The Theory of The Firm Under Perfect Competition

Concept of Revenue

Objectives

After going through this chapter, you shall be able to understand the following concepts.

- Concept of Revenue
- Types of Revenue- Total Revenue, Average Revenue and Marginal Revenue
- Relationship between Total Revenue, Average Revenue and Marginal Revenue under Perfect and Imperfect Competition

Introduction

Revenue is the money income for a firm which it receives from the sale of goods produced. In other words, revenue refers to the sale proceeds or sales receipts. Generally, the firm sells its goods at the price which covers its cost of producing the goods along with some margin known as profit. In other words, profit is the difference between the selling price and cost of producing a product. That is:

Revenue = Cost + Profit

or, Profit = Revenue – Cost

Types of Revenue

There exist mainly three types of revenue, *viz*.

1. Total Revenue
2. Average Revenue
3. Marginal Revenue

Total Revenue (TR)

It is defined as the total sale proceeds of a producer by selling corresponding level of output. It can also be defined as price times the quantity of output sold. That is:

TR = Price × Quantity of output sold

or, TR = P × Q

i.e. TR = PQ

Average Revenue (AR)

It is defined as revenue earned per unit of output sold. AR is same as that of price of the output. For example, if price of an output is Rs 5 and the total quantity sold is 10 units, then

$TR = P \times Q$

or, $TR = 5 \times 10 = \text{Rs } 50$

$$AR = \frac{TR}{Q} = \frac{50}{10} = \text{Rs } 5$$

i.e. AR = Price of the output = Rs 5

Marginal Revenue (MR)

It is defined as the change in the total revenue due to sale of one more unit output. It is calculated by either of the two following ways.

1. $MR = \dfrac{\text{Change in Total Revenue}}{\text{Change in Quantity sold}}$

$$MR = \frac{\Delta TR}{\Delta Q}$$

2. $MR_n = TR_n - TR_{n-1}$

where,

MR_n represents Marginal Revenue due to n^{th} unit of output

TR_n represents Total Revenue of n units of output

TR_{n-1} represents Total Revenue of n –1 units of output

Example: If a firm has TR of Rs 100 by selling 10 units of output and TR of Rs 110 by selling 11 units of output, then the change in TR due to the sale of one extra unit (from 10 to 11) is Rs 10 (i.e. Rs 110 – Rs 100). Thus, Rs 10 is the change in TR of Rs 100 by selling the 11^{th} unit of output.

Algebraically,

$MR_n = TR_n - TR_{n-1}$

$MR_{11} = TR_{11} - TR_{10}$ = Rs 110 – Rs 100 = Rs 10

Or

$$MR = \frac{\Delta TR}{\Delta Q} = \frac{110 - 100}{11 - 10} = \text{Rs } 10$$

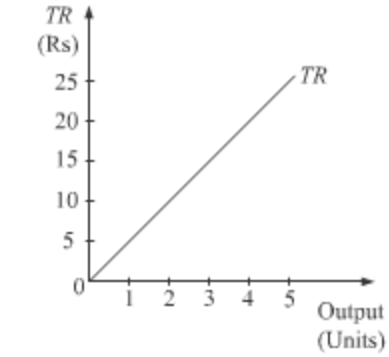
Relationship between TR, AR and MR

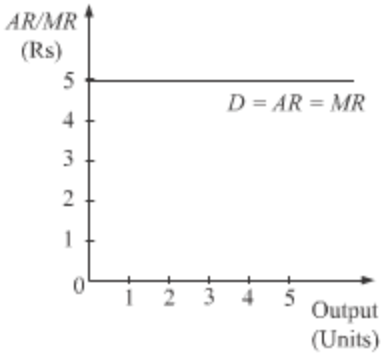
In order to understand the relationship between TR, AR and MR, first of all we need to learn about the types of AR and MR curves faced by firms under different market structures. For time being, let us limit ourselves to this point only that under perfect competition, an individual firm faces a horizontal demand curve for its product. The same demand curve represents AR and MR curve. That is, in other words the demand curve, AR curve and MR curve are the same curve under perfect competition firm and are drawn as the horizontal line parallel to *x*-axis. On the other hand, under imperfect competition market structure (whether monopoly, monopolistic or oligopolistic market), a firm faces a downward sloping demand curve and has different AR and MR curves. Under imperfect competition, AR and MR are two different curves both sloping downwards with MR being less elastic (steeper) and AR is relatively more elastic (flatter).

