

# Break-even Analysis

IPE 4111



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# Break-even analysis

- A break-even analysis is a financial tool which helps to determine at what stage a company, or a new service or a product, will be profitable.
- In other words, it's a financial calculation for determining the number of products or services a company should sell to cover its costs.
- It is of vital importance in determining the practical application of cost functions. It is a function of three factors, i.e. sales volume, cost and profit.
- It aims at classifying the dynamic relationship existing between total cost and sales volume of a company

# Break-even point

- Break-even point represents that volume of production where total costs equal to total sales revenue, resulting into a no-profit or no-loss situation.



# Break-even point

- If output of any product falls below the break-even point there is loss; and if output exceeds that point there is profit.
- Thus, it is the minimum point of production where total costs are recovered.



# Break-even point

- The break-even point (B.E.P.) of a firm can be found out in two ways. It may be determined in terms of
  - physical units (volume of output) or
  - money value (value of sales)

# Break-even analysis

## ➤ Fixed cost

A fixed cost is a cost that does not change with an increase or decrease in the amount of goods or services produced or sold.

Example: Rent, insurance, interest expense, property taxes etc.

## ➤ Variable cost

A variable cost is an expense that increases or decreases in direct proportion to production volume.

Example: Direct labor, raw materials, packaging etc.

# Break-even analysis

## Recurring costs

- Costs that are repetitive and occur when a firm produces similar goods and services on a continuing basis.
- Variable costs are recurring costs because they repeat with each unit of output.
- A fixed cost that is paid on a repeatable basis is also a recurring cost:
  - Office space rental

# Break-even analysis

## Nonrecurring costs

- Costs that are not repetitive, even though the total expenditure may be cumulative over a relatively short period of time.
- Typically involve developing or establishing a capability or capacity to operate.
- Examples are purchase cost for real estate upon which a plant will be built, and the construction costs of the plant itself.



# Break-even analysis

## ➤ Unit Price

The amount of money charged to the customer for each unit of a product or service.

## ➤ Total Cost

The sum of the fixed cost and total variable cost for any given level of production.

$$\text{Total cost} = (\text{Fixed Cost} + \text{Total Variable Cost})$$

## ➤ Revenue

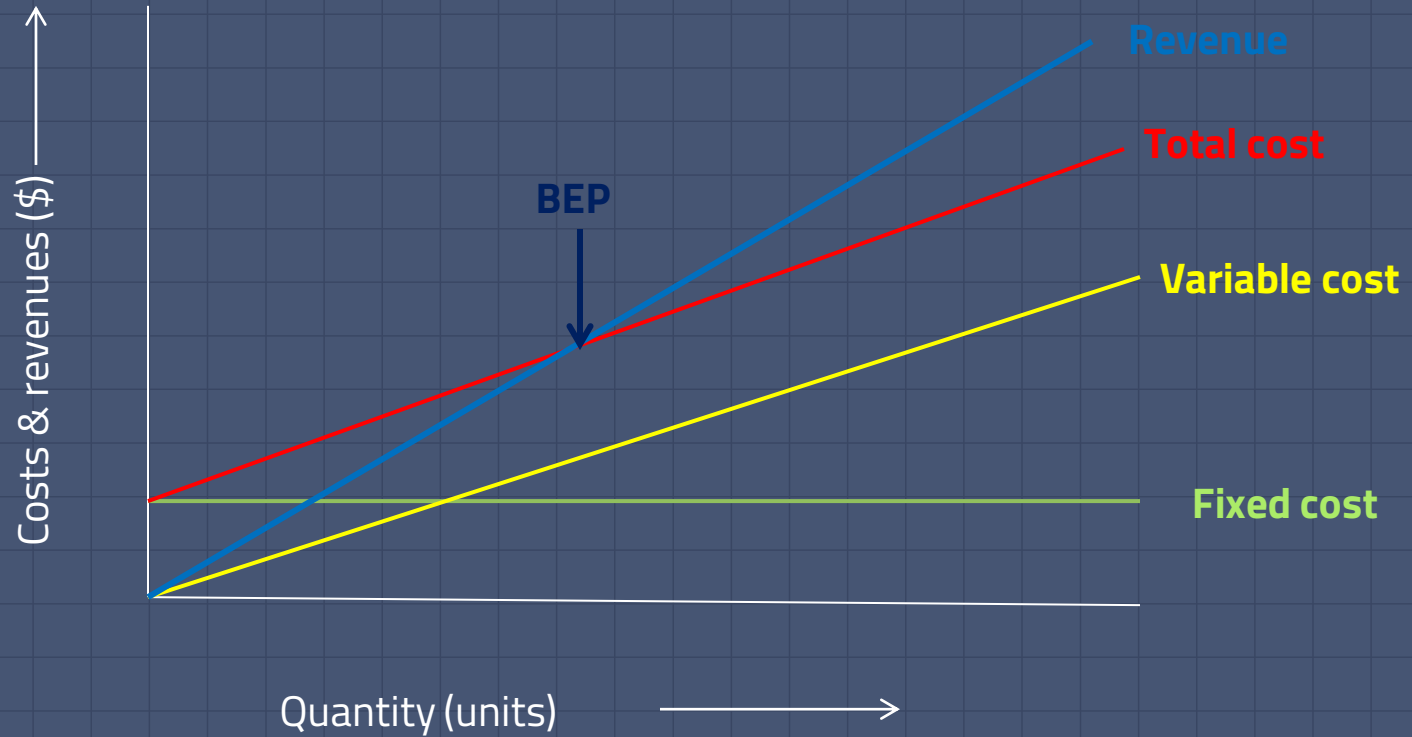
Revenue is the total amount of income generated by the sale of goods or services related to the company's primary operations.

