

Break Even Point Analysis

The break-even point is the point at which total revenue is equal to total cost. At this point, the profit is zero. (A particular company neither makes nor loses money at this point).

There are two types of **costs** to consider: **variable** and **fixed**. Fixed costs include things like rent, lease payment, insurance payment, etc. Fixed costs do NOT depend on the number of units (e.g. number of pizzas sold). Variable costs vary with the number of units. For example, the more pizzas you make, the greater the food cost.

Revenue will vary with the number of units. Generally, as the number of units increases, revenue also increases.

Some Formulas

Total revenue = price x number of units (**TR = P*X**). This is also known as the revenue function.

Total cost = variable cost x number of units + total fixed cost (**TC = VC*X + FC**). This is also known as the cost function.

At break-even point, TR = TC.

Example

A firm manufactures a product that sells for \$12 per unit. Variable cost per unit is \$8 and fixed cost per period is \$1200. Capacity per period is 1000 units.

- Graph the revenue and cost functions.
- Find the number of units sold and the revenue amount (\$) at break-even point.

Solution

Given: X is the number of units

$$P = 12$$

$$VC = 8X$$

$$FC = 1200$$

a) The revenue function

The revenue function is a *linear* function described by $TR = 12*X$ in this example.

In order to graph the revenue function, we need to find at least **two** points that lie on $TR = 12*X$.

If zero units are produced, $X = 0$ and $TR = 12*0 = 0$. Thus we have one point (0,0).

At capacity, 1000 units are produced. Thus, when $X = 1000$, $TR = 12(1000) = 12000$. This gives us another point on the graph (1000, 12000).

We plot the points (0,0) and (1000, 12000) on the graph of "x" versus revenue (\$) and join the points with a straight line. This is the revenue function.

The cost function

The revenue function is also a *linear* function described by $TR = 12X$.

In order to graph the cost function, again, we need to find at least **two** points that lie on $TC = 8X + 1200$.

We can use the same x values as before ($x = 0$, and $x = 1000$).

When $X = 1000$, $TC = 8(1000) + 1200$.

$$TC = 8000 + 1200$$

$$TC = 9200$$

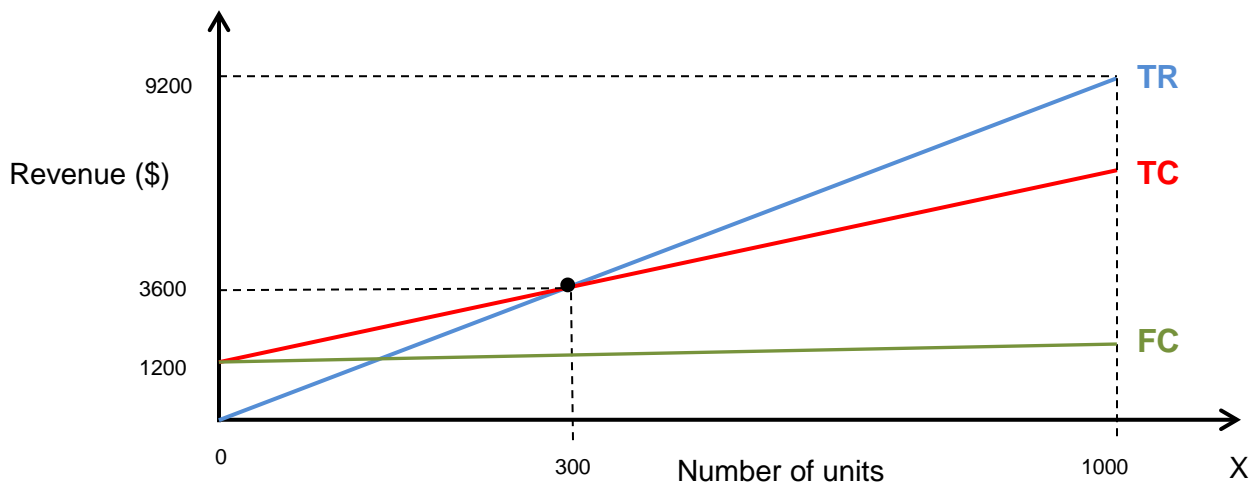
When $X = 0$, $TC = 8(0) + 1200$

$$TC = 0 + 1200$$

$$TC = 1200$$

We plot the points (1000, 9200) and (0, 1200) on the same graph of "x" versus revenue (\$) and join the points with a straight line. This is the cost function.

The break-even point is the **point of intersection** for the revenue and cost functions.



Note: It is also useful to graph a function representing the fixed costs. Since the fixed cost is always 1200 no matter how many units are produced, a horizontal line ($FC = 1200$) represents the fixed costs function.

b) The number of units sold and the revenue amount (\$) at break-even point can be found from the graph above or algebraically.

Algebraically:

At break-even point, $TR = TC$

Thus, $12X = 8X + 1200$.

Solving this equation for "X" will give us the number of units sold at break-even point.

$$12X - 8X = 1200$$

$$4X = 1200$$

$$X = \frac{1200}{4}$$

$$X = 300$$

Thus, break-even point is reached when 300 units are sold.

The revenue (\$) at break-even point can be found using our formula $TR = 12 \cdot X$ and now we know that $X = 300$.

$$TR = 12(300)$$

$$TR = 3600$$

Thus, at break-even point, the revenue is \$3600.