

# UNIT 9 COST-VOLUME-PROFIT ANALYSIS

## Objectives

The aims of this unit are to:

- acquaint you with the nature of Cost-Volume-Profit analysis
- illustrate the factors which affect Cost-Volume-Profit relationships
- examine the role of break-even analysis by elaborating the Cost-Volume-Profit framework
- discuss the applications of Cost-Volume-Profit relationships in specific decisions

## Structure

- 9.1 Introduction
- 9.2 What is Cost-Volume-Profit Analysis?
- 9.3 Interplay and Impact of Factors on Profit
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- 9.8 Key Words
- 9.9 Self-assessment Questions/Exercises
- 9.10 Further Readings

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## 9.1 INTRODUCTION

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Managers have to take frequent decisions which involve considerations of selling prices, variable costs, and fixed costs. Many of these decisions are a part of their planning responsibilities and have, as such, to be based on predictions about costs and revenues. Almost every question that is posed has a 'cost-profit' aspect.

You may react to what Horngren (1985, p. 43) states about cost-volume-profit relationships:

"Cost-volume-profit analysis is a subject inherently appealing to most students of management because it gives a sweeping overview of the planning process and because it provides a concrete example of the importance of understanding cost behaviour—the response of costs to a wide variety of influences."

Probably, you belong to the category of management students identified by Horngren. If you have a propensity to know about the planning process and the cost behaviour, you are sure to get at once interested in the study of cost-volume-profit relationship.

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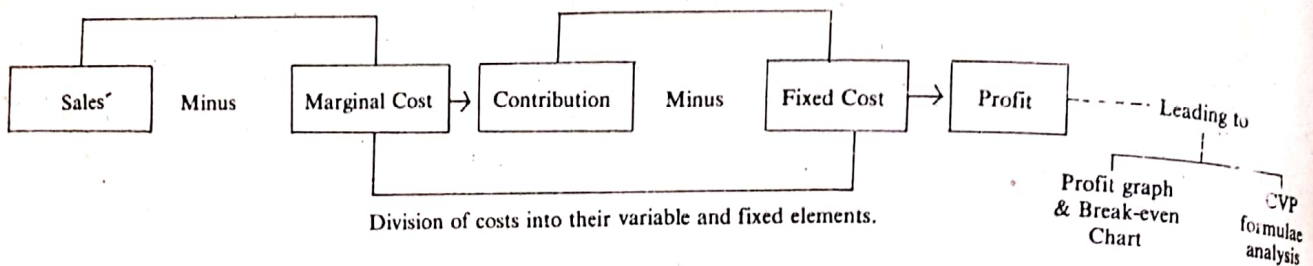
## 9.2 WHAT IS CVP ANALYSIS?

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The Cost-Volume-Profit (CVP) analysis is an attempt to measure the effect of changes in volume, cost, price and product-mix on profits. You will appreciate that while these variables are inter-related, each one of them, in turn, is affected by a number of internal and external factors. For instance, costs vary due to, among others, choice of plant, scale of operation, technology, efficiency of work-force and management efficiency.

Also, cost of inputs bought externally is affected by market forces. While many wide-ranging factors influence costs and profits, the largest single variable affecting them in the short-run is the volume of output. Hence, the CVP relationship acquires a vital significance for the manager facing a wide spectrum of short-run decisions like: what are the most profitable and what are the least profitable products? How does a reduction in selling prices affect profits? How does volume or product-mix affect product costs and profits? What will be the break-even point if volume and costs change? How an increase in wages and/or other operating expenses will affect profit? What will be the effect of plant expansion on costs, profit and volume of sales? Answers to all such questions will have to be formulated in a cost-benefit framework and CVP analysis will offer the technique for doing it.

You may, in fact, perceive CVP analysis as one of the decision-models which managers employ to choose among alternative courses of action. The basic (simplified) CVP model may be outlined as follows:



You may now be getting ready to comprehend the CVP concept. You will observe that profits are a function of the interplay of costs, prices, and each one of them is relevant to profit planning. In fact, variance between actual and budgeted profit arises due to one or more of the following factors: selling price, volume of sales, variable costs, and fixed costs.

You will also appreciate that these four factors which cause deviations in planned profits, differ from each other in terms of controllability by management. It is obvious that selling prices largely depend upon external forces. Costs, of course, are more controllable. But they pose a problem of measurement. This is more so when a firm manufactures two or more products. Nevertheless, a knowledge of fixed and variable costs is essential if costs are to be controlled. Consider a tenuous cost-volume-profit transit:

“Sales price change → volume change → unit costs change → profit structure change”

You may try an answer to the question: How will costs change in the foregoing situation? Would you succeed? Probably, not quite so at this stage! But the CVP decision model will of course have an answer within its own assumptive framework.

### 9.3 INTERPLAY AND IMPACT OF FACTORS ON PROFIT

We have said above that costs and volume do influence profit. You will observe more objectively the extent and nature of this impact with the help of an illustration. It is proposed to evaluate the effect of

- price changes on net profit,
- volume changes on net profit,
- price and volume changes on net profit,
- an increase or decrease in variable costs on net profit,
- an increase or decrease in fixed costs on net profit,
- all four factors viz., price, volume, variable costs, and fixed costs on net profit.



