

Cost – Volume – Profit Analysis

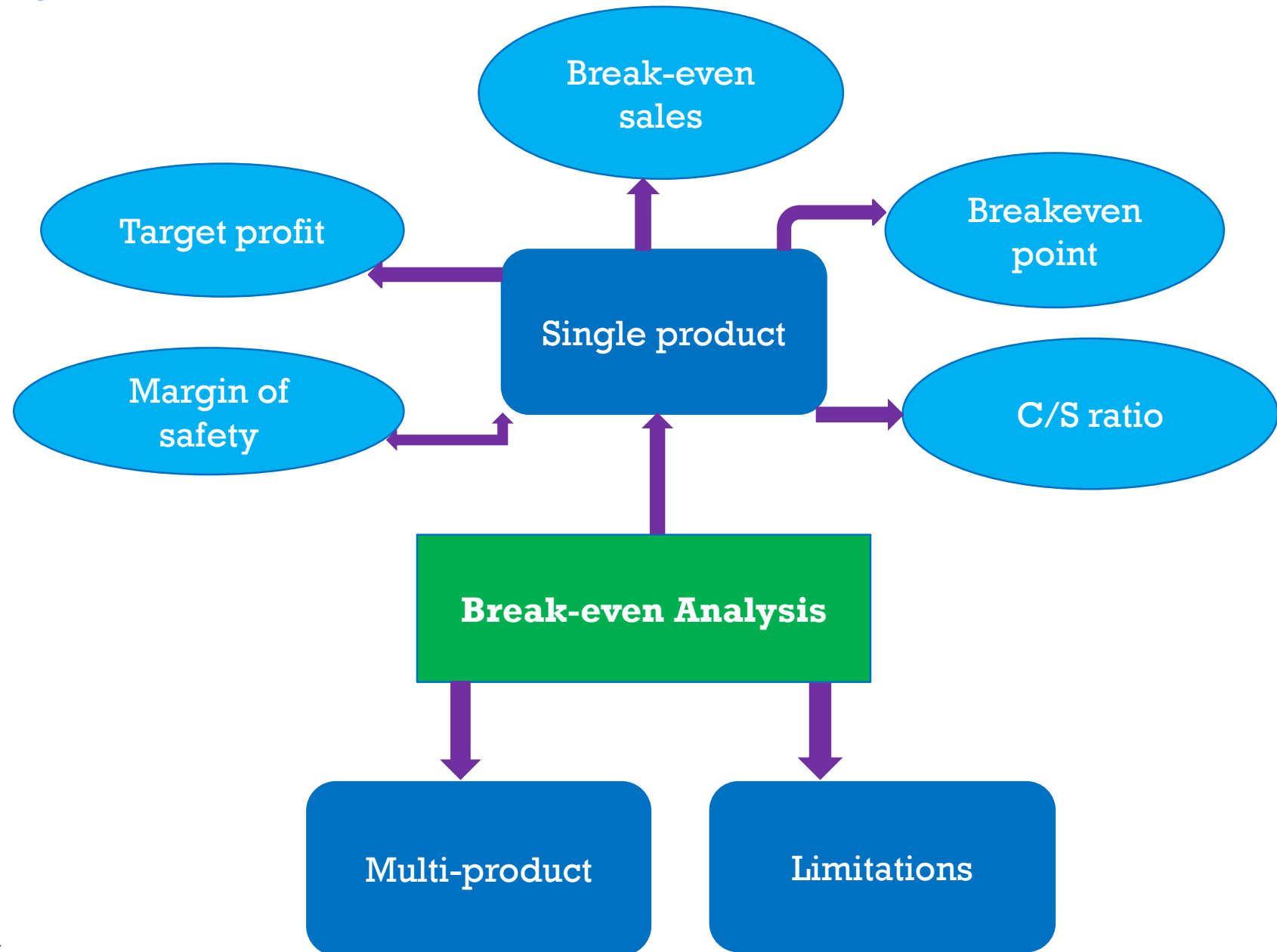


Syllabus Learning Outcomes

By the end of this session you should be able to

- explain the nature of CVP analysis
- calculate and interpret break-even point and margin of safety
- calculate the contribution to sales ratio, in single and multiproduct situations, and demonstrate an understanding of its use
- calculate target profit or revenue in single and multi-product situations, and demonstrate an understanding of its use
- prepare break even charts and profit volume charts and interpret the information contained within each, including multi-product situations
- discuss the limitations of CVP analysis for planning and decision making and answer questions relating to these areas.