The relationship between TR, AR, MR differs in two types of markets i.e. Perfect and Imperfect competition. This point will be more clear once we are through with different types of market structures.

Relationship between TR, AR and MR- Under Perfect Competition Market

Output (units)	**Price = *AR*** (in Rs)	***TR = P × Q*** (in Rs)	$MR_n = TR_n - TR_{n-1}$ (in Rs)
1	5	5	5 – 0 = 5
2	5	10	10 – 5 = 5
3	5	15	15 – 10 = 5
4	5	20	20 – 15 = 5
5	5	25	25 – 20 = 5

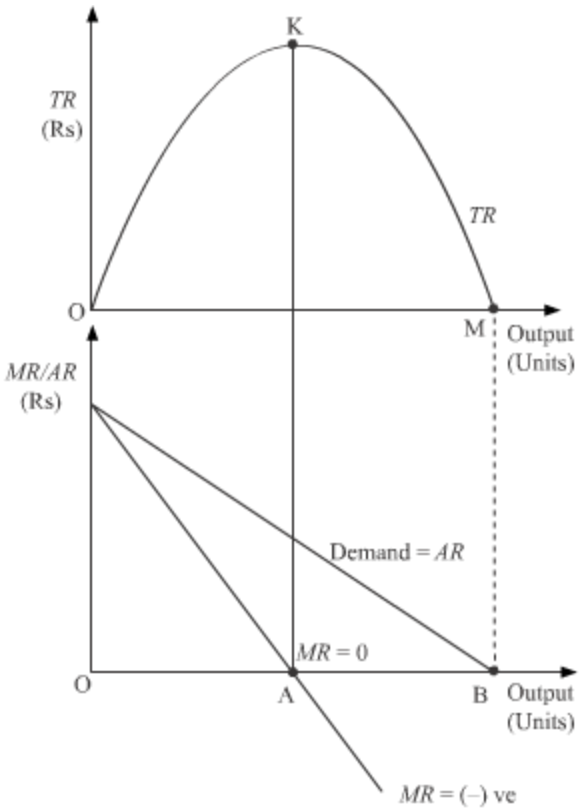




1. Under perfect competition market, AR equals MR throughout all output levels.
2. TR curve is a linear positively sloped line from the origin.
3. The increase in TR is in the same proportion as the increase in the output sold.
4. MR curve is a straight horizontal line parallel to the *x*-axis and coincides with the AR curve.

Relationship between TR, AR and MR- Under Imperfect Competition Market

Output (units)	**Price = *AR*** (in Rs)	***TR* = *P* × *Q*** (in Rs)	$MR_n = TR_n - TR_{n-1}$ (in Rs)
1	10	10	10 – 0 = 10
2	9	18	18 – 10 = 8
3	8	24	24 – 18 = 6
4	6	24	24 – 24 = 0
5	4	20	20 – 24 = –4



1. When TR curve is increasing at diminishing rate, MR curve is falling but remains positive.
2. When TR curve attains its maximum point 'K', MR curve touches the *x*-axis and becomes zero.
3. When TR curve starts falling, MR curve becomes negative.
4. AR curve is a downward sloping and is falling throughout all levels of output. The AR curve remains above the MR curve.
5. When TR curve touches the *x*-axis and becomes zero, the AR curve also becomes zero and the MR curve is negative.

Perfect Competition and Its Features

Objectives

After going through this chapter, you shall be able to understand the following concepts.

- Concept of Market and its Forms
- Perfect Competition Market and its various features
- Pure Competition Market and its various features

Introduction to the Concept of Market

In economics, the concept of market is comparatively broader than what it usually means as. It is not only limited to a geographical location known as *mandi* or *bazaar* but also

implies the presence of buyers and sellers, presence of commodity or product that the buyers and sellers are ready to compete with each other to buy and sell. Now-a-days, with the advancement in technology such as, online transactions, etc. the concept of market has become even wider. Think of online booking of movie tickets, telephonic booking of table at restaurant, etc. one need not to visit the exact place of market (cinema hall or restaurant) for purchase and sell. It can be done from anywhere and anytime. Thus, with the time yet to come, the concept of market will become more sophisticated and complex.

