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Department of Economics

Topic: Break-even Analysis
Paper-I: MICROECONOMICS
Part-I
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BREAK-EVEN ANALYSIS

✓ Break-even analysis is of immense help to businesses when they are making decisions relating to output.
✓ It is also called the *cost–volume–profit analysis* or *profit contribution analysis*.
✓ It helps a firm in analysing the relationship between total revenue, total cost, and total profit.
✓ With the help of this analytical tool, a firm is able to differentiate the ranges of production which are profitable from those which are not profitable.
✓ Thus, by using break-even analysis, a firm is in a position to find out the level of output where revenue and cost break even.
✓ Break-even analysis is useful when a firm is planning on its output for targeting a certain level of profits.

Break-even analysis when Revenue and Cost functions are Linear

✓ Let us see graphical representation of break-even analysis.
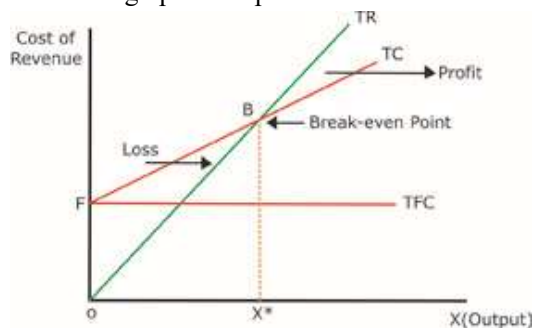
✓ The figure shows linear revenue and cost functions:
  ➢ The total revenue curve in the figure depicts the revenue which a firm will earn at different levels of output, assuming that the price of the good is constant.
  ➢ The total cost curve starts from point F on the Y axis, depicting the linear relationship between cost and output.
  ➢ The total fixed cost curve is a straight line starting from point F on the Y axis depicting a fixed cost of OF.
  ➢ The total variable cost is the vertical distance between total cost curve and the total fixed cost curve. As the amount of output increases, the total variable cost increases.
✓ It is obvious from the figure that:
  ➢ *Up to output OX** of the good, the total cost is greater than the total revenue. Thus, *the firm will incur losses.*
  ➢ *At the output OX** of the good, total cost is equal to total revenue. Thus, *the firm will break even,* making neither profits nor losses at point B, which is the break-even point. The break-even level of output is that level of output at which a firm neither makes profits nor losses. It is the level of output at which total cost is equal to total revenue.
  ➢ *Beyond the output OX** of the good, the total cost is smaller than the total revenue. Thus, the *firm will make profits*.

Algebraic Analysis

We can write,

$$\pi = TR - TC$$

Where, π is profit, TR is total revenue and TC is total cost.

$$\text{But, } TR = P_x \times Q_x$$
$$\text{And, } TC = TVC + TFC$$
$$\text{However, } TVC = AVC \times Q_x$$
$$\text{Thus, } TC = AVC \times Q_x + TFC$$

Where, P_x is per-unit price of good x, Q_x is quantity of good x, TVC is the total variable cost, and AVC is the average variable cost. At the break-even level of output, the total cost is equal to the total revenue. Assume that the break-even level of output is Q^*_x.

Thus,

$$TR = TC$$
$$P_x \times Q_x^* = AVC \times Q_x^* + TFC$$
$$P_x \times Q_x^* - AVC \times Q_x^* = TFC$$
$$Q_x^* (P_x - AVC) = TFC$$
$$Q_x^* = TFC/(P_x - AVC)$$

In this equation, $(P_x - AVC)$ in the denominator is the contribution per unit of output.

- ✓ It measures the contribution made by each unit of output to cover the fixed cost.
- ✓ Also, the equation shows that the break-even level of output is determined by the amount of the total fixed cost, per unit price of good x and average variable cost.
- ✓ If any of these variables change, the break-even level of output will also change.

Break-even analysis when Revenue and Cost functions are Non-Linear

The figure shows non-linear revenue and cost functions:

- The total revenue curve in the figure depicts the revenue, which firm will earn at different levels of output.
- The total cost curve starts from point, F on the Y-axis depicting the relationship between cost and output.
- The total fixed cost curve is a straight line starting from point, F on the Y-axis depicting a fixed cost of OF.
- The total variable cost is the vertical distance between total cost curve and the total fixed cost curve. As the amount of output increases, the total variable cost increases.
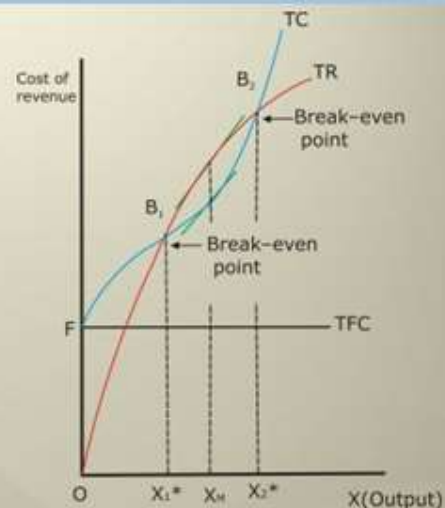
It is obvious from the figure that

- Up to output *OX1** of the good, the total cost is greater than the total revenue. Thus, the firm will incur losses.
- At the output *OX1** of the good, total cost is equal to total revenue. Thus, the firm will break even making neither profits nor losses at point *B1*. This is the break-even point. It represents the *level* of output at which total cost is equal to the total revenue.
- Between the output *OX1* and OX2** of the good, total cost is smaller than total revenue. Thus, the firm will make profits, which will be a maximum at the output level *OXM at which the distance* between the total cost and total revenue curves is a maximum.
- At the output *OX2** of the good, total cost is equal to total revenue once again. Thus, the firm will break even making neither profits nor losses at point *B2*. This is another break-even point at which total cost is equal to total revenue. The break-even point *B2* may not be of much relevance to a firm as it may be beyond the capacity of a firm to produce this output.