COST VOLUME PROFIT ANALYSIS

This section is going to deal with sales, expenses and profits of an enterprise. Profits of an enterprise are affected by many factors. The purpose of Cost volume profit analysis (CVP) is to study all the factors and help in making decisions to improve profits for the company.

Key factors influencing profits are:
1. Selling prices
2. Volume of sales
3. Variable cost
4. Fixed cost

The purpose of this chapter is to analyze relationship among the above-mentioned factors in such a way that we can estimate change in profits with change in any of the above factors.

CVP analysis finds out the relationship between sales, expenses and profits.

Let us first understand the basic structure to analyze financial information. Then we will move towards techniques of CVP analysis.

**HYPOTHETICAL EXAMPLE:**

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>SALES</td>
<td>100,000</td>
</tr>
<tr>
<td>LESS: VARIABLE COST</td>
<td>40,000</td>
</tr>
<tr>
<td>CONTRIBUTION</td>
<td>60,000</td>
</tr>
<tr>
<td>LESS: FIXED COST</td>
<td>20,000</td>
</tr>
</tbody>
</table>
EARNING BEFORE INTEREST AND TAXES (EBIT)  

40,000

LESS: INTEREST  

3000

EARNING AFTER INTEREST BEFORE TAXES  

37,000

LESS: TAXES  

3700

EARNING AFTER TAX/ PROFIT AFTER TAX  

33,300

DIVIDENDS  

33,300

The above example shows the entire structure, which is used to calculate overall financial performance of a company from different dimensions. We will break down the entire chain into different parts and analyze each part to understand micro-performance of the enterprise.

A total of 3 techniques are used for making management decisions regarding performance of the company:

1. Contribution margin concept
2. Break even analysis
3. Profit volume analysis

In 2016 RBI PHASE 2, one question was asked from break-even analysis. We expect RBI to get into further details in this topic next year. This is the reason that we are going to cover all 3 techniques related to CVP analysis.
CONTRIBUTION MARGIN CONCEPT:

Contribution margin shows the relationship between sales and contribution of the enterprise. Contribution margin helps us understand two important things:

1. The ratio of variable cost to sales- There is always a direct relation and constant ratio between sales and variable cost. For example, a question may say that variable costs are 40% of sales. This means that as sales increase, variable cost will also increase proportionately due to a direct relation between the two. So if sales are 1 lakh, variable cost will be 40,000 and if sales are increased to 2 lakh, variable cost will increase proportionately to 80,000. Contribution margin helps us to understand this ratio and decide whether the company has very high variable costs or not.

2. The level of fixed costs- fixed costs are costs which remain fixed, no matter what is the level of sales. Contribution margin to fixed cost comparison helps us to understand whether contribution provided by a company is enough to cover fixed costs or not. If not, then what level of sales will be required to cover at least fixed costs.

The formula for contribution margin ratio (or PV Ratio) is:

\[
\frac{(SALES - VARIABLE\ COST)}{SALES}
\]

For example,

<table>
<thead>
<tr>
<th>PRODUCTION OF 10000 UNITS</th>
<th>PRODUCTION OF 14000 UNITS</th>
</tr>
</thead>
<tbody>
<tr>
<td>SALES</td>
<td>10,00,000</td>
</tr>
<tr>
<td>LESS: VC (60%)</td>
<td>600,000</td>
</tr>
<tr>
<td>CONTRIBUTION</td>
<td>400,000</td>
</tr>
<tr>
<td>LESS: FC</td>
<td>200,000</td>
</tr>
<tr>
<td>EBIT</td>
<td>200,000</td>
</tr>
</tbody>
</table>

As can be seen, EBIT increased from 200,000 to 3,60,000 as sales increased from 10,000 to 14,000 units. With an increase in sales of 40%, profits should also have increased by 40% but they increased more due to constant fixed cost.
It is also important to remember that fixed cost remain constant till the time production is within 100% capacity of the company. The moment it goes above its full capacity, additional fixed assets have to be purchased for production.

