

## 1. Details of the module and its structure

Module Detail	
Subject Name	Economics
Course Name	Economics 03 (Class XII, Semester - 1)
Module Name/Title	Concept of Cost – Part 3
Module Id	leec_10303
Pre-requisites	Cost concepts and relationship with production
Objectives	After going through this lesson, the learners will be able to understand the following: <ol style="list-style-type: none"><li>1. Meaning of cost and types of costs</li><li>2. Scale of operation in short run and behavior of fixed and variable cost</li><li>3. Relationship between production and cost</li><li>4. Calculation of different types of costs</li></ol>
Keywords	Cost concepts and its types, Short run and Long run, Fixed Cost and Variable Cost, Total Cost, Total Variable Cost, Total Fixed Cost.

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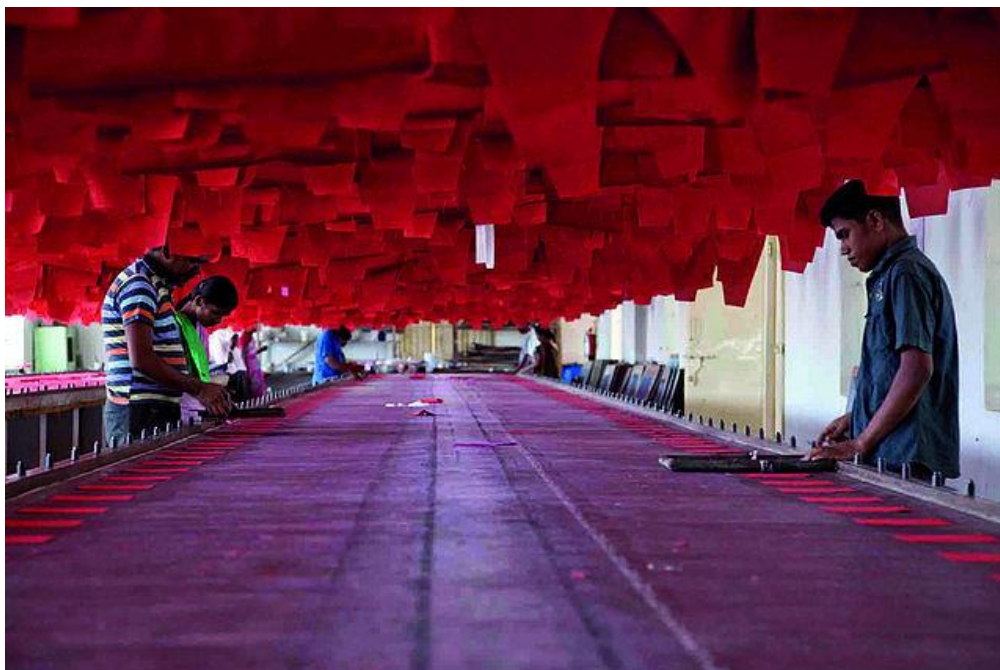
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### 1. Introduction

The objective of a firm is typically to its maximize profits. One way in which the firm can do this is to minimize its cost of production. Economists consider this ability of the firm to maximize the profit while minimizing the cost as efficiency.

In economics, cost refers to the expenses incurred by a firm in the process of production. In this module we look at the concept of costs, and how costs change as output is increased.

Suppose, a firm that produces clothes is required to increase its output in the next year. How would the firm go about it?



Source: <https://goo.gl/75XFiH>

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Perhaps they will hire more workers, increase the raw material in the form of textile, threads, dyes etc. They may also have to increase the number of machines, or the water and electricity required to produce the extra clothes now. Therefore, an increase in output would require more expenditure by the firm. Economists call these expenses on factor inputs like land, labour, raw materials and fuel, the cost of production.

## 2. Types of Cost

As a concept cost is most easily understood as the sum of explicit costs (that is, cash payment made by firms to outsiders for hiring factor services and buying raw material, etc.) and implicit cost (that is, cost of self-owned and self-supplied inputs). Now let us expand, on all the aforementioned concepts through an example.

A farmer decides to become a flour mill owner.



Source: <https://goo.gl/JeHcYm>

She will need a machine to turn wheat into flour, a building to store all the wheat (raw material), as well as electricity and workers to manage the mill. These inputs were bought by the mill owner through money and, these are called the explicit costs.

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Explicit cost refers to the money spent on renting land/building, hiring workers, buying raw materials, power and other overhead expenditures.

