



RAMA UNIVERSITY

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Lecture-11



Marginal Costing and Profit Planning

Marginal Costing and Profit Planning

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Objectives

After studying this Chapter, you will be able to:

- Define absorption costing
- Compute marginal costing and CVP analysis
- Illustrate break-even analysis
- Know the use of cost data in decision making

Introduction

It is one of the premier tools of management not only to take decisions but also to fix an appropriate price and to assess the level of profitability of the products/services. This is a only costing tool demarcates the fixed cost from the variable cost of the product/service in order to guide the firm to know the minimal point of sales to equate the cost of production. It is a tool of analysis highlighting the relationship in between the cost, volume of sales and profitability of the firm.

11.1 Absorption Costing

Absorption costing technique is also known by other names as “Full costing” or “Traditional costing”. According to this technique, all costs are recognised or identified with the products manufactured. Both fixed and variable costs of each product manufactured are taken into account to ascertain the total cost.

According to author, the absorption costing tells as to how much fixed cost is absorbed besides the variable cost by each product manufactured. According to this technique, while the variable costs are directly charged to each Chapter of the goods produced, the fixed costs are distributed to each category of product manufactured by the same firm. In absorption costing, “Fixed cost” will also be taken into account in ascertaining the profit on sale.

This technique is called traditional costing, as this system of costing emerged from the beginning of the factory stage. In this technique, “fixed cost” refers to the closing stock of material held by the firm. These are charged against the sales later, as a part of the goods sold.

The traditional technique popularly known as total cost or absorption costing technique does not make any difference between fixed and variable cost in the calculation of profit.



Note Absorption costing can be calculated by the following ways:

Sales Revenue		xxxxx
Less: Absorption Cost of Sales		
Opening Stock (Valued @ absorption cost)	xxxx	
Add: Production Cost (Valued @ absorption cost)	xxxx	
Total Production Cost	xxxx	
Less: Closing Stock (Valued @ absorption cost)	<u>(xxx)</u>	
Absorption Cost of Production	xxxx	
Add: Selling, Admin & Distribution Cost	xxxx	
Absorption Cost of Sales		(xxxx)
Un-Adjusted Profit		xxxxx
Fixed Production O/H absorbed	xxxx	
Fixed Production O/H incurred	(xxxx)	
(Under)/Over Absorption		xxxxx
Adjusted Profit		xxxxx

Limitations of Absorption Costing

The following are the limitations of absorption costing:

1. In absorption costing, a portion of fixed cost is carried over to the subsequent accounting period as part of closing stock which is an unsound practice because costs pertaining to a period should not be allowed to be vitiated by the inclusion of costs pertaining to the previous period and vice-versa.

- Absorption costing is dependent on the levels of output which may vary from period to period, and consequently cost per Chapter changes due to the existence of fixed overhead. Unless fixed overhead rate is based on normal capacity, such changed costs are not helpful for the purposes of comparison and control.
- The cost to produce an extra Chapter is variable production cost. It is realistic to the value of closing stock items as this is a directly attributable cost. The size of total contribution varies directly with sales volume at a constant rate per Chapter. For the decision-making purpose of management, better information about expected profit is obtained from the use of variable costs and contribution approach in the accounting system.

Self Assessment

Fill in the blanks:

- Absorption costing technique is also known by other names as "Full costing" or
- According to author, the absorption costing tells as to how much is absorbed besides the variable cost by each product manufactured.

11.2 Marginal Costing

According to ICMA, London, "Marginal cost is the amount at any given volume of output, by which aggregate costs are charged, if the volume of output is increased or decreased by one Chapter."

Marginal cost is the cost nothing but a change occurred in the total cost due to changes taken place on the level of production i.e either an increase/decrease by one Chapter of product.



Example: The firm XYZ Ltd. incurs ₹ 1000 for the production of 100 Chapters at one level of operation. By increasing only one Chapter of product i.e. 101 Chapters, the firm's total cost of production amounted ₹ 1010.

Total cost of production at first instance (C') = ₹ 1000

Total cost of production at second instance (C'') = ₹ 1010

Total number of Chapters during the first instance (U') = 100

Total number of Chapters during the second instance (U'') = 101

Increase in the level of production and Cost of production:

Change in the level of production in Chapters = U'' - U' = 1

Change in the total cost of production = C'' - C' = ₹ 10

$$\text{Marginal Cost} = \frac{\text{Change (Increase) in the Total Cost of Production}}{\text{Change (Increase) in the Level of Production}} = \frac{₹ 10}{1} = ₹ 10$$

If the same firm reduces the total volume from 100 Chapters to 99 Chapters, the total cost of production

5. ₹ 990/-

Decrease in the level of production and cost of production:

$$\text{Marginal Cost} = \frac{\text{Change (Increase) in the Total Cost of Production}}{\text{Change (Increase) in the Level of Production}} = \frac{₹ 10}{1} = ₹ 10$$

Notes



Did u know? Why marginal cost is called as incremental cost?

From the above example, it is obviously understood that marginal cost is nothing but a cost which incorporates the incremental changes in the cost of production due to either an increase or decrease in the level of production by one Chapter, meant as incremental cost.

From the following classifications of cost, the inter twined relationship in between the variable cost and marginal cost is explained as below:

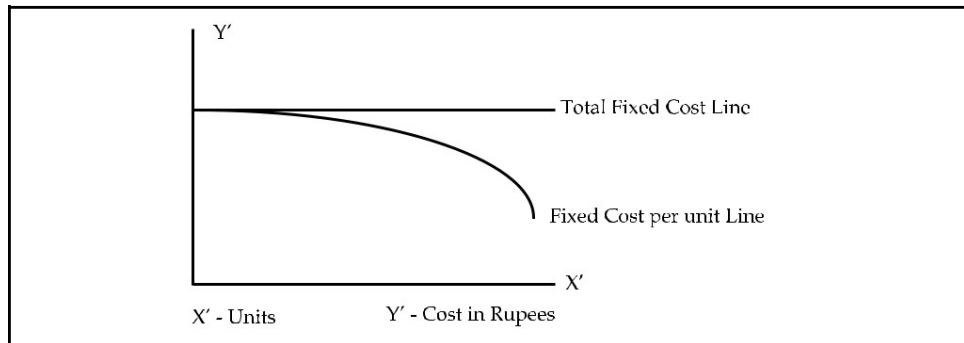
Table 11.1: Statement of Fixed, Variable and Total Costs per Chapter

