each product sold and produced are constant (*i.e.*, the sales mix is constant).
- 6- There may be tendency to continue to use a break even analysis after the cost and income functions here changed

- 7- Best suited to analysis of one product at a time;
- 8- Difficult to classify cost as all variable or all fixed;

The break-even analysis is not our favorite analysis because:

- It is frequently mistaken for the payback period, the time it takes to recover an investment. There are variations on break even that make some people think we have it wrong. The one we do use is the most common, the most universally accepted, but not the only one possible.
- It depends on the concept of fixed costs, a hard idea to swallow. Technically, a break-even analysis defines fixed costs as those costs that would continue even if you went broke. Instead, you may want to use your regular running fixed costs, including payroll and normal expenses. This will give you a better insight on financial realities. We call that “burn rate” these post-Internet days.
- It depends on averaging your per-unit variable cost and per-unit revenue over the whole business.

However, whether we like it or not, this table is a mainstay of financial analysis. You may choose to leave it out, but really, a business plan would not be complete without it. And, although there are some other ways to do a Break-even Analysis, this is the most standard.

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