However, economists find this list of expenditures incomplete. Suppose the mill owner from the above example, made earnings as a farmer before. She will lose this earning upon becoming a mill owner. Therefore, when economists calculate the profits for the mill owner they will also take the loss of the farm earnings which is a lost opportunity or implicit cost of production.

Implicit cost refers to the opportunity cost or the cost of self-owned and self-supplied inputs that could have alternatively been used in an activity other than the production process.

Hence, economic cost which is the sum of the explicit and implicit cost is the exhaustive concept of cost rather than just the money spent on visible material expenditures.

Economic cost = Explicit cost (incurred on various factor inputs) + Implicit cost (opportunity cost)

#### Opportunity Cost

The concept of opportunity cost discussed above, is applicable to other factor inputs and not just the labour from farming. When a producer uses a resource in a particular way, it sacrifices the next best alternative. If instead of using the land for the flour mill it was used by the farmer for a grocery shop it might have earned some money as rent. This lost income is also an opportunity cost.

Whatever be the decision of the farmer to be a mill owner or not, she will have to take both the explicit cost of hiring workers and raw materials as well as the implicit cost of losing out on the farm income or rental income from grocery shop into account.

Another way to think about these costs is in terms of the money and real costs.

Money cost of production are all the expenses incurred by the firm to hire land, labour, capital and raw materials.

Real cost of production will include all the money costs of the expenses incurred by the firm as well as the implicit costs of the alternate use of labour, land or any other input self-supplied by the firm.

In other words, the cost of incurring sacrifice, discomfort, toil and pain in supplying the factors of production by their owners in addition to the money costs are part of real costs. For example, if owner of a business uses her own land for manufacturing spoons instead of charging any rent for it then it will be part of real cost. Here the cost involved is the opportunity cost of the land. If the

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company was not using the land for manufacturing spoons then this land holding could have been used elsewhere for some other purpose and procured an income. This income which could have been earned under the next best alternate investment is the opportunity cost which needs to be considered while calculating the real cost for the firm. Let us take an example,

A firm ABC is producing shirts. Various operational business expenditure are as follows:

Power - Rs. 5,00,00,

Cost of fabric - Rs. 10, 00, 000,

Salaries - Rs. 8, 00, 000,

Direct and Indirect Overhead Expenses - Rs. 10, 00, 000.

The company is not paying any rent as the land used by the firm is owned by the entrepreneur. If this land had been rented out by the entrepreneur, it would have earned a rent of Rs. 2,00 000 per annum.

What would be money and real costs for the firm?

Here, money cost is Rs. 33, 00, 000, obtained after adding the following: power charges, cost of fabric, salaries, direct and indirect overhead expenses.

Continuing with the discussion of opportunity cost, we examine the case of ABC firm in the example above. Since, the firm has used its land for setting up the factory that produces shirts, it cannot be rented out for another purpose. The opportunity cost of a firm is the next best alternative which is sacrificed. In this case the opportunity cost of using its own land to the firm is Rs.2,00,000.

Therefore, the real cost is Rs. 35, 00, 000, which has been obtained after adding money cost and, the rent which the building belonging to the promoter could have earned in outside market.

### **Costs and Profits**

All operating expenses of the firm that are recorded in the book of accounts of a firm, are referred to as the **Accounting Cost**. Such expenses include cost of raw material, wages and salaries, direct and indirect business overheads, depreciation, taxes etc. Deduction of these business expenses from the revenues of any firm provides us with the accounting profit. In other words, accounting costs are the same as explicit costs. The related accounting profit is calculated as:

Accounting Profit = Total Revenue - Accounting Cost ( Explicit cost of doing business such as hiring workers and buying raw materials)

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Similarly, economic cost includes all the explicit cost as well as implicit cost of a firm and, the related economic profit is calculated as:

Economic Profit = Total Revenue - (Accounting Cost + Opportunity Cost (Implicit cost indirectly borne by the firm))

There is another kind of profit, however, which is important for the firm to consider whether or not to stay in business at all. Economists call it normal profit.

Normal profit is the minimum profit an entrepreneur needs to earn to continue in business.

In other words, without this minimum profit, the entrepreneur will have to stop conducting business and move to some other industry. We could also think of normal profits as an opportunity cost of entrepreneurship. Normal profits are included in the opportunity cost, or the implicit cost of production. Therefore, normal profits are a part of the economic cost (or the total cost) of a firm.

The only discussion on cost of production up until now has been around those expenses that impact the firm. However, production has effects on the society, as well.