S. No.	Chapters	Fixed Cost (₹)	Fixed Cost per Chapter (₹)	Variable Cost (₹)	Variable Cost per Chapter (₹)	Marginal Cost (₹) $\Delta C/\Delta U$	Total Cost (₹)
1.	1	500	500	10	10	10	510
2.	50	500	100	500	10	10	1000
3.	100	500	5	1000	10	10	1500
4.	150	500	3.333	1500	10	10	2000

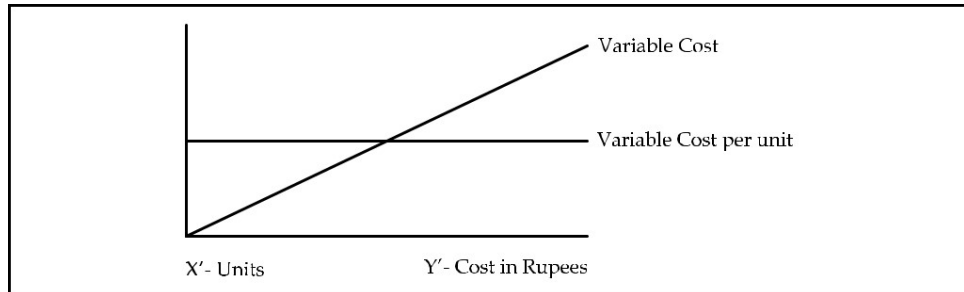
Fixed Cost: It is a cost remains constant or fixed irrespective level of production.



Example: Rent ` 500 is to be paid irrespective level of production. It remains constant/ fixed irrespective of changes taken place on the level of production.



Variable cost: It is a cost, which varies with level of production.



The following are the various components of variable cost:

6. **Direct Materials:** Materials cost consumed for the production of goods.
7. **Direct Labour:** Wages paid to the labourers who directly involved in the production of goods.
8. **Direct Expenses:** Other expenses directly involved in the production stream.
9. **Variable portion of Overheads:** Generally the overheads can be classified into two categories, viz. Variable overheads and Fixed overheads.

The variable overhead is the cost involved in the procurement of indirect materials, indirect labour and indirect expenses.

Indirect Material – Cost of fuel, oil and so on

Indirect Labour – Wages paid to workers for maintenance of the firm.

From the Table 11.1 the marginal cost is equivalent to the variable cost per Chapter of the various levels of production. The fixed cost of ₹ 500 is the cost remains the same at not only irrespective levels of production but also already absorbed at the initial level of production. The initial absorption of fixed overhead led the marginal cost to become as variable cost.

Semi-variable cost: Another major classification is semi variable/fixed cost which is a cost partly fixed/variable to the certain level of production or consumption, e.g. Electricity charges, telephone charges and so on.

It jointly discards the importance of the fixed cost and the semi- variable cost for analysis while ascertaining the marginal cost.

Marginal Costing is defined as “the ascertainment of marginal cost and of the effect on profit of changes in volume or type of output by differentiating between fixed and variable costs.”



Caution In marginal costing, the change in the level of cost of operation is equivalent to variable cost due to fixed cost component which is fixed irrespective level of outputs.



Example: The following figures are extracted from the books of KSBS Ltd. Find out profit by using marginal costing and absorption costing. Is there any variations in the results obtained under the two methods is given below?

The basic production data are:

Normal volume of production = 19,500 Chapters per period

Sale price – ₹ 4 per Chapter

Variable cost – ₹ 2 per Chapter

Fixed cost – ₹ 1 per Chapter

Total fixed cost = ₹ 19,500 (₹ 1 × 19,500 Chapters, normal)

Selling and distribution costs have been omitted. The opening and closing stocks consist of both finished goods and equivalent Chapters of work-in-progress.

Notes

Other Informations:

	Period I	Period II	Period III	Period IV	Total
Opening stock Chapters	–	–	4,500	1,500	–
Production Chapters	19,500	22,500	18,000	22,500	82,500
Sales Chapters	19,500	18,000	21,000	24,000	82,500
Closing stock Chapters	–	4,500	1,500	–	–

Solution:

Marginal Costing Method

	Period I	Period II	Period III	Period IV	Total
Sales	78,000	72,000	84,000	96,000	3,30,000
Direct cost:					
Opening stock @ ` 2 per Chapter	–	–	9,000	3,000	–
Variable cost:					
@ ` 2 per Chapter	39,000	45,000	36,000	45,000	1,65,000
Closing stock:					
@ ` 2 per Chapter	–	9,000	3,000	–	–
Cost of goods sold	39,000	36,000	42,000	48,000	1,65,000
Contribution	39,000	36,000	42,000	48,000	1,65,000
Fixed cost	19,500	19,500	19,500	19,500	78,000
Profit	19,500	16,500	22,500	28,500	87,000

Absorption Costing Method

Sales	78,000	72,000	84,000	96,000	3,30,000
Opening stock @ ` 3 per Chapter	–	–	13,500	4,500	–
Cost of production @ ` 3 per Chapter	58,500	67,500	54,000	67,500	2,47,500
Less: Cost of closing stock @ ` 3 per Chapter	–	13,500	4,500	–	–
Cost of sales (actual)	58,500	54,000	63,000	72,000	2,47,500
Less: Over-absorbed fixed cost		3,000		3,000	6,000
Add: Under-absorbed fixed cost		–	1,500	–	1,500
Profit	19,500	21,000	19,500	27,000	87,000

The relationship shown above may be summarized as follows:

10. When output is equal to sales i.e., with no opening or closing stock, the profit under absorption costing and marginal costing is equal.
11. When output is less than sales i.e., closing stock is less than opening stock, the profit under marginal costing is greater than the profit under absorption costing.
12. When output is greater than sales i.e., closing stock is more than the opening stock, the profit under the marginal costing is less than the profit under absorption costing.

Self Assessment

Fill in the blanks:

13. is the cost nothing but a change occurred in the total cost due to changes taken place on the level of production.

4. The is the cost involved in the procurement of indirect materials, indirect labour and indirect expenses.
14. The initial absorption of led the marginal cost to become as variable cost.

