Patrician College of Arts and Science

DEPARTMENT OF COMMERCE

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Marginal Costing and Cost-Volume-Profit Analysis

Cost behaviour

Cost behaviour is 'the way in which cost per unit of output is affected by fluctuations in the level of activity'.

- Fixed cost
- Variable cost
- Semi-variable cost

In some situations increases in activity (volume) can affect the cost structure and the relevant range becomes a factor.

- Step cost

Marginal costing

- Marginal costing is an approach where variable costs are charged to cost units, but the fixed cost for the relevant period is written off in full against the total contribution for that period.
- The fixed cost is not shared or apportioned to any cost centre or cost unit.
- While marginal costing can be used as part of a routine cost accounting system, its main use is in providing relevant information for planning and decision-making.

Contribution

Contribution is a key term in marginal costing. It is simply the difference between total sales and total variable cost.

The principle of marginal costing

Since fixed costs are constant within the relevant range of volume sales, it follows that by selling one extra unit or creating one extra sale

- Revenue will increase by the sales value of one item
- Costs will only increase by the variable cost per unit
- The increase in profit will equal sales value less variable costs, i.e. the contribution

If the volume of sales falls by one unit, then profit will fall by the contribution of that unit. If the volume of sales increases by one unit, profit will increase by the contribution of that unit.

Fixed costs relate to time and do not change with increases or decreases in sales volume. It voids the often arbitrary apportionment of fixed cost and highlights contribution, which is considered more appropriate for decision-making purposes.

Advantages of marginal costing

- The marginal costing approach is preferable for decision-making, as contribution is the most reliable criteria upon which to base a decision.
- It avoids arbitrary apportionment of fixed costs and the under- or over-absorption of overheads.
- Separating fixed and variable costs can help in short-term pricing decisions. As fixed costs will remain unaffected by fluctuations in activity within a relevant range, management can focus on variable costs and contribution.
- Fixed costs, by their nature, relate to periods of time rather than volume of production and thus should be treated as such in the preparation of profit statements.
- It gives a more accurate picture of how an organisation's cash flows and profits are affected by sales and volume.
- In manufacturing organisations, it avoids the manipulation of profits through increased production volumes.

Disadvantages of marginal costing

- A marginal costing system identifies the contribution each item earns. It does not establish the fixed cost per item, so there is a danger that items will be sold on an ongoing basis at a price which fails to cover fixed costs.
- Marginal costing does not conform to the principles required by the accounting standards for stock valuation, which requires that stock is valued based on the total cost incurred in bringing the product to its present condition and location. This is because no element of fixed cost is included in the stock valuation provided by marginal costing. Therefore, year-end adjustments are necessary before the preparation of the financial statements for reporting purposes.

Cost-Volume-Profit (CVP) Analysis

CVP analysis considers the interaction between sales revenue, total costs and the volume of activity, which between them make up profit.

Using the CVP model, profit can be predicted for given situations.

Objective of CVP analysis

- The objective of CVP analysis is to establish what would happen to profit if sales volume fluctuates in the short term.
- The focus is on the volume of activity for a business, because this is one of the most important variables affecting sales, costs and profit.
- The CVP model is based on the equation

Profit = total sales – total costs

Expands to

Profit = total sales – [total fixed costs + total variable costs]

Expands to

Profit = selling price per unit x no of units sold – {fixed costs + (variable cost per unit x number of units sold)}

CVP & profit statement

Sales Revenue (price x volume sold)	x
Less Variable costs (cost x volume sold)	x
Total Contribution	x
Less Fixed costs	x
Net profit	x

Break-even point

The break-even point is the point at which neither a profit or a loss is incurred. Break-even occurs where total contribution is exactly equal to fixed cost and hence sales revenue is exactly equal to variable cost plus fixed cost.

Formula to calculate the volume required to break-even:

$$\frac{\text{Fixed Cost}}{\text{Contribution per unit}} = \text{Break-even units}$$

Formula to calculate the sales revenue required to break-even:

$$\frac{\text{Fixed Cost}}{\text{Contribution per unit}} \times \text{unit selling price} = \text{Break-even revenue}$$

Target profit

In profit planning, management set profit targets and need information such as the sales levels in units or revenue required to achieve this target profit. The break-even formula can be expanded to establish the volume required to achieve a desired profit level.

$$\frac{\text{Fixed Cost + Target Profit}}{\text{Contribution per unit}} = \text{volume of sales to achieve target profit}$$

Margin of safety

The margin of safety is the amount of sales the business can afford to lose and still not make a loss. It is the difference between the budgeted sales volume (or revenue) and the budgeted break-even volume (or revenue). It can be expressed in units / products or € sales or as a percentage.