Chapter Overview



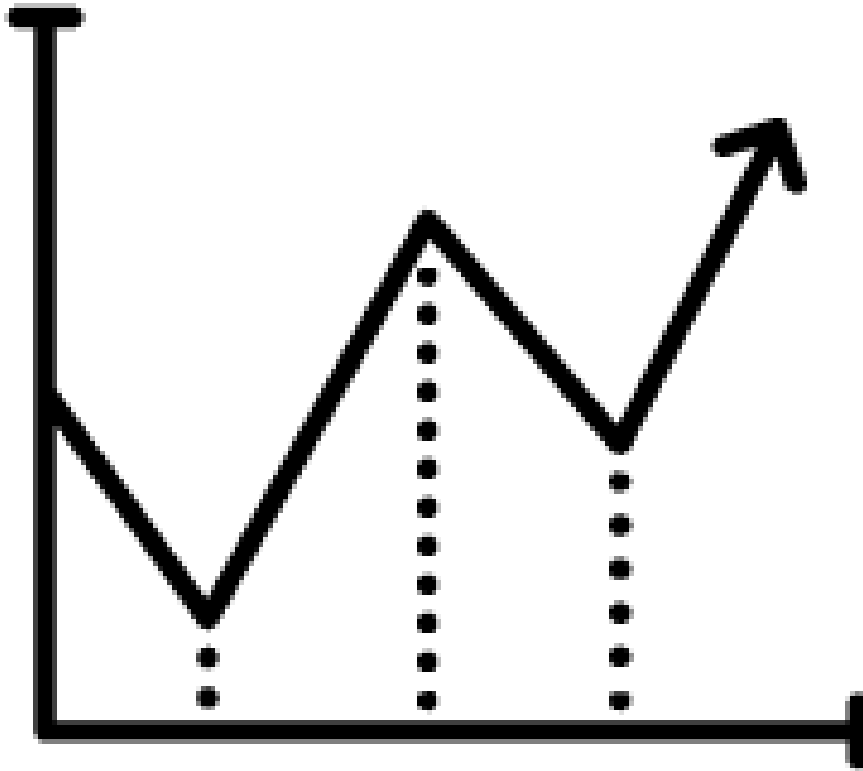
Breakeven Analysis

Also known as CVP analysis, or cost-volume-profit analysis, breakeven analysis is the study of the effects on future profit of changes in:

- fixed costs
- variable costs
- sales price
- quantity
- mix.

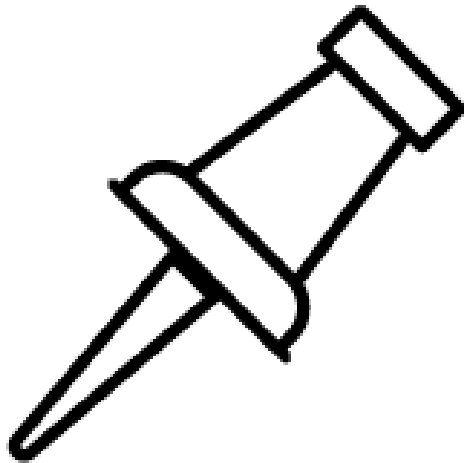
CVP analysis is a particular example of '*what if?*' analysis.

CVP answers these questions:



- How much do I need to sell to cover my costs?
- How much do I need to sell to make \$X of profit?
- How far away is my current activity / budget from covering my costs?

CVP Assumptions



- Total Cost is a **linear** function:
 - Satisfies $y = a + bx$
 - a = total fixed costs
 - b = variable cost per unit
 - c = total units
- Change in inventory is ignored.
- Single product or constant mix of products.
- Selling price and variable cost per unit does not change.

Single Product Breakeven Analysis

The breakeven point is the level of activity at which there is neither profit, nor loss.