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11.3 Costs-Volume Profit Analysis

The Cost-Volume-Profit (CVP) analysis helps management in finding out the relationship of costs and revenues to profit. The aim of an undertaking is to earn profit. Profit depends upon a large number of factors, the most important of which are the costs of the manufacturer and the volume of sales effected. Both these factors are interdependent – volume of sales depends upon the volume of production, which in turn is related to costs. Cost again is the result of the operation of a number of varying factors such as:

15. Volume of production,
16. Product mix,
17. Internal efficiency,
18. Methods of production,
19. Size of plant, etc.

Of all these, volume is perhaps the largest single factor which influences costs which can basically be divided into fixed costs and variable costs. Volume changes in a business are a frequent occurrence, often necessitated by outside factors over which management has no control and as costs do not always vary in proportion to changes in levels of output, management control of the factors of volume presents a peculiar problem.

As profits are affected by the interplay of costs and volume, the management must have, at its disposal, an analysis that can allow for a reasonably accurate presentation of the effect of a change in any of these factors which would have no profit performance. Cost-volume-profit analysis furnishes a picture of the profit at various levels of activity. This enables management to distinguish between the effect of sales volume fluctuations and the results of price or cost changes upon profits. This analysis helps in understanding the behaviour of profits in relation to output and sales.

Fixed costs would be the same for any designated period regardless of the volume of output accomplished during the period (provided the output is within the present limits of capacity). These costs are prescribed by contract or are incurred in order to ensure the existence of an operating organisation. Their inflexibility is maintained within the framework of a given combination of resources and within each capacity stage such costs remain fixed regardless of the changes in the volume of actual production. As fixed costs do not change with production, the amount per Chapter declines as output rises.

Absorption or full costing system seeks to allocate fixed costs to products. It creates the problem of apportionment and allocation of such costs to various products. By their very nature, fixed costs have little relation to the volume of production.

Variable costs are related to the activity itself. The amount per Chapter remains the same. These costs expand or contract as the activity rises or falls. Within a given time span, distinction has to be drawn between costs that are free of ups and downs of production and those that vary directly with these changes.

Study of behaviour of costs and CVP relationship needs proper definition of volume or activity. Volume is usually expressed in terms of sales capacity expressed as a percentage of maximum sales, volume of sales, Chapter of sales, etc. Production capacity is expressed as a percentage of maximum production, production in revenue of physical terms, direct labour hours or machine hours.

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Analysis of cost-volume-profit involves consideration of the interplay of the following factors:

- 20. Volume of sales
- 21. Selling price
- 22. Product mix of sales
- 23. Variable cost per Chapter
- 24. Total fixed costs

The relationship between two or more of these factors may be (a) presented in the form of reports and statements, (b) shown in charts or graphs, or (c) established in the form of mathematical deduction.

11.3.1 Objectives of Cost-Volume-Profit Analysis

The objectives of cost-volume-profit analysis are given below:

- 25. In order to forecast profit accurately, it is essential to know the relationship between profits and costs on the one hand and volume on the other.
- 26. Cost-volume-profit analysis is useful in setting up flexible budgets which indicate costs at various levels of activity.
- 27. Cost-volume-profit analysis is of assistance in performance evaluation for the purpose of control. For reviewing profits achieved and costs incurred, the effects on cost of changes in volume are required to be evaluated.
- 28. Pricing plays an important part in stabilising and fixing up volume. Analysis of cost-volume-profit relationship may assist in formulating price policies to suit particular circumstances by projecting the effect which different price structures have on costs and profits.
- 29. As predetermined overhead rates are related to a selected volume of production, study of cost-volume relationship is necessary in order to know the amount of overhead costs which could be charged to product costs at various levels of operation.

11.3.2 Profit-Volume (P/V) Ratio

The ratio or percentage of contribution margin to sales is known as P/V ratio. This ratio is known as marginal income ratio, contribution to sales ratio or variable profit ratio. P/V ratio, usually expressed as a percentage, is the rate at which profits increase with the increase in volume. The formulae for P/V ratio are:

$$\text{P/V ratio} = \text{Marginal contribution/Sales}$$

Or

$$\text{Sales value} - \text{Variable cost/Sales value}$$

Or

$$1 - \text{Variable cost/Sales value}$$

Or

$$\text{Fixed cost} + \text{Profit/Sales value}$$

Or

$$\text{Change in Profits/Contributions/Changes}$$

A comparison for P/V ratios of different products can be made to find out which product is more profitable. Higher the P/V ratio more will be the profit and lower the P/V ratio, lesser will be the profit. P/V ratio can be improved by:

1. Increasing the selling price per Chapter.
2. Reducing direct and variable costs by effectively utilising men, machines and materials.
3. Switching the product to more profitable terms by showing a higher P/V ratio.



Caselet

Cost-Volume-Profit Analysis

N. R. Parasuraman

ONE issue of paramount interest to management is the impact of costs and volume on profits. If a linear relationship could be established among costs, volume and profits, it would help decision-makers to figure out the right volume, the right cost and consequently the right profit.

That profit is the difference between sales turnover (in value) and cost is common knowledge. Sales turnover equals sale price per Chapter multiplied by the number of Chapters. This means that sales turnover goes up with higher volume and comes down with lower volume. One also knows intuitively that total cost rises with higher volume and falls with lower volume, but the extent of this movement is not known. Under the cost-volume-profit analysis (CVP analysis), given the cost pattern, the impact of costs on profits for various volumes, as also of volumes on profits, is studied.

The analysis would be easier if the cost can be segregated into fixed and variable. In fact, the basic tenet of CVP analysis is to split the cost into variable, which varies with volume, and fixed, which remains constant regardless of the volume. Let us assume that such a division of costs is easily possible. And it may be noted that even when such an absolute segregation is not possible, there are statistical tools which enable the analyst to do so with a fairly high degree of accuracy.

Consider the following example:

A firm sells its products at ` 10 per Chapter. The variable cost per Chapter is ` 6. And regardless of the volume, the firm has to spend ` 50,000 on other expenses (fixed expenses). In this case, the profit chart of the firm for various volumes can be analysed as follows:

Sale price per Chapter - ` 10

Variable cost per Chapter - ` 6

Contribution per Chapter - ` 4 ($10 - 6$)

No. of Chapters required to meet fixed costs - $50,000 / 4 = 12,500$ Chapters

Here, the difference between the sales price per Chapter and the variable cost per Chapter is called the contribution per Chapter. This means that for every Chapter sold, ` 4 comes in as a contribution to meet fixed expenses. How many such Chapters will be needed to meet the fixed expenses completely? This can easily be computed as 12,500. So, in terms of Chapters, 12,500 Chapters are required to meet both the variable and the fixed costs. This is called the break-even point (BEP) in Chapters.