### **Private Cost and Social Cost**

Let me give an example. Suppose, a factory uses colours and dye in its production process. The factory releases the by-products and wastes generated in the production process into the nearby river. This polluted water causes damages for people living downstream who use that water for domestic and agricultural purpose. Economists also calculate these costs when taking the decision regarding production. We know that the firm incurs actual expenses like cost of raw material, wages, overhead expenses etc, but these are the private cost of the firm. In other words, costs borne privately by the firm. But the damage caused to the river water by the firm's production is the external cost of production. We add this external cost to the private costs to get the social cost of production.

### **3. Fixed Cost and Variable Cost**

There is yet another way to segregate the costs incurred by the firm in the process of production. Every firm incurs two kinds of costs- fixed and variable.

Let us return to our flour mill example. We use several inputs in the production process, for instance the mill machine which converts wheat into flour. This machine is a fixed input, because it does not

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matter if you produce zero or 1000 kilos of flour you will need this machine to set up the mill business. The cost of buying this machine is your fixed cost, formally called the total fixed cost. Other examples of these costs are rent of the factory, interest on borrowings or salaries of any permanent employees in the factory.

But there are several other inputs that are also required in production. Some of these inputs change directly with the change in the level of output. So, if you increase your production from 500 kilos to 1000 kilos, you will require more electricity, more labourers and other raw materials. In economics we refer to these as the variable inputs and, the cost incurred on purchasing them is referred to as the variable cost. Examples of variable costs are expenses on raw material, power, fuel, wages of non-permanent workers etc.

Fixed cost refers to the expenditure on fixed inputs which are incurred independent of the level of output produced.

Variable cost refers to the expenditure on variable inputs which varies with the change in the level of output.

Therefore, it is possible for a firm to incur zero variable cost if it produces zero output but it would still incur the cost of fixed input.

#### **4. Short Run Costs and Long Run Costs**

In our mill example, if we wish to increase output in a short period of time, we can only do so by hiring more labourers, buying more raw material and increasing the power supply. In other words, through an increase in the variable inputs. The firm is not able to change all factor inputs in the very short run. For example, buying another machine or plant would require more planning, perhaps a loan for the purchase. This is not possible in a short period of time. Therefore, short run costs basically consist of both fixed costs and variable costs. In the long run, the firm is able to change all its factor inputs. Thus, all costs are variable costs. There are no fixed costs in the long run.

Short run is a time period in which a firm cannot change all the inputs. Output can be increased only by increasing the variable input, thus increasing variable costs. Thus, short run costs basically consist of fixed costs and variable costs.

Long run is a time period in which a firm can change all factor inputs. Thus, all costs are variable costs. There is no fixed cost in the long run.



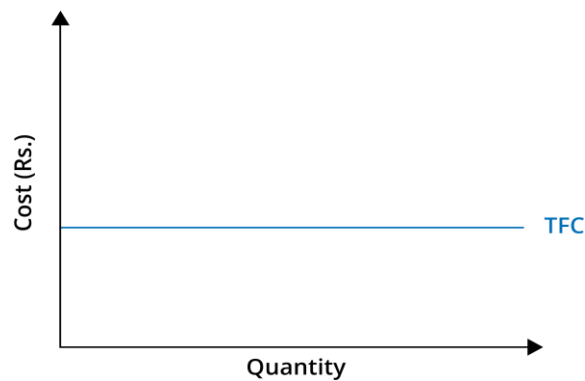
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Let us now discuss the graphical representation of our cost concepts.

### **Total Fixed Cost**

We know that TFC remains constant even at different levels of output and can never be zero even if there is no output being produced currently. The total fixed cost curve is a graphical representation of the fixed cost (taken on the Y axis) plotted against quantity (taken on the X axis). It is a horizontal line always parallel to the X axis, representing a constant cost despite the increase in output.