## ➤ Profit/ loss

The monetary gain or loss resulting from revenues after subtracting all associated costs.

$$\text{Profit/loss} = (\text{Total Revenue} - \text{Total Costs})$$

# Break-even chart



# Break-even analysis

- A simple relation for the breakeven point may be derived when revenue and total cost are linear functions of quantity,  $Q$ .

$$\begin{aligned} TR &= TC \\ sQ &= FC + vQ \end{aligned}$$

Where,

$TR$  = Total revenue =  $s \times Q$

$s$  = Price per unit

$Q$  = Quantity

$TC$  = Total cost =  $FC + VC$

$FC$  = Fixed cost

$VC$  = Variable cost =  $v \times Q$

$v$  = Variable cost per unit

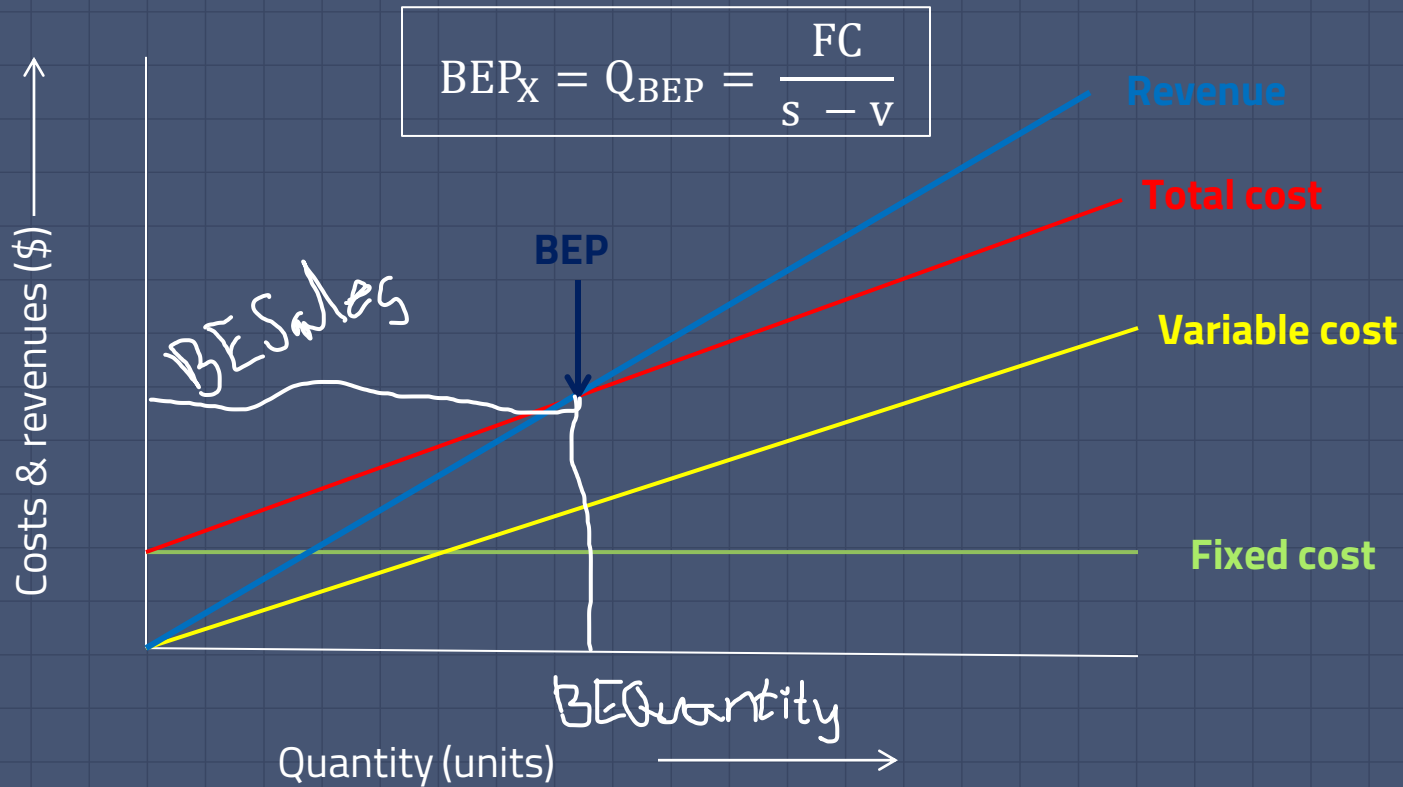
# Break-even analysis

$$\begin{aligned}\text{Profit, } P &= \text{Total revenue} - \text{Total cost} \\ &= TR - (FC + VC) \\ &= sQ - FC - vQ \\ &= (s - v)Q - FC\end{aligned}$$