The relationship between contribution and sales can also be expressed as a ratio, which is called contribution margin. In the example, the contribution margin is $4/10$ or 0.4. The BEP

Contd...

Notes

in rupees can be found by dividing the fixed cost with the contribution margin. This will be ₹ 50,000/0.4 = ₹ 1,25,000.

Understanding the BEP concept enables one to take a number of strategic decisions.

The following is an illustrative list of the uses of CVP and BEP analyses:

Deciding on a level of sales to achieve a targeted profit: At the BEP of sales, there is neither profit nor loss. It means that the contribution (sales minus variable expenses) has just about covered the fixed expenses. This suggests that for sales beyond this point, the entire contribution will be profits because there is no more fixed expenses to meet. So, if a profit of, say, ₹ 1,00,000 is targeted in the illustration, all that is to be done is to sell additional units that will make the incremental contribution beyond meeting the fixed expenses as ₹ 1,00,000.

In other words, the new volume is targeted to cover not only the fixed expenses of ₹ 50,000, but also the profit of ₹ 1,00,000. So, dividing ₹ 1,50,000 by the contribution per Chapter of ₹ 4 gives us 37,500 Chapters. Thus, 37,500 Chapters will have to be manufactured to achieve a profit of ₹ 1,00,000.

The number of Chapters to be manufactured to achieve target profit = target profit plus fixed expenses divided by contribution per Chapter.

Determining the profit at a targeted level of sales: Similarly, if the management has targeted a level of sales on the basis of its market survey or otherwise, the profits that will emerge from that level of sales can be determined using CVP analysis. The contribution margin per Chapter multiplied by the number of Chapters produced over and above the BEP gives us this figure. Of course, profits can always be computed as the difference between sales and total cost. But what CVP analysis achieves is that incremental profits from selling additional Chapters can be easily calculated on the basis of the established relationship between cost and volume.

Determining the impact of additional fixed costs: If the fixed costs go up, the revised BEP can be computed. A no-profit, no-loss situation comes up only at the increased point now, consequent to the increased fixed costs. The entire structure of relationship between cost and volume will undergo a change consequent to this increase in fixed cost.

In real life, it may be difficult to segregate cost strictly into its fixed and variable elements. What can be attempted is to bring about as close a split as possible. The advantages of CVP analysis would far outweigh whatever difficulties one might face in segregation.

Source: thehindubusinessline.com

Self Assessment

Fill in the blanks:

31. Profit depends upon a large number of factors, the most important of which are the costs of the manufacturer and the effected.
32. The Cost-Volume-Profit (CVP) analysis helps management in finding out the relationship of to profit.
33. Cost-volume-profit analysis furnishes a picture of the at various levels of activity.
34. The ratio or percentage of contribution margin to sales is known as

11.4 Break-even Point

Break-even analysis examines the relationship between the total revenue, total costs and total profits of the firm at various levels of output. It is used to determine the sales volume required for the firm to break-even and the total profits and losses at other sales level. Break-even analysis is a method, as said by Dominick Salnatore, of revenue and total cost functions of the firm. According to Martz, Curry and Frank, a break-even analysis indicates at what level cost and revenue are in equilibrium.

In case of break-even analysis, the break-even point is of particular importance. Break-even point is that volume of sales where the firm breaks even i.e., the total costs equal total revenue. It is, therefore, a point where losses cease to occur while profits have not yet begun. That is, it is the point of zero profit.

The following are the key methods of computing BEP:

Break-even Point in Chapters

$$\text{BEP} = \frac{\text{Fixed Costs}}{\text{Selling price} - \text{Variable costs per Chapter}}$$

For Example,

$$\text{BEP} = \frac{\text{Fixed Costs } `10,000}{\text{Selling price } `5 \text{ per Chapter} - \text{Variable costs } `3 \text{ per Chapter}}$$

Therefore,

$$\text{BEP} = \frac{`10,000}{5 - 3} = 5,000 \text{ Chapters.}$$

The conclusion that can be drawn from the above example is that sales volume of 5000 Chapters will be the accurate point at which the manufacturing Chapter would not make any loss or profit.

Break-even Point (Sales Volume `)

Break-even point in sales can be found out by two methods.

35. Selling Price Method

36. PV Ratio Method

37. **Selling Price Method:** Under this method Break-even sales volume in rupees is found out through the product of Break-even Point in Chapters and selling price per Chapter.

$$\text{BEP (')} = \text{Break-even Point (Chapters)} \times \text{Selling price per Chapter}$$

38. **PV Ratio Method:** Under this method, break-even sales volume in rupees can be determined through the following ratio

$$\text{BEP (')} = \frac{\text{Fixed Cost}}{\text{PV ratio}}$$

where

$$\text{PV Ratio} = \frac{\text{Sales} - \text{Variable cost}}{\text{Sales}} = \frac{\text{Contribution}}{\text{Sales}}$$



Example: Calculate Break-even point `

Sales	6,00,000
Fixed Cost	1,50,000

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Variable Expenses

Direct Material	2,00,000
Direct Labour	1,20,000
Overhead Expenses	80,000

The first step is to find out the total volume of variable expenses.

$$\begin{aligned} \text{Variable Expenses} &= \text{Direct Material} + \text{Direct Labour} + \text{Overhead Expenses} \\ &= ₹ 2,00,000 + 1,20,000 + 80,000 = ₹ 4,00,000 \end{aligned}$$

The second step is to find out the contribution.

$$\begin{aligned} \text{Contribution} &= \text{Sales} - \text{Variable Expenses} \\ &= ₹ 6,00,000 - 4,00,000 = ₹ 2,00,000 \end{aligned}$$

The third step is to find out PV ratio.

$$\begin{aligned} \text{PV ratio} &= \text{Contribution} / \text{Sales} \\ &= ₹ 2,00,000 / ₹ 6,00,000 = 1/3 \end{aligned}$$

The final Step is to find out Break-even sales

$$\text{Break-Even Point (Rupees)} = \frac{\text{Fixed Cost}}{\text{PV ratio}} = \frac{₹ 1,50,000}{1/3} = ₹ 4,50,000$$



Note It is not possible to find out the break-even points in Chapters due to non-availability of selling price and variable cost per Chapter; this constrains the computation of contribution margin per Chapter.