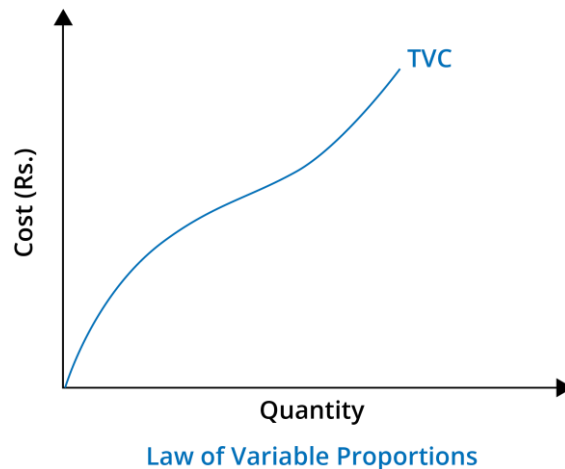
**Figure 1: Total Fixed Cost Curve**



### **Total Variable Cost**

We know that total variable costs are the costs which vary or change directly with the size of output produced. In other words, as we produce more output, more variable factors are employed leading to an increase in the total variable cost. The nature of TVC curve is such that it initially increases at diminishing rate and after a certain point i.e. a point of inflexion, it increases at an accelerating rate. This is due to Law of Variable Returns to Factor or the Law of Variable Proportions.

**Figure 2: Total Variable Cost Curve**





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Initially, the firm increases the level of output, by increasing its variable factor and benefits from increasing returns. The output increases at a higher rate than the increase in input, and as a result the total variable cost increases but at a diminishing rate. To go back to the flour mill example, by adding one additional worker the firm is able to increase its output by more than one unit of flour. This phase continues till a certain point, after which an additional worker (variable input), does not lead to enough of an increase in the output. This is the point of inflexion. Beyond this point diminishing returns to the factor come into play. Suppose, you go on increasing the number of workers in the mill, but the number of flour machines stay constant. Soon, there will be too many workers in proportion to the machines and, the gain that was initially made in production by adding workers will start to decline.

Therefore, a firm cannot go on increasing its output continuously by only increasing one input factor endlessly. Sooner or later, on account of the law of variable returns to a factor implies that at a given state of technology the restriction of not being able to increase all factor inputs, results in increase in production at a diminishing rate.

Let us now discuss, a cost concept related to the fixed and variable costs.

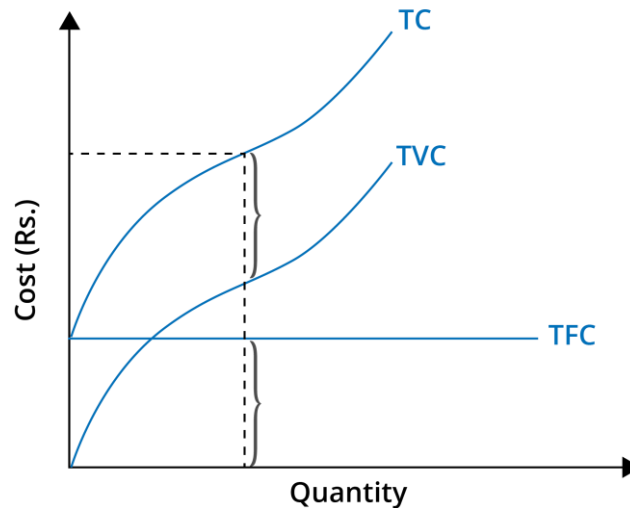
### **Total Cost**

Total Cost of a firm is the total expenditure incurred by the firm in producing the given amount of output. It is the economic cost of producing a commodity incurred by a firm. Total cost (TC) is the sum of TFC (Total Fixed Cost) and TVC (Total Variable Cost).

Symbolically:  $TC = TFC + TVC$

Graphically, the TC curve is just a vertical summation of TFC and TVC at a given level of output. You will notice that the TC curve and TVC curve are parallel to each other. This is because the TFC curve which is the difference between the TVC and TC curve is constant for all levels of output.

Figure 3: Total Cost Curve



## 5. Marginal Cost

Marginal cost (MC) is the rise in the total cost with every additional unit of the output produced. We can also say that MC is the change in TVC with the change in the output. The reason for using total cost and total variable cost interchangeably is the following. Consider, a factory that produces fans. If producing an additional fan requires employing two additional workers then, the marginal cost of the additional fan is the cost of hiring the two additional workers.

In practice, marginal cost can be segregated into short and long-run period. In short run, some factors are variable while others remain fixed. Therefore, any change that takes place in the total cost, in the short run is on account of the change in variable inputs and TVC, as the fixed inputs as well as the TFC remain constant. Hence, marginal cost that is the change in total cost with every extra unit of output produced is entirely determined by the change in the TVC.

On the other hand, in long run all cost is variable or marginal. Therefore, MC will include changes across all inputs.