In the above question, contribution margin ratio is calculated as:

\[
\text{Sales} - \text{VC}/\text{sales} = 10,00,000 - 600,000/10,00,000 = 40\%
\]

PV Ratio helps us to decide whether to increase sales or not. In the above example, an increase in sales turned profitable for the company as it was operating at below 100% capacity and had the potential to produce more profits for the company.

A low PV ratio (less contribution margin) is a sign that variable costs are too high and need to be reduced in order to increase profits. It is a warning sign of very high costs of production.

**BREAK EVEN ANALYSIS:**

Break-even analysis aims to tell us the level at which cost and revenue are in equilibrium.

Break-even point is the point of production or sales at which there is no profit and no loss. At a point above break-even point, the enterprise experiences profit and if the company produces less than break-even sales, it experiences loss.

At the break-even point, profit being zero, contribution (sales – variable cost) is equal to fixed cost. In other words, the break-even point is that point where the company is able to cover its fixed costs completely.

For example,

Selling price per unit = Rs. 20
Variable cost per unit = Rs. 10
Total fixed cost = Rs. 100,000

Let us make the chart for the above:

<table>
<thead>
<tr>
<th>SALES (20 * X)</th>
<th>200,000</th>
</tr>
</thead>
<tbody>
<tr>
<td>LESS: VC (10 * X)</td>
<td>100,000</td>
</tr>
<tr>
<td>CONTRIBUTION (10* X)</td>
<td>100,000</td>
</tr>
<tr>
<td>LESS: FIXED COST</td>
<td>100,000</td>
</tr>
<tr>
<td>EBIT</td>
<td>NIL</td>
</tr>
</tbody>
</table>

Since, it is break-even point, so EBIT or operating profits will be ZERO.

We have to find the level of sales where break-even point is achieved. By using the above chart, we find out the level of sales as Rs. 200,000 with 10,000 units of Rs. 20 each.

If the company sells more than 10,000 units, it will make profits. You can justify this by keeping a figure of 11000 units in sales.

BREAK EVEN POINT/ SALES FORMULA:

- Break even point = fixed costs/ contribution margin per unit
- Break even sales = fixed costs / PV ratio

You can verify the above answer of 10,000 units and Rs 200,000 sales by using the above-mentioned formulas.
MARGIN OF SAFETY:
The difference between sales and break-even point is called as margin of safety. The margin determines safety for the enterprise. A company with fewer margins is on the verge of going into losses, if its production or sales reduces. On the other hand, a company with higher margins is safe against running into losses.

The margin of safety can be found out by using the following formula:

1. Margin of safety = Profit / PV ratio
2. Margin of safety = profit * sales / sales – VC

ANGLE OF INCIDENCE:
The angle at which sales are equal to total costs is called angle of incidence. In the above CHART, it is clear that the break-even point is at 10,000 units. The angle made by income line and total cost line at the break-even point is what is called as angle of incidence.
A large angle of incidence is preferable by the enterprise as it shows that profits increase faster after reaching break even point. A small angle of incidence shows that variable cost forms a larger part of total cost, reducing the gap between income and cost line.

The third concept, PROFIT VOLUME ANALYSIS has been studied partially through profit-volume ratio / contribution margin ratio. A detailed study of this concept is not required.

**COST INDIFFERENCE POINT:**
Cost indifference point refers to that level of output where the total cost or the profit of two alternatives is equal. When two or more alternative methods of production are considered, and the use of one machine involves higher fixed cost and lower variable cost while use of another machine involves lower fixed cost and higher variable cost, cost indifference point will help in identifying the alternative which is more profitable for a given output. When sales are below the point of cost indifference, the machine with lower fixed cost will be more profitable.