11.4.1 Uses of Break-even Analysis

Break-even analysis is a very generalised approach for dealing with a wide variety of questions associated with profit planning and forecasting. Some of the important practical applications of break-even analysis are:

39. What happens to overall profitability when a new product is introduced?
40. What level of sales is needed to cover all costs and earn, say, ₹ 1,00,000 profit or a 12% rate of return?
41. What happens to revenues and costs if the price of one of a company's product is hanged?
42. What happens to overall profitability if a company purchases new capital equipment or incurs higher or lower fixed or variable costs?
43. Between two alternative investments, which one offers the greater margin of profit (safety)?
44. What are the revenue and cost implications of changing the process of production?
45. Should one make, buy or lease capital equipment?

11.4.2 Assumptions of Break-even Analysis

Notes

The break-even analysis is based on certain assumptions, namely:

46. All costs are either perfectly variable or absolutely fixed over the entire period of production but this assumption does not hold good in practice.
47. The volume of production and the volume of sales are equal; but in reality they differ.
48. All revenue is perfectly variable with the physical volume of production and this assumption is not valid.
49. The assumption of stable product mix is unrealistic.

11.4.3 Advantages of Break-even Analysis

The main advantages of using break-even analysis in managerial decision making can be the following:

50. It helps in determining the optimum level of output below which it would not be profitable for a firm to produce.
51. It helps in determining the target capacity for a firm to get the benefit of minimum Chapter cost of production.
52. With the help of the break-even analysis, the firm can determine minimum cost for a given level of output.
53. It helps the firms in deciding which products are to be produced and which are to be bought by the firm.
54. Plant expansion or contraction decisions are often based on the break-even analysis of the perceived situation.
55. Impact of changes in prices and costs on profits of the firm can also be analysed with the help of break-even technique.
56. Sometimes a management has to take decisions regarding dropping or adding a product to the product line. The break-even analysis comes very handy in such situations.
57. It evaluates the percentage financial yield from a project and thereby helps in the choice between various alternative projects.
58. The break-even analysis can be used in finding the selling price which would prove most profitable for the firm.
59. By finding out the break-even point, the break-even analysis helps in establishing the point wherefrom the firm can start payment of dividend to its shareholders.

11.4.4 Drawbacks of Break-even Analysis (BEA)

This analysis will be useful only in situations relatively stable and slow moving rather than volatile and erratic ones. In conditions when proper managerial accounting techniques and procedures are maintained, the BEA will be useful. In a particular period costs are affected not by the output of that period but due to past output or a preparation for future output. As such the BEA cannot pin down that cost is the result of output of a particular period. It is difficult to deal with selling costs under the framework of BEA because changes in selling costs are a

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cause to bring out changes in output and not the result of output sales. In the real world, perfect competition is very rare and as such it is necessary to make calculations at different time periods. The relationship between cost, revenue and volume (output) is realistic only over narrow ranges of output and for long ranges. If too many products and too many plants are grouped together in a productive process, the BEA cannot identify which is good or which is bad, since all are grouped together. The BEA assumes that profits are the result of output but ignores that other factors like technological changes, improved management and variations in the proportions of fixed factors are also possible for profits. In spite of these, BEA is an important tool in decision making.



Example: From the following information relating to quick standards Ltd., you are required to find out (i) PV ratio (ii) break-even point (iii) calculate the volume of sales to earn profit of ` 6,000/-

Total Fixed Costs	` 4,500
Total Variable Cost	` 7,500
Total Sales	` 15,000

Solution:

First step to find out the Contribution volume

Sales	` 15,000
Variable Cost	<u>` 7,500</u>
Contribution	` 7,500
Fixed Cost	<u>` 4,500</u>
Profit	<u>` 3,000</u>

1. Second step to determine the PV ratio

$$\text{PV ratio} = \frac{\text{Contribution}}{\text{Sales}} \times 100 = \frac{7,500}{15,000} \times 100 = 50\%$$

Third step to find out the Break-even sales

60. Break-even sales = $\frac{\text{Fixed cost}}{\text{PV ratio}} = \frac{4,500}{50\%} = 9,000$

61. Margin of safety can be found out in two ways

(a) Margin of Safety = Actual sales – Break-even sales
 = ` 15,000 – ` 9,000 = ` 6,000

(b) Margin of Safety = $\frac{\text{Profit}}{\text{PVratio}} = \frac{` 3,000}{50\%} = ` 6,000$

4. Sales required to earn profit = ` 6,000/-

To determine the sales volume to earn desired level of profit

$$= \frac{\text{Fixed Cost} + \text{Desired Profit}}{\text{PV ratio}}$$

62. $\frac{` 4,500 + ` 6,000}{50\%} = ` 21,000$



Did u know? What is margin of safety?

Margin of safety is the difference between the actual sales and sales at break-even point. Sales beyond break-even volume brings in profits. Such sales represent a margin of safety.

Margin of safety = Actual sales – Break-even Sales

$$= \frac{\text{Profit}}{\text{P/V ratio}}$$

$$\text{or} \quad = \frac{\text{Profit} \times \text{Selling Price per Chapter}}{\text{Selling Price per Chapter} - \text{Variable Cost Per Chapter}}$$

Self Assessment

Fill in the blanks:

63. Break-even analysis helps in determining the of output below which it would not be profitable for a firm to produce.
64. Break-even point is the point of
65. Break-even point is that volume of where the firm breaks even.

11.5 Use of Cost Data in Decision Making

The break-even analysis uses the cost data to make decisions. The following are the key methods used for break-even analysis:

66. Break-even Charts
67. Algebraic Method

11.5.1 Break-even Chart

The difference between Price and Average Variable Cost (P – AVC) is defined as ‘profit contribution’. That is, revenue on the sale of a Chapter of output after variable costs are covered represents a contribution toward profit. At low rates of output, the firm may be losing money because fixed costs have not yet been covered by the profit contribution. Thus, at these low rates of output, profit contribution is used to cover fixed costs. After fixed costs are covered, the firm will be earning a profit.