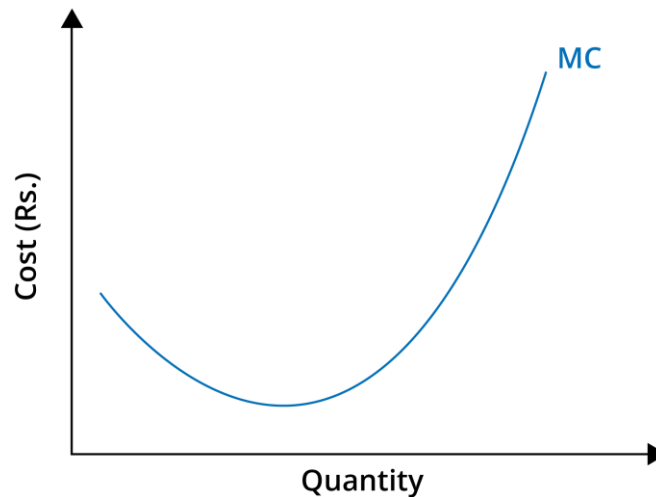
$$\text{Symbolically: } MC = \Delta TVC / \Delta Q$$

where,  $\Delta$  is change, TVC is total variable cost and Q is output produced.

Graphically, the marginal cost curve is a U-shaped curve that first observes a decline, comes to a point that is its minimum and begins to rise.

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Figure 4: Marginal Cost Curve

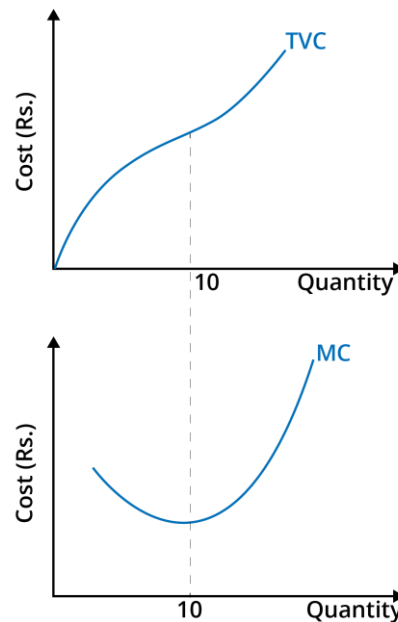


#### 6. Relationship between Production and Cost

To understand the fall and rise in the MC curve better we have to look at the relationship between both, production and cost as well as TVC and MC. The relationship between production and cost, is such that an increase in marginal product due to increasing returns corresponds to a decline in the marginal cost. Similarly, when marginal product decreases the marginal cost begins to increase.

As far as the relationship between TVC and MC is concerned we know marginal cost is the difference in total variable cost of consecutive units of output. If we relate TVC with MC we can conclude that with every additional unit of output produced the TVC initially increases at a diminishing rate. This is due to law of variable proportions as we have discussed above. Consequently, the MC which is change in TVC observes a decline initially. This decline in MC is related to increasing returns to the variable factor that is employed. However, beyond a certain level of output, employing more variable factors leads to an increase in the TVC at an accelerated rate. Once the decreasing returns to the variable factor set in, the increase in TVC at an increasing rate results in the MC also witnessing a rise.

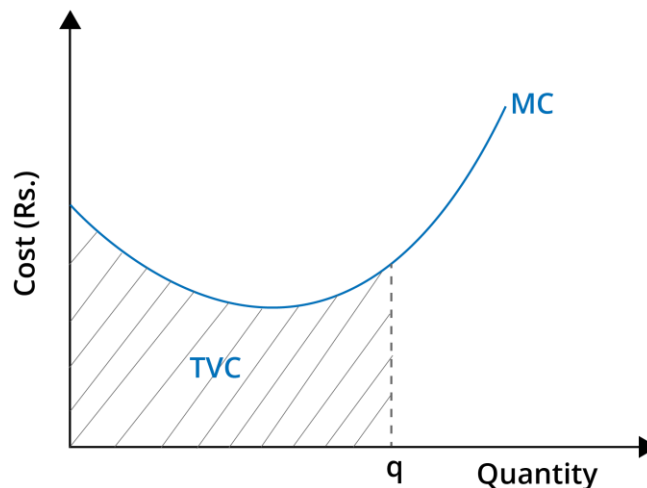
**Figure 5: TVC and MC curves**



As we can see from the graph, the MC curve declines till a point, as the TVC initially increases at a decreasing rate. The MC is lowest at this point beyond which the law of variable proportions or diminishing returns applies. Now the TVC curve begins to increase at an increasing rate and, corresponding to this the MC also begins to rise. We know the TC and TVC curves are parallel to each other due to the constant TFC represented by the horizontal TFC curve. The relationship between TC and MC is quite similar to the relationship between TVC and MC.

