

**Applications of CVP formulae:**

**A Determination of the level of sales (Rs.)**

a) To achieve a given profit when fixed cost and P/V ratio are known:

$$\frac{\text{Given profit} + \text{fixed cost}}{\text{P/V ratio \%}}$$

Example:  $\frac{2,000 + 6,000}{40\%} = \text{Rs. } 20,000$

b) To maintain the current profit after an increase in fixed cost when the new fixed cost and original P/V ratio are known:

$$\frac{\text{Current profit} + \text{New Fixed cost}}{\text{P/V ratio \%}}$$

**Example: Using change in information as given in (a):**

$$\frac{\text{Rs. } 2,000 + \text{Rs. } 7,000}{40\%} = \text{Rs. } 22,500$$

Proof: Contribution = 40% of Rs. 22,500  
Less fixed cost

Rs. 9,000  
Rs. 7,000  
Rs. 2,000

Profit

c) To earn a minimum return on a new investment in plant and machinery as well as the current profit when new fixed cost and original P/V ratio are known:

$$\frac{\text{Current profit} + \text{Minimum return in additional profit} + \text{New fixed cost}}{\text{P/V ratio \%}}$$

**Example: Using change in information as given in (c):**

$$\frac{2,000 + 2,000 + 7,000}{40\%} = \text{Rs. } 27,500$$

Proof: Contribution = 40% of Rs. 27,500  
Less fixed cost

Rs. 11,000  
7,000  
4,000

Profit

d) To achieve an increased profit when current sales level and P/V ratio are known and when no change is envisaged in fixed cost.

$$\text{Current sales level} + \frac{\text{Increased profit required}}{\text{P/V ratio \%}}$$

**Example: Using change in information in (d):**

$$\text{Rs. } 20,000 + \frac{1,000}{40\%} = \text{Rs. } 22,500$$

Proof: Contribution = 40% of Rs. 22,500  
Less fixed cost

Rs. 9,000  
Rs. 6,000  
Rs. 3,000

Profit

**B Determination of Sales Volume in units:**

c) To maintain the current profit when a reduction in selling price is contemplated, given current contribution, new P/V ratio, new selling price per unit:

$$\frac{\text{Total Contribution before price reduction}}{\text{New P/V ratio as a result of the price reduction}} \div \text{New selling price per unit}$$

Example: Using change in information in (b):

	26,667 units
Rs. $\frac{8,000}{20\%}$ + Rs. 1.50	
Proof: Sales $26,667 \times 1.50$	Rs. 40,000
Variable Cost $26,667 \times 1.20$	32,000
Contribution	8,000
Fixed Cost	6,000
Profit	2,000

- f) To maintain the current profit after an increase in fixed costs, given the new fixed cost, contribution per unit, and constant P/C ratio.

$$\frac{\text{New fixed cost} + \text{Profit before increase in fixed cost}}{\text{Contribution per unit}}$$

Example: Using change in information in (a):

	11,250 units
Rs. $\frac{7,000 + 2,000}{.80}$	
Proof: Contribution = $11,250 \times .80$	Rs. 9,000
Less fixed cost	7,000
Profit	2,000

## 9.7 SUMMARY

Cost volume profit analysis provides a framework within which the impact of volume changes in the short-run may be examined on profit. Cost behaviour is added as a dimension and corresponding changes in profit, break-even point, and margin of safety are observed.

Break-even analysis is an integral part of CVP analysis, even though the former is just incidental to the latter.

CVP analysis is used as a tool of planning. A profit plan has essentially to be based on it. A number of managerial decisions are often premised on this vital tool of analysis. Examples of such decisions are: distribution channels, outside contracting, sales promotion expenditures, and pricing strategies.

The conventional break-even chart is based on a number of assumptions, the most relevant being the 'planned range of activity', the 'short-run', and 'linearity of cost functions'.

Many useful conclusions can be drawn from CVP and break-even analysis. Notice, for example, the following:

- A firm with a high proportion of fixed cost to total cost is accompanied by a high break-even point, and carries a potential for substantial profits once the break-even point is reached.
- A company with a low proportion of fixed cost to total cost, on the other hand, commands greater flexibility in terms of profitable operation.
- An increase in sales prices lowers the break-even point and increases the margin of safety.
- An increase in costs pushes up the break-even point and lowers the margin of profit.

## 9.8 KEY WORDS

**CVP analysis** is a technique of analysis to study the effects of costs and volume variations on profit.

**Break-even point** is a level of sales (volume or value) where total costs and total revenues are equal.

**Margin of safety** is the excess of sales, budgeted or actual, over the break-even sales volume. It shows the amount by which sales may decrease before losses occur.

**Margin of safety ratio** is a relative expression of margin of safety and is obtained by dividing the sales with actual (or budgeted) sales.

**Unit contribution line** is the relationship between contribution (i.e., sales minus variable costs) per unit and different sales levels shown on a profit graph.

**Profit Graph** is a depiction of the unit contribution line on a graph with sales on the horizontal scale and profit/fixed cost/loss on the vertical scale.

**PV ratio** is the percentage of contribution to sales.

**Variable cost ratio** is the percentage of variable costs to sales value.

**Mixed costs** are costs which carry both fixed and variable element. These are also known as semi-variable costs.

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20. COST MANAGEMENT QUESTIONS/EXERCISES

Activity 6 Study Figures VI through XI and note your comments on important conclusions that you would arrive at from each figure.

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CVP and Break-even Analysis: A resume This concluding section of the unit presents CVP relationship and break-even applications in the form of mathematical formulations.

The following abbreviations are used :

- FC = Fixed Cost
- C = Contribution
- P = Profit
- S = Sales

P/V ratio = Profit-volume ratio

BE point = Break-even point

MS = Margin of Safety

VC = Total Variable Cost

1  $FC = C - P$  or alternatively  $(P/V \text{ ratio} \times S) - P$

2  $C = FC + P$  or alternatively  $P/V \text{ ratio} \times S$

3 BE point:

a) In terms of sales value (Rs.)

$$BE = \frac{FC}{C} \times S \text{ or alternatively}$$

$$\frac{FC}{P/V \text{ ratio}} \text{ or } \frac{1 - \frac{VC}{S}}$$

b) In terms of sales volume (Units)

$$BE = \frac{FC}{C \text{ per unit of product}}$$

4  $MS = S - BE \text{ point}$

5  $P = C - FC$  or alternatively  $P/V \text{ ratio} \times MS$

6 MS ratio =  $\frac{P}{C}$  or alternatively  $\frac{\text{Actual sales} - BE \text{ sales}}{\text{Actual sales}}$

Illustration 2

The following data relates to a firm for an accounting period:

Sales	Rs. 20,000
Variable cost	12,000
Contribution	8,000
Fixed cost	6,000
Profit	2,000

Units manufactured and sold 10,000

The following changes have been planned:

- a) Fixed cost increases to Rs. 7,000.
- b) Selling price per unit reduced to Rs. 1.50.
- c) Rs. 2,000 minimum additional profit is required for additional fixed cost of Rs. 1,000.
- d) Extra profit is also required and this is put at Rs. 1,000.

The new P/V ratio is  $\frac{3,000}{15,000} = 20\%$