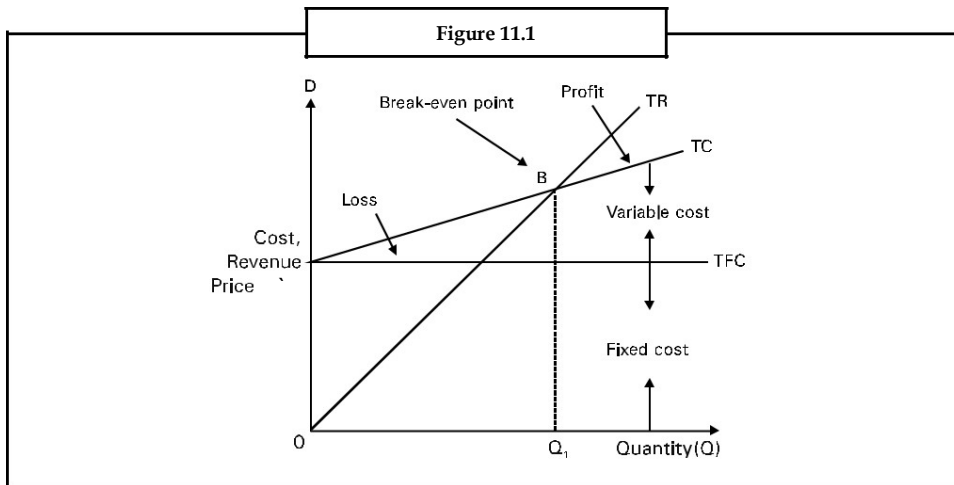
A manager may want to know the output rate necessary to cover all fixed costs and to earn a “required” profit of R. Assume that both price and variable cost per Chapter of output (AVC) are constant. Profit is equal to total revenue (P.Q.) less the sum of Total Variable Costs (Q.TVC) and fixed costs. Thus,

$$p_R = PQ - [(Q \cdot AVC) + FC]$$

$$p_R = TR - TC$$

The break-even chart shows the extent of profit or loss to the firm at different levels of activity. A break-even chart may be defined as an analysis in graphic form of the relationship of production and sales to profit. The Break-even analysis utilises a break-even chart in which the Total Revenue (TR) and the Total Cost (TC) curves are represented by straight lines, as in Figure 11.1.

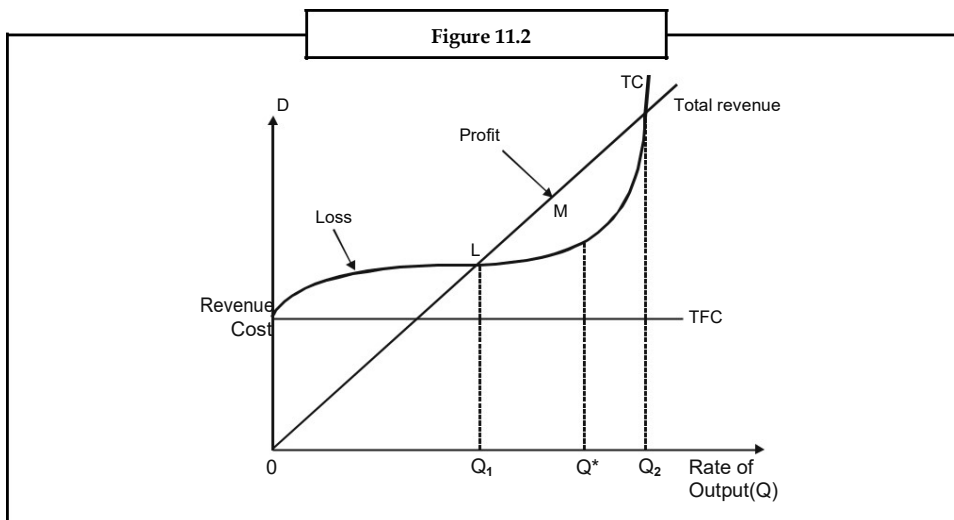
Notes



In the figure total revenues and total costs are plotted on the vertical axis whereas output or sales per time period are plotted on the horizontal axis. The slope of the TR curve refers to the constant price at which the firm can sell its output. The TC curve indicates Total Fixed Costs (TFC) (The vertical intercept) and a constant average variable cost (the slope of the TC curve). This is often the case for many firms for small changes in output or sales. The firm breaks even (with TR=TC) at Q_1 (point B in the figure) and incurs losses at smaller outputs while earnings profits at higher levels of output.

Both the Total Cost (TC) and Total Revenue (TR) curves are shown as linear. TR curve is linear as it is assumed that the price is given, irrespective of the output level. Linearity of TC curve results from the assumption of constant variable costs.

If the assumptions of constant price and average variable cost are relaxed, break-even analysis can still be applied, although the key relationship (total revenue and total cost) will not be linear functions of output. Nonlinear total revenue and cost functions are shown in Figure 11.2. The cost function is conventional in the sense that at first costs increase but less than in proportion to output and then increase more than in proportion to output. There are two break-even points – L and M. Note that profit which is the vertical distance between the total revenue and total cost functions, is maximised at output rate Q^* .

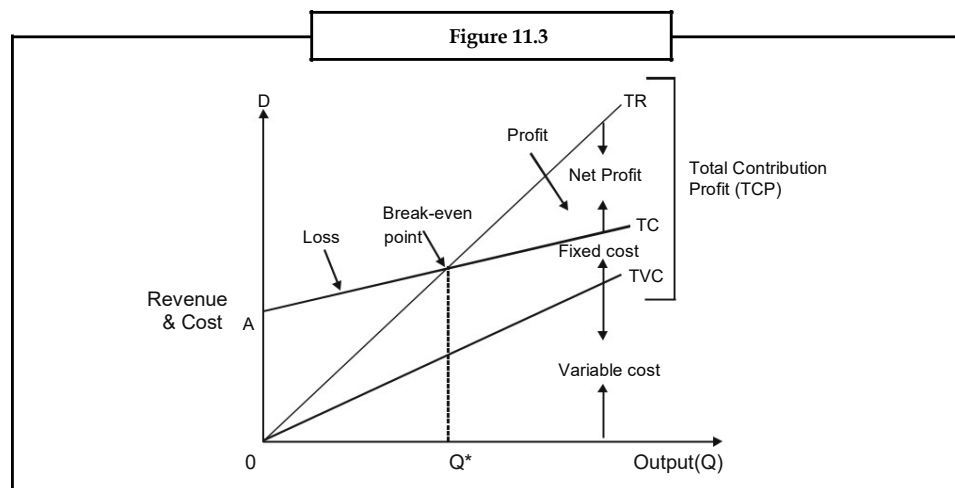


Of the two break-even points, only the first, corresponding to output rate Q_1 is relevant. When a firm begins production, management usually expects to incur losses. But it is important to know at what output rate the firm will go from a loss to a profit situation. In Figure 11.2 the firm would want to get to the break-even output rate Q_1 as soon as possible and then of course, move to the profit maximising rate Q^* . However, the firm would not expand production beyond Q^* because this would result in a reduction of profit.