Cost Indifference point = difference in fixed cost / difference in contribution per unit
Or,
Cost indifference point = difference in fixed cost / difference in PV ratio
Let us solve some questions to understand what kind of questions may be asked in the examination:

1. The selling price per Television is Rs. 100. Variable cost per TV is Rs 50. The maximum capacity of the plant is 2000 TVs. Fixed cost is provide to us as Rs. 50,000. Find out the break event sales for the company. Also, find out the number of TVs, which need to be sold to get a profit of Rs. 50,000

Answer:
BES = Fixed cost / PV ratio;
BES = 50,000 / 0.5 = 100,000 rupees

Sales for desired profit = fixed cost + profit / contribution per unit
100,000 / 50 = 2000 units or sales of Rs 200,000

NOTE that this question can also be solved by taking help of the structure that we have created on first page. Even if you fail to remember the formulas, it's not impossible to solve these kind of questions.

2. Break even point of a machine is given as 5000 units. Fixed cost is provided to us as Rs. 60,000. The variable cost is given as Rs 12. Find out the profit for the company at a production and sale of 10,000 units.

Answer:
At 5000 units production, there is no profit no loss. Therefore, at this level of production, contribution is equal to fixed cost i.e. 60,000 rupees. Variable cost is also Rs 60,000 (12 * 5000). Therefore, sales at break even point is 1,20,000 rupees with per unit sale price being Rs 24 (1,20,000/ 5000).
At sale units of 10,000 units, total sales is equal to 240,000 rupees. Now, using the structure created to solve such questions, we get contribution as 1,20,000 and fixed cost is limited at 60,000. The profit at this level is Rs. 60,000.

IMPORTANT FORMULAS:
• P/V RATIO = Change in Profit/ Change in Sales
• CONTRIBUTION = sales * P/V ratio
• Contribution = (sales at Break even point in Rs * PV ratio) + Profit
• Contribution = (sales at Break even point in units * contribution per unit) + Profit
• Contribution = (margin of safety * PV ratio) + Fixed cost
• Contribution = Profit/ margin of safety in %
• Sales for a desired profit = (Fixed Cost + desired profit) / PV Ratio
• Margin of Safety = Actual Sales – breakeven point
• Profit = Margin of Safety * PV ratio
• Profit = actual sales * M/ S ratio * PV ratio
• Fixed Cost = sales at Break Even Point in Rs. * PV ratio
• PV Ratio = change in profit * 100 / change in sales

Practice Questions:

1. Calculate break even point from the following information:
   Selling price per unit of a product is given as Rs. 10. Variable cost of the product is Rs. 7.50 per unit. The fixed cost is given as Rs 10,000.

   Answer:
   Contribution per unit = Rs 2.50
   Fixed cost = Rs 10,000
   Break even point = fixed cost / contribution per unit = 10,000/2.50 = 4000 units

2. The selling price of a product is given as Rs. 20 per unit. The variable cost is Rs 14 per unit. The fixed costs are Rs. 792000. Find out Break even sales and number of units that must be sold to earn a profit of Rs 60,000.
Answer:

Contribution per unit = 20 - 14 = 6 per unit.

PV ratio = contribution / sales = \( \frac{6}{20} \times 100 = 30\% \)

Break even sales = fixed cost / PV ratio = \( \frac{792000}{30\%} \times 100 = 2640000 \)

Units to be sold to earn a profit of Rs 60,000 =

Fixed cost + desired profit / contribution per unit = \( \frac{852000}{6} = 142000 \) units

3. Fill in the blanks:

<table>
<thead>
<tr>
<th>Selling price per unit</th>
<th>-------</th>
</tr>
</thead>
<tbody>
<tr>
<td>Variable cost as a% of sales</td>
<td>60%</td>
</tr>
<tr>
<td>Number of units sold</td>
<td>10000</td>
</tr>
<tr>
<td>Contribution</td>
<td>Rs 20,000</td>
</tr>
<tr>
<td>Fixed cost</td>
<td>Rs 12,000</td>
</tr>
<tr>
<td>Profit</td>
<td>-------</td>
</tr>
</tbody>
</table>

Answer:

(Profit = 8000; selling price per unit = Rs 5)

4. A company has a PV ratio of 40%. By what percentage must sales be increased to offset a 10% reduction in selling price?