Breakeven point in units =

$$\frac{\text{Fixed costs}}{\text{Contribution per unit}}$$

Margin of safety expressed as a % =

$$\frac{\text{Budgeted sales} - \text{breakeven sales}}{\text{Budgeted sales}} \times 100$$

Contribution to sales ratio (C/S ratio) =

$$\frac{\text{Contribution}}{\text{Sales}}$$

Breakeven point in sales revenue =

$$\frac{\text{Fixed costs}}{\text{CS ratio}}$$

Margin of safety =

Budgeted level of activity – breakeven level of activity

Sales revenue required to earn a target profit =

Level of activity to earn a required profit =

$$\frac{\text{Required profit} + \text{Fixed costs}}{\text{Contribution per unit}}$$

$$\frac{\text{Required profit} + \text{Fixed costs}}{\text{CS ratio}}$$



Question

Thapelo manufactures and sells a single product that has the following cost and selling price structure:

	\$/unit
Selling price	120
Direct material	(22)
Direct labour	(36)
Variable overhead	(14)
Fixed overhead	(12)
	36

The fixed overhead absorption rate is based on the normal capacity of 2,000 units per month.

Assume that the same amount is spent each month on fixed overheads.

Budgeted sales for next month are 2,200 units.

Calculate:

- i. The break-even point, in sales units per month
- ii) the margin of safety for next month (in units and %)
- iii) the budgeted profit for next month
- iv) the sales required to achieve a profit of \$96,000 in a month

Graphs

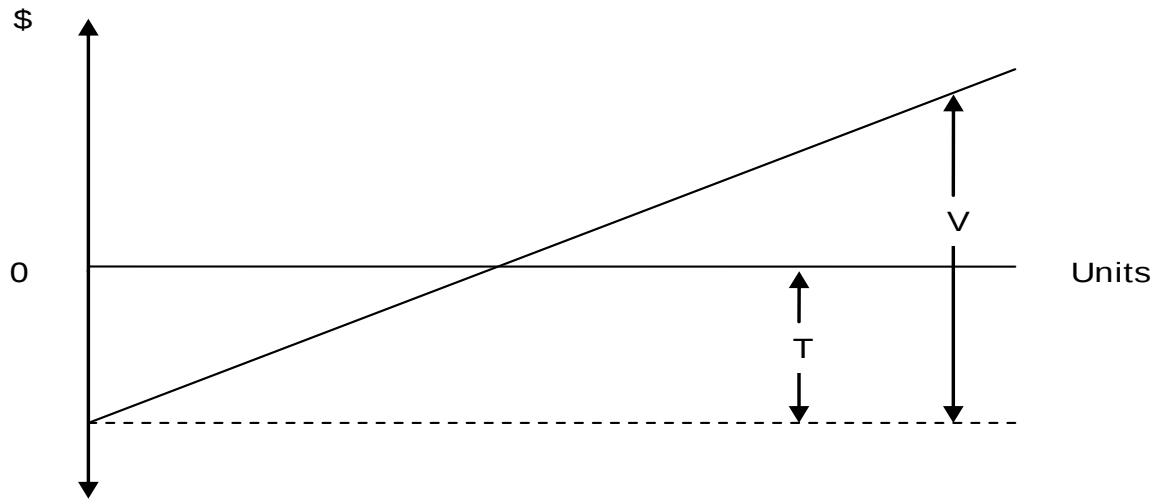
1. Conventional Break-even chart
2. Modern Break-even chart
3. Profit volume.

Let's do some drawings.....



Question Time

The following represents a profit/volume graph for an organisation



At the specific levels of activity indicated, what do the lines depicted as 'T' and 'V' represent?

Line 'T'

- A. Loss
- B. Loss
- C. Total fixed costs
- D. Total fixed costs

Line 'V'

- Profit
- Contribution
- Profit
- Contribution

Multi-product CVP Analysis

❑ CVP Analysis assumes that, if a range of products is sold, sales will be in accordance with a pre-determined sales mix.

❑ When a pre-determined sales mix is used, it can be depicted in the CVP

Analysis by assuming average revenues and average variable costs for the given sales mix.

❖ However, the assumption has to be made that the sales mix remains constant.

This is defined as the relative proportion of each product's sale to total sales. It could be expressed as a ratio such as 2:3:5, or as a percentage as 20%, 30%, 50%.