Notes

Contribution Margin

In the short run, where many of the firm's costs are fixed, businessmen are often interested in determining the contribution additional sales make towards fixed costs and profits. Contribution analysis provides this information. Total contribution profit is defined as the difference between total revenues and total variable costs, which equals price less average variable cost on a per Chapter basis. Figure 11.3 highlights the meaning of contribution profit. Total contribution profit, it can be seen, is also equal to total net profit plus total fixed costs.



Contribution profit analysis provides a useful format for examining a variety of price and output decisions.

As is clear from Figure 11.3 Total Contribution Profit (TCP) = Total Revenue (TR) – Total Variable Cost (TVC)

$$= \text{Total Net Profit (TNP)} + \text{Total Fixed Cost (TFC)}$$

Therefore, if $TNP = 0$ then, $TCP = TFC$. This occurs at break-even point. From the above equation it is also clear that

$$TR = TCP + TVC$$

$$68. (TNP + TFC) + TVC$$

Total Contribution Profit (TCP)

$$69. TR - TVC$$

$$70. \text{Net Profit} + \text{Fixed Cost}$$



Example: From the following figures, ascertain the break-even sales and also show the computation by means of a graph.

Notes

	(₹)
Sales	20,00,000
Fixed Costs	5,00,000
Variable costs	12,00,000

Solution:

Total Contribution:	(₹)
Sales	20,00,000
Variable Cost	12,00,000
Contribution	8,00,000

As percentage of sales or P/V ratio = $\frac{8,00,000}{20,00,000} \times 100 = 40\%$

Alternatively: $(\text{Fixed Cost} + \text{Profit}) / \text{Sales} \times 100 = \frac{5,00,000 + 3,00,000}{20,00,000} \times 100 = 40\%$

Break-even sales:

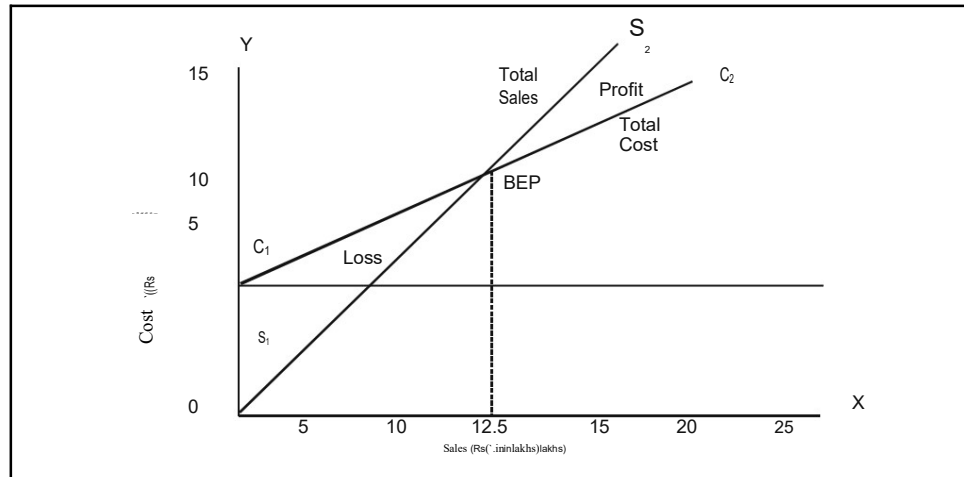
Fixed Costs/P/V Ratio i.e., $\frac{5,00,000}{40} = 12,50,000$

Proof: Variable Costs:	(₹)
60% of ₹ 12,50,000	7,50,000
Fixed Costs	5,00,000
Total Cost	12,50,000

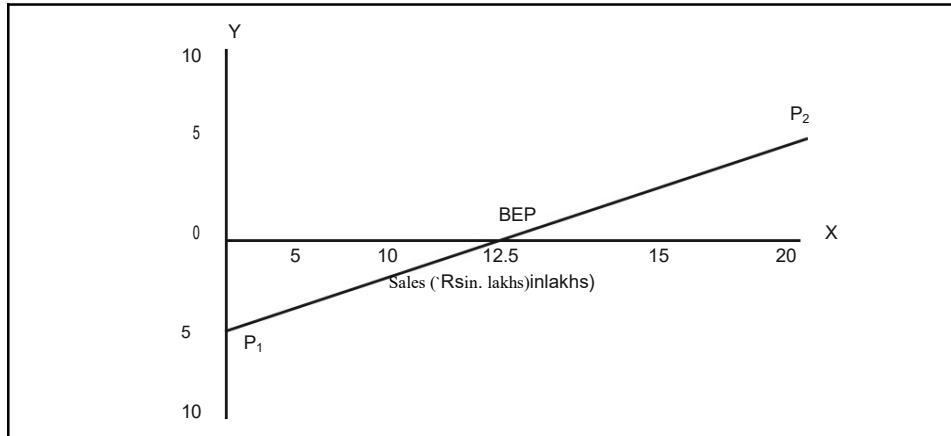
Total costs equal sales; hence there is neither profit nor loss.

Points plotted:

Break-even Chart			
Sales (₹)	Variable Costs (60% of sales)	Fixed Costs (₹)	Total Cost (₹)
0	0	5,00,000	5,00,000 (C ₁)
15,00,000	9,00,000	5,00,000	14,00,000 (C ₂)



Profit-Volume Chart: (At zero sale loss is ₹ 5 lakh; at ₹ 20,00,000 sales, profits is ₹ 3 lakh (P₂). Draw a line to join these two points. The break-even sale is at the point where it meets the X-axis).