The following assumptions are made in the illustration: normal sales volume is 2,00,000 units at a selling price of Rs. 2 per unit; capital investment is Rs. 2,00,000 and management expects to earn a fair return on it; fixed costs are Rs. 1,60,000; variable expenses are Re. 1 per unit.

Solutions for the six situations are tabulated separately. The control column of each table shows 'normal volume' and a decrease in volume by 10% and 20% is shown on the left, while an increase in volume by the same percentages is shown on the right of the 'central column', calculations show not only net profit or loss for each set of conditions but also the net profit per unit, the percentage return of investment, and the break-even point.

### Influence of price changes on Profit.

Table 1

Particulars	Decrease in price		Normal Volume	Increase in Price	
	20%	10%		10%	20%
Units	2,00,000	2,00,000	2,00,000	2,00,000	2,00,000
Sales (Rs.)	3,20,000	3,60,000	4,00,000	4,40,000	4,80,000
Variable cost (Rs.)	2,00,000	2,00,000	2,00,000	2,00,000	2,00,000
Marginal Income (Rs.)	1,20,000	1,60,000	2,00,000	2,40,000	2,80,000
Fixed costs (Rs.)	1,60,000	1,60,000	1,60,000	1,60,000	1,60,000
Net profit/(Net loss) (Rs.)	(40,000)	0	40,000	80,000	1,20,000
Net profit/(Net loss) per unit (P.s.)	(.20)	—	.20	.40	.60
% change in profit	- 200%	- 100%	—	+ 100%	+ 200%
Return on investment	- 20%	0%	20%	40%	60%
Break-even point rupee sets	4,26,667	3,60,000	3,20,000	2,93,333	2,74,286

You may note the following from the above situations: (a) a 10% decrease in price reduces profit to zero, while a 10% increase in price increases profit by 100%. (b) with lower selling prices and a constant volume, the break-even point increases.

This happens because a reduction in sales revenue on account of decrease in sales price reduces the marginal income (contribution). A much greater number of units have to be sold in order to recover the fixed costs.

### Influence of volume changes on Net Profit.

Table 2

Particulars	Decrease in Volume		Normal Volume	Increase in Volume	
	20%	10%		10%	20%
Units	1,60,000	1,80,000	2,00,000	2,20,000	2,40,000
Sales (Rs.)	3,20,000	3,60,000	4,00,000	4,40,000	4,80,000
Variable cost (Rs.)	1,60,000	1,80,000	2,00,000	2,20,000	2,40,000
Marginal income (Rs.)	1,60,000	1,80,000	2,00,000	2,20,000	2,40,000
Fixed costs (Rs.)	1,60,000	1,60,000	1,60,000	1,60,000	1,60,000
Net profit (Rs.)	—	20,000	40,000	60,000	80,000
Net profit per unit (Rs.)	—	.11	.20	.273	.33
% change in profit	- 100%	- 50%	—	+ 50%	+ 100%
Return on investment	0%	10%	—	30%	40%
Break-even point (Rs.)	3,20,000	3,20,000	3,20,000	3,20,000	3,20,000

You may note here the following: (a) a 20% decrease in volume reduces sales to the break-even point which remains constant because variable costs change in proportion to sales. (b) a 20% increase in volume improves profit by 100%. A similar increase in price (viz., by 20%) increases profit by 200% [see above].

### Influence of changes in prices and volume on Net Profit.

Table 3

Particulars	Increase in Price		Normal Volume	Decrease in Price	
	20%	10%		10%	20%
	and Decrease in volume			and Increase in volume	
	20%	10%		10%	20%
Units	1,60,000	1,80,000	2,00,000	2,20,000	2,40,000
Sales (Rs.)	3,84,000	3,96,000	4,00,000	3,96,000	3,84,000
Variable costs (Rs.)	1,60,000	1,80,000	2,00,000	2,20,000	2,40,000
Marginal income (Rs.)	2,24,000	2,16,000	2,00,000	1,76,000	1,44,000
Fixed costs (Rs.)	1,60,000	1,60,000	1,60,000	1,60,000	1,60,000
Net profit/(Net loss) (Rs.)	64,000	56,000	40,000	16,000	(16,000)
Net profit per unit (Rs.)	.40	.31	.20	.0727	.066
% change in profit	+ 60%	+ 40%	—	- 60%	- 140%
Return on investment	32%	28%	20%	8%	8% loss
Break-even point (Rs.)	2,74,286	2,93,333	3,20,000	3,60,000	4,26,667

Please note in this situation that (a) the price increase, as assumed, would result in higher profits, even if it is accompanied by a decrease in volume of the same order. The reverse, however, is true of a price decrease accompanied by a volume increase, and (b) that the break-even point would be at its lowest when prices are increased and volume decreased because higher rupee volume with lower unit volume reduces the variable cost ratio.