$$Q = \frac{P + FC}{s - v}$$

$$Q_{\text{BEP}} = \frac{FC}{s - v}$$

# Break-even chart



$$\text{BEP}_{\$} = \text{BEP}_x \times s$$

$$= \frac{\text{FC}}{s - v} \times s$$

$$= \frac{\text{FC}}{\frac{s - v}{s}}$$

$$= \frac{\text{FC}}{1 - \frac{v}{s}}$$

## Example

Normal production level of a renowned company is 60 units per month, but due to significantly improved economic conditions, production is now 72 units per month. Fixed cost is \$2400 per month. Variable cost per unit is \$35 and selling price per unit is \$75.

- a) Calculate the break-even point.
- b) How does the increased production level of 72 units per month compare with the current break-even point?
- c) What is the current profit level per month for the facility?
- d) What will be the selling price if monthly production level reduced to 45 units and others remain constant?

## Example

Here,

Fixed costs, FC = \$2400 per month

Variable cost per unit,  $v = \$35$

Selling price per unit,  $s = \$75$

(a). We know,

$$Q_{\text{BEP}} = \frac{\text{FC}}{s - v}$$

$$= \frac{2400}{75 - 35}$$

$$= 60 \text{ units}$$



## Example

(b) The breakeven value is 60 units. The increased production level of 72 units is above the breakeven value.

$$\begin{aligned}\text{(c) Profit, } P &= (s - v)Q - FC \\ &= (75 - 35) \times 72 - 2400 \\ &= \$ 480\end{aligned}$$

$$\begin{aligned}\text{(d) Profit, } P &= (s - v)Q - FC \\ \text{For } Q &= 45 \text{ units,} \\ 480 &= (s - 35) \times 45 - 2400 \\ s &= \$ 99\end{aligned}$$

# Break-even analysis

## Multiproduct Case

$$BEP_{\$} = \frac{FC}{\sum \left[ \left( 1 - \frac{v_i}{s_i} \right) \times W_i \right]}$$

Where

- v = variable cost per unit
- s = price per unit
- FC = fixed costs
- W = percent each product is of total dollar sales
- i = each product

## Example

The owner of a small restaurant wants to calculate the break-even sales. Their fixed cost is \$3,500 per month. The details information are summarized in following table.

Item	Price (\$)	Cost (\$)	Annual Forecasted Sales Units
Sandwich	2.95	1.25	7,000
Soft drink	0.80	0.30	7,000
Fries	1.55	0.47	5,000
Tea	0.75	0.25	5,000
Salad	2.85	1.00	3,000

- Calculate the annual break-even sales.
- Calculate the number of units of each product that will need to be sold per day in order to achieve that annual break-even sales.

# Example

Fixed costs = \$3,500 per month

Item (i)	Selling price (s) (\$)	Variable cost (v) (\$)	(v/s)	1 - (v/s)	Annual Forecasted Sales (\$)	% of Sales (W)	Weighted Contribution (col 5 x col 7)
Sandwich	2.95	1.25	0.4	0.58	20,650	0.446	0.259
Soft drink	0.8	0.3	0.4	0.62	5,600	0.121	0.075
Fries	1.55	0.47	0.3	0.7	7,750	0.167	0.117
Tea	0.75	0.25	0.3	0.67	3,750	0.081	0.054
Salad	2.85	1	0.4	0.65	8,550	0.185	0.12
					46,300	1	0.625

## Example

$$(a) \text{BEP}_{\$} = \frac{\text{FC}}{\sum [(1 - \frac{v_i}{s_i}) \times w_i]}$$

$$\text{BEP}_{\$} = \frac{3500 \times 12}{0.625}$$

$$= \$ 67200$$

$$(b) \text{Annual sales} = \$ 67200$$

$$\begin{aligned} \text{Daily sales} &= \frac{67200}{312} \\ &= \$ 215.38 \end{aligned}$$

## Example

$$\text{Sandwich sales per day} = \frac{0.446 \times 215.38}{2.95} = 32.56 \approx 33 \text{ units}$$

$$\text{Soft drink sales per day} = \frac{0.121 \times 215.38}{0.80} = 32.58 \approx 33 \text{ units}$$

$$\text{Fry sales per day} = \frac{0.167 \times 215.38}{1.55} = 23.21 \approx 24 \text{ units}$$

$$\text{Tea sales per day} = \frac{0.081 \times 215.38}{0.75} = 23.26 \approx 24 \text{ units}$$

$$\text{Salad sales per day} = \frac{0.185 \times 215.38}{2.85} = 13.98 \approx 14 \text{ units}$$

# Thank You