11.5.2 Algebraic Method

Break-even analysis can also be performed algebraically, as follows. Total revenue is equal to the selling price (P) per Chapter times the quantity of output or sales (Q). That is

$$TR = (P) \cdot (Q)$$

Total costs equal total fixed costs plus Total Variable Costs (TVC). Since TVC is equal to the Average (per Chapter) Variable Cost (AVC) times the quantity of output or sales, we have

$$TC = TFC + TVC$$

or, $TC = TFC + (AVC) \cdot (Q)$

Setting total revenue equal to total costs and substituting Q_B (the break-even output) for Q, we have

$$TR = TC$$

$$(P) \cdot (Q_B) = TFC + (AVC) \cdot (Q_B)$$

Or, $TFC = P \cdot (Q_B) - (AVC) \cdot (Q_B)$

$$TFC = Q_B \cdot (P - AVC)$$

$$OB \text{ (the break-even output)} = \frac{TFC}{P - AVC} = \frac{TFC}{ACM}$$

The denominator in the above equation (i.e., P - AVC) is called the contribution margin per Chapter (ACM) because it represents the portion of the selling price that can be applied to cover the fixed costs of the firm and to provide for profits.



Task Break even sales	₹ 1,60,000
Sales for the year 2007	₹ 2,00,000
Profit for the year 2007	₹ 12,000

Calculate:

71. Profit or loss on a sale value of ₹ 3,00,000.
72. During 2008, it is expected that selling price will be reduced by 10%. What should be the sale if the company desires to earn the same amount of profit as in 2007?

Notes

Self Assessment

State whether the following statements are true or false

- 73. The difference between Price and Average Variable Cost is defined as 'break-even point'.
- 74. The break-even chart shows the extent of profit or loss to the firm at different levels of activity.
- 75. Contribution profit analysis provides a useful format for examining a variety of price and output decisions.

11.6 Summary

Marginal costing is one of the important tools of management not only to take decision, but also to fix an appropriate price and to assess the level of profitability.

Marginal cost is nothing, but a change occurred in the total cost due to small change in the quantity produced.

Absorption costing technique is also known by other names as "Full costing" or "Traditional costing".

The cost-volume-profit analysis is a tool to show the relationship between various ingredients of profit planning.

The ratio or percentage of contribution margin to sales is known as P/V ratio.

The crucial step in this analysis is the determination of break-even point.

BEP is defined as the sales level at which the total revenue equals total cost.

Margin of safety is the difference between the actual sales and sales at break-even point.

Sales beyond break-even volume brings in profits.

11.7 Keywords

BEP (Chapters): It is the level of Chapters at which the firm neither incurs a loss nor earns profit.

BEP (Volume): It is the level of sales in Rupees at which the firm neither incurs a loss nor earns profit.

Contribution: It is an amount of balance available after the deduction of variable cost from the sales.

Fixed Cost: It is a cost which is fixed or remains the same for irrespective level of production.

Marginal Cost: Change occurred in the cost of operations due to change in the level of production.

PV Ratio: Profit volume ratio which is nothing but the ratio in between the contribution and sales.

Variable Cost: It varies along with the level of production.

11.8 Review Questions

- 76. SV Ltd. a multi-product company, furnishes you the following data relating to the year 2009:

Particulars	First half of the year	Second half of the year
Sales	` 45,000	` 50,000
Total cost	` 40,000	` 43,000

Notes

Assuming that there is no change in prices and variable costs that the fixed expenses are incurred equally in the two half year periods calculate for the year 2009.

Calculate:

PV ratio

Fixed expenses

Break-even sales

Margin of safety

77. Analyse the important of the following in relation to break-even analysis:

Break-even point

Margin of safety

Profit volume ratio

78. Illustrate the graphic approach of BEP analysis.

79. Examine the concept of the profit volume ratio.

80. A ball pen manufacturer has developed a new ball pen with unique features. His design development executive has suggested three possible retail prices viz ` 15 for super star; ` 10 for deluxe and ` 7.50 for economy model. His marketing manager opines that the wholesalers and retailers have to be given at least 30% discount.

The estimated fixed cost would be around ` 70,000 and variable cost per Chapter would be ` 3.50.

Calculate break-even point for each model of the ball pen.

81. The PV ratio of a firm dealing precision instrument is 50% and the margin of safety is 40%. You are required to work out the B.E.P and the net profit if sales volume is ` 50,00,000.

82. The annual profit plan of ABC Ltd. is given in the following table. From the data given in the table, calculate the breakeven point in Chapters.

Annual profit plan of ABC Ltd.

Particulars	Fixed Cost (₹)	Variable Cost (₹)	Total (₹)
Budgeted sales (2,00,000, ` 21 each)			` 42,00,000
Direct labour		8,00,000	
Direct material		9,00,000	
Factory overheads	6,00,000	2,00,000	
Administrative expenses	5,00,000	1,00,000	
Distribution expenses	3,00,000	2,00,000	
Total	14,00,000	22,00,000	36,00,000
Budgeted profit			6,00,000
Capacity of production	2,50,000 Chapters		

83. Explain the relevance of adopting CVP concept in business operations.

84. How do Income statements prepared under marginal and absorption costing differ?

- Notes**
10. Taking suitable data construct a simple break-even chart and show the break-even point, angle of incidence and margin of safety on the chart.
 11. Does the marginal costing concept violate the generally accepted accounting principles? Discuss.

Answers: Self Assessment

- | | |
|------------------------|----------------------|
| 1. Traditional costing | 2. fixed cost |
| 3. Marginal cost | 4. variable overhead |
| 5. fixed overhead | 6. volume of sales |
| 7. costs and revenues | 8. profit |
| 9. P/V ratio | 10. optimum level |
| 11. zero profit | 12. sales |
| 13. False | 14. True |
| 15. True | |

11.9 Further Readings



Books B.M. Lall Nigam and I.C. Jain, *Cost Accounting*,
Prentice-Hall of India (P) Ltd.

Hilton, Maher and Selto, *Cost Management*, 2nd
Edition, Tata McGraw-Hill Publishing Company Ltd.

M.N. Arora, *Cost and Management Accounting*, 8th
Edition, Vikas Publishing House (P) Ltd.

M.P. Pandikumar, *Management Accounting*, Excel
Books.



Online links www.allbusiness.com

www.internalaccounting.com