Answer:

Let sales be (100*1) = Rs 100

Contribution will be Rs 40 (40% PV ratio) and Variable cost will be Rs 60

When selling price reduces by 10%, new sales = Rs 90

But variable cost will remain the same i.e. Rs 60

Therefore, new contribution is Rs 30

Volume of sales required to maintain the same sales =

Contribution * new sales / new contribution = \( \frac{40 \times 90}{30} = 120 \)
5. A company has sales of Rs 140,000 and variable cost of Rs 75,000. The fixed cost is given as Rs 50,000. Find out the required sales to get a profit of Rs 30,000.
   (Answer: Rs. 160,000)

6. | | Sales | Profit |
---|---|---|---|
| **Year 2004** | Rs 120,000 | 8000 |
| **Year 2005** | Rs 140,000 | 13,000 |

Find out the following:
   a. PV ratio
   b. BEP point in 2004 and 2005
   c. Profit when sales are Rs 180,000
   d. Margin of safety in 2005

(Answer: PV Ratio = change in profit * 100 / change in sales = 25%;
   BEP in 2004 = 88000 rupees; BEP in 2005 = 88000 rupees;
   Profit = 23000;
   Margin of safety = 52000)

7. A company sold in 2 consecutive periods 7000 units and 9000 units and incurred a loss of 10,000 rupees in year 1 and profit of 10,000 in year 2. The selling price per unit is Rs 100. Find out the PV ratio and number of units to break even
   (Answer: PV ratio= 10%; number of units to break even = 8000 units)

8. Find out fixed cost and PV ratio from the following information:

| | Total sales | Total cost (fixed + variable) |
---|---|---|

<table>
<thead>
<tr>
<th>Year 1</th>
<th>7000</th>
<th>5800</th>
</tr>
</thead>
<tbody>
<tr>
<td>Year 2</td>
<td>9000</td>
<td>6600</td>
</tr>
</tbody>
</table>

(Answer: PV ratio = 60%; fixed cost = 3000)

9. Find out fixed cost and PV ratio from the following information:

<table>
<thead>
<tr>
<th>sales</th>
<th>Total cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Year 1</td>
<td>2400,000</td>
</tr>
<tr>
<td>Year 2</td>
<td>30,00000</td>
</tr>
</tbody>
</table>

(Answer: PV ratio = 30%; fixed cost = 10,00000)

10. If margin of safety is Rs. 2,40,000 (40% of sales) and PV ratio is 30%. Calculate its break even sales and amount of profit on sales of Rs. 900,000
(Answer: break even sales = 3,60,000; profit on sales of 900,000 = 162,000)

11. A company earned a profit of Rs 30,000 during a financial year. If the variable cost and selling price of the product are Rs 8 and Rs 10 per unit respectively, find out the amount of margin of safety
(Answer: MOS= Rs. 150,000)

12. Fixed cost is given as Rs 4000. Break even sales are given as Rs 20,000. Profit is Rs 1000. Calculate sales for earning a profit of Rs 1000?
(Answer: sales = Rs 25000)

13. Selling price per unit is given as Rs 20/ unit. Variable cost is Rs. 12. fixed cost is given as Rs 96000. Find out break even units and break even sales.
(Answer: BEP = 12000 units. BES = Rs 240,000)

14.
<table>
<thead>
<tr>
<th>Year</th>
<th>Sales</th>
<th>Profit</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>20,00,000</td>
<td>2,00,000</td>
</tr>
<tr>
<td>2</td>
<td>30,00,000</td>
<td>4,00,000</td>
</tr>
</tbody>
</table>

Find out PV ratio and sales required to earn a profit of Rs 500,000
(Answer: PV ratio = 20%; sales for profit of 5 lakh = 3500,000)

15. A company has a fixed cost of Rs 20,000. It sells two products - A and B, in the ratio of 2 units of A and 1 unit of B. contribution is Rs 1 per unit of A and Rs 2 per unit of B. how many units of A and B would be sold at break even point?
(Answer: A = 10,000 units; B = 5000 units)