Margin of safety in units

Budgeted sales volume
less
Break-even volume

Formula for margin of safety in revenue

Budgeted sales revenue
less
Break-even revenue

Formula for Margin of safety (percentage)

$$\frac{\text{Forecast sales} - \text{break-even sales}}{\text{Forecast sales}} \times 100$$

C/S ratio

The C/S ratio is simply the contribution divided by sales, multiplied by 100.

Sometimes key information may not be available (total revenue may be presented without unit price or volume data). The contribution to sales ratio (C/S ratio) can be used to calculate the break-even point in revenue and the revenue required to achieve a target profit.

Break-even revenue using CS ratio:

$$\frac{\text{Fixed cost}}{\text{Contribution to sales ratio}} = \text{Break-even revenue}$$

Target profit using CS Ratio:

$$\frac{\text{Fixed cost + Profit}}{\text{Contribution to sales ratio}} = \text{Revenue for target profit}$$

Break-even charts

Break-even charts give a graphical view of CVP analysis. The chart is simple to understand and is particularly useful when communicating to non-accountants. It gives a visual display of how much output needs to be sold to make a profit and the likelihood of making a loss, if actual sales fall short of targets.

Profit-Volume chart

The profit volume chart is very useful in showing the impact on profit of different activity levels.

Assumptions underlying CVP analysis

- Revenue and cost behaviour are linear over the relevant range, i.e. they take the form of a straight-line on a chart.
- Variable costs per unit remain constant, thus ignoring the impact of quantity discounts.
- Variable costs are directly proportional to sales.
- Fixed costs remain constant within the relevant range.
- All costs can be classified into their fixed and variable components.
- Volume / activity levels are the only factors that influence costs.
- Selling price per unit remains constant although economists point out that in order to sell additional units, selling price is normally reduced.
- The sales mix remains constant.

CVP in multi-product situations

Many businesses in the hospitality, tourism and retail sectors sell a variety of different products / services that generate different contribution margins. In these multi-product firms, CVP analysis can be used however it must be assumed that the proportion each product represents of total sales (sales mix) remains constant.

CVP in multi-product situations

There are two ways of calculating the break-even point and thus applying CVP analysis.

- Calculate the break-even point for all products separately and aggregate the answers to give an overall break-even point for the business.
- Calculate an average C/S ratio assuming that the product sales mix remains constant.

CVP analysis and uncertainty

The output and information provided by the CVP model is only as good as its inputs. The model requires inputs such as likely sales mix, selling price levels, total fixed costs and variable cost per unit. These inputs are all estimated and thus will be subject to varying degrees of uncertainty.

Risk can simply be defined as the likelihood that what is expected to occur will not actually occur. Thus there is a strong possibility that the financial estimates and inputs for the CVP model will not turn out as expected. How do managers deal with this?

- Sensitivity analysis
- Use of probabilities
- Simulations

Sensitivity analysis

- Each element of sales and costs are uncertain to some extent. Some elements may be subject to more uncertainty than others, while some uncertainties will have greater consequences than others.
- Sensitivity analysis helps by showing how sensitive profit and the break-even point are to changes in assumptions about volume, price and costs.
- Sensitivity analysis involves taking a single variable and examining the effect of changes in that variable on the projected profit and break-even levels.

Use of probabilities

- Another approach to helping managers develop a sense of the effects of inaccurate forecasting is to prepare projected profit statements according to different possible scenarios.
- This approach involves changing a number of variables simultaneously in order to portray the effects of each possible economic scenario.
- Management can then apply probabilities to each stated scenario to estimate a most likely effect.
- At the end of this process, management have an idea of effects on the business of worst and best case scenarios and hence a better feel for a most likely scenario.

Simulations

This approach is really a development of sensitivity analysis. It involves the use of specific simulation computer software. In essence, the approach applies a range of possible values to the various key variables (sales volume, sales price, variable costs, fixed costs) in the projected profit statement. The computer software then selects, at random, a value for each variable from the range given and proceeds to generate the projected profit or loss based on the values chosen. This process is repeated using other values for each variable until many (usually thousands of) combinations of values for each key variable have been selected, all producing different profit outcomes.