FORMULAS TO LEARN

Breakeven point = $\frac{\text{Fixed costs}}{\text{Weighted average unit contribution}}$

Breakeven revenue = $\frac{\text{Fixed costs}}{\text{Weighted average C/S ratio}}$

Steps To Follow

How to calculate a multi-product breakeven point

- Calculate the contribution per unit.
- Calculate the weighted average contribution per unit.
- Calculate the breakeven point in number of units (Total).
- Calculate the breakeven point in units (for each product) and revenue

Example – J Co

J Co produces and sells two products.

The M sells for \$7 per unit and has a total variable cost of \$3 per unit.

The N sells for \$15 per unit and has a total variable cost of \$5 per unit.

For every five units of M sold, one unit of N will be sold.

Fixed costs total \$30,000.

Required

- (a) What is the breakeven sales volume?
- (b) What is the breakeven sales revenue?

Example Answer: J Co

- Contribution: M = \$4, N = \$10
- Contribution from sale of std mix:
 $(\$4 \times 5) + (\$10 \times 1) = \$30$
- Fixed costs $\div$ contribution per mix
 $= \$30,000 \div \$30 = 1,000$ mixes
- M $1,000 \times 5 = 5,000$ units, $5,000 \times \$7 = \$35,000$ revenue
- N $1,000 \times 1 = 1,000$ units, $1,000 \times \$15 = \$15,000$ revenue
- Total breakeven revenue = \$50,000

Practice Question

United Trading sells three products as follows:

Product	<i>Footballs</i>	<i>Baseballs</i>	<i>Rugby balls</i>
	\$	\$	\$
Selling price	7	6	9
Variable costs	3	4.50	5
Budgeted sales (units)	2,000	4,000	3,000

Assume that the sales mix is 'fixed' in these proportions.

Fixed costs are \$20,000.

Required

- (a) What is the breakeven sales volume?
- (b) What is the breakeven sales revenue?

Solution

Product	<i>Footballs</i>	<i>Baseballs</i>	<i>Rugby balls</i>
	\$	\$	\$
Selling price	7	6	9
Variable costs	3	4.50	<u>5</u>
Contribution	4	1.50	<u>4</u>

$$\begin{aligned}\text{Breakeven point} &= \frac{\text{Fixed costs}}{\text{Average contribution}} \\ &= \frac{\$20,000}{\$2.889 \text{ (W1)}} \\ &= 6,923 \text{ units}\end{aligned}$$

Workings

$$\begin{aligned} \text{(W1) Average contribution} &= \frac{(\$4 \times 2) + (\$1.50 \times 4) + (\$4 \times 3)}{2 + 4 + 3} \\ &= \$2.889 \end{aligned}$$

The 6,923 units would be split as follows:

	<i>Sales mix</i>	(a) <i>Units</i>	<i>SP</i> \$	(b) <i>Revenue</i> \$
Football	2	1,538	7	10,766
Baseball	4	3,077	6	18,462
Rugby ball	3	<u>2,308</u>	9	<u>20,772</u>
	9	<u>6,923</u>		<u>50,000</u>

What The Multi-product P/V Chart Highlights

- The overall company **breakeven point**
- Which products should be **expanded in output** (the most profitable in terms of C/S ratio)
- Which products, if any, should be **discontinued**
- What effect **changes** in selling price and sales revenue would have on breakeven point and profit
- The **average profit** (the solid line which joins the two ends of the dotted line) earned from the sales of the products in the mix

Advantages of CVP Analysis

- Graphical representation of cost and revenue data can be more easily understood by non-financial managers.
- Highlighting the breakeven point and margin of safety gives managers an indication of the level of risk involved.

Limitations Of CVP Analysis

- It is assumed that fixed costs are the same in total and variable costs are the same per unit at all levels of output.
- It is assumed that sales prices will be constant at all levels of activity.
- Production and sales are assumed to be the same.
- Uncertainty in estimates of fixed costs and unit variable costs is often ignored.

Relevant Technical Article

<https://www.accaglobal.com/gb/en/student/exam-support-resources/fundamentals-exams-study-resources/f5/technical-articles/CVP-analysis.html>

TYU 4 Kaplan Text book