We can also examine the relationship between the TVC and MC curve in the following way.

**Figure 6: TVC and MC curves**



For zero level of output the MC is undefined. Now, for the first unit of output, total cost takes the combined value of total variable cost and total fixed cost. For the second unit, a similar addition of the variable and fixed cost yields the total cost. However, moving from first to second unit of output the marginal cost falls, as the total variable cost declines and fixed cost stays constant. With every additional unit of output produced, the MC curve begins to initially decline. Suppose we want to find out the TVC till a particular unit of output, 'q'. Then we can calculate the TVC by adding up the MC upto that level of output, that is the area under the curve.

Now let us solve a hypothetical schedule to better understand the cost concepts we have learnt. If we were given only the quantity of the produced goods, 'Q', TVC and TFC in the schedule, would we be able to calculate the TC and MC for all quantities based on the aforementioned formulae? Let us also assume that the unit for TVC and TFC is in rupee terms.

**Table 1:**

Q	0	1	2	3	4	5	6	7	8	9	10
TVC	0	30	55	75	105	155	225	315	425	555	705
TFC	55	55	55	55	55	55	55	55	55	55	55

**Solution 1:**

Q	TVC	TFC	TC = TVC+TFC	MC = $\Delta\text{TVC}/\Delta q$
0	0	55	55	---
1	30	55	85	30
2	55	55	110	25
3	75	55	130	20
4	105	55	160	30
5	155	55	210	50
6	225	55	280	70
7	315	55	370	90
8	425	55	480	110
9	555	55	610	130
10	705	55	760	150

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For instance, for the 1st unit produced of the good, we know that the TVC is equal to 30 rupees and the TFC is 55 rupees. Since TC is a sum of the TVC and TFC, the TC for the 1st unit will be 85 (30 +55) rupees. Further, MC is defined as the change in total variable cost divided by the change in quantity. For the first unit, the change in TVC from producing 0 units to 1st unit is by 30 rupees, whereas change in quantity is 1. Therefore, MC is equal to 30 rupees. We calculate the TC and MC for all 10 units similarly.

### **7. Relationship between TFC, TVC, TC Curves:**

As we know, total cost is the summation of total fixed cost and total variable cost represented as,

$$TC = TFC + TVC$$

We have also observed that the TFC curve is a horizontal line parallel to X-axis. The reason is that TFC is fixed or constant and remains the same at all levels of output. Hence, TFC is never zero even at zero level of output. Fixed factors are employed independent of whether the firm is currently undertaking production or not, resulting in the firm to bear some fixed cost. TVC curve and TC curve are upward sloping similar curves because TVC and TC increase with increase in output. TC curve is vertical summation of TFC and TVC curves. Again at zero level of output, TC is equal to TFC because there is no variable cost. Since there is no production, there is no requirement for any expenditure on variable inputs such as raw materials, power and fuel. Beyond this output, change in TC is entirely due to change in TVC. Consequently, TC curve and TVC curve have a similar inverse S shape. The TVC curve starts from zero level of output whereas TC curve starts from an intercept on Y-axis equal to the TFC. As the vertical distance between TC curve and TVC curve remains the same (i.e., equal to TFC). The shape of TVC and TC, that is, inverse 'S' signifies an initial increase at a diminishing rate and after the point of inflexion, an increase at an accelerated rate due to Law of Variable Proportions or Returns to Factor.

### **8. Summary**

- Cost in economics refers to the expenses incurred by a firm in the process of production.
- Explicit cost refers to money expenditure incurred to buy inputs.
- Implicit cost refers to the opportunity cost of self-owned inputs.
- Opportunity cost is the value of the next best alternative sacrificed.

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- Economic cost is the sum of all explicit and implicit costs, including normal profits.
  - Short run is a time period in which a firm cannot change all the inputs. Output can be increased only by increasing variable inputs, and therefore incurring variable costs. The cost of fixed inputs remains unchanged.
  - Long run is a time period in which a firm can change all factor inputs and change the level of output accordingly. Since, all inputs can be changed, all costs are variable.
  - Total cost is the total expense incurred by a firm and is the sum total of the fixed and variable cost. Formally, it is the sum of total fixed cost and total variable cost.
  - Marginal cost is the cost of producing an incremental unit of output. The shape of cost curves depends on the law of variable returns to factor.