Before proceeding, let us understand the meaning of market, firm and industry.

Meaning of Market, Firm and Industry

1. *Market*: Market acts as a medium which provides a platform, where buyers and sellers are brought into contact with each other in order to exchange (buy and sell) goods and services.

2. *Firm*: Firm basically refers to an individual production unit operating under an industry.

3. *Industry*: Industry refers to the collection of all the production units or firms that produce the same product.

Features of Market

The following are the basic features of a market.

1. *Buyers*- It refers to those who demand a commodity to fulfil their satisfaction.

2. *Sellers*- It refers to those who produce goods in order to sale and to earn profits.

3. *Commodity*- It refers to the existence of tangible or intangible commodities and services, which the sellers wants to sell and the buyers wants to buy.

4. *Area*- It refers to the place where both the buyers and the sellers can contact each other and interact.

5. *Competition*- There must be some sought of competition among the buyers' and the sellers to buy and sell commodity in the market. The competition among the buyers raises prices (as demand is more), while the competition among sellers leads price to fall (as supply is more).

Forms of Market

In order to understand the forms of market, let us first analyse the factors on which the market structure depends. The following are the two important factors on which the market structure depends.

1. ***Number of sellers of commodity***- This refers to the number of sellers in the market selling the product. That is, whether there exists a single seller or a large number of sellers in the market.

2. ***Nature of types of commodity***- This refers to the nature of commodity. That is, whether the commodity has close, perfect or hard substitutes.

Depending on these two factors, the market structure can be divided into following four market forms.

1) Perfect Competition
2) Monopoly Competition
3) Monopolistic Competition } Imperfect Competitions
4) Oligopoly Market

The first form of market is explored in this lesson, while the others in the subsequent lessons.

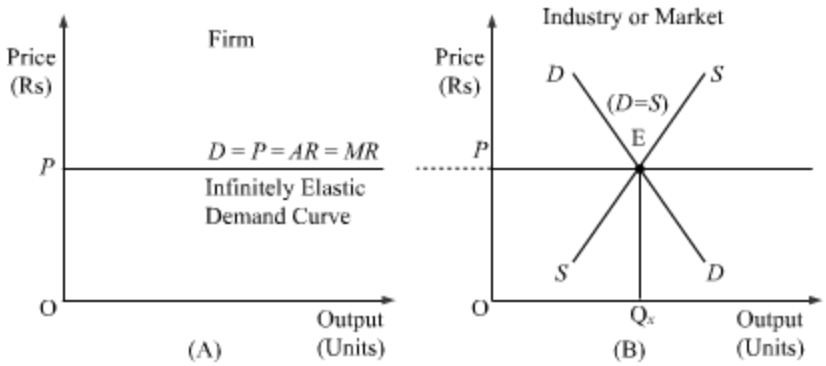
Perfect Competition (PC)

This type of market structure refers to a market, which consists of large number of buyers and large number of sellers such that no individual seller is able to influence the existing market price of the product. All the sellers in a perfect competition market are producing homogenous products, i.e. the outputs of all the sellers are similar to each other and each firm is selling their output at a uniform price.

Features of Perfect Competition

1. ***Large number of buyers and sellers* (*Why a perfect competitive firm is a price taker and not a price maker?*)**

   There exist a large number of buyers and sellers in a perfect competitive market. The number of sellers is so large that no individual firm owns the control over the market price of the commodity. Due to the existence of large number of sellers in the market, there exists perfect and free competition in the market. The firm acts as a *price taker*, while the price is determined by the '*invisible hands of market*', i.e. by demand for and supply of the commodities. In other words, firms have no control over the existing market price and cannot influence it. If an individual firm raises its price, then it will lose all its buyers to other firms and vice-versa. Thus, firms have no role to play other than supplying the required output at the existing market price and therefore *a firm is a price taker and not a price maker*.



In the figure, the part A depicts the infinitely elastic demand curve faced by an individual firm in a perfect competition market. The part B depicts how the market demand and market supply curve interacts to determine the market price. The market price 'OP' is determined by the intersection of market (industry) demand curve DD and market (industry) supply curve SS. The market equilibrium is at point 'E', where OQ_x amount of output is supplied at the equilibrium market price *OP*. The price for the commodity is given to an individual firm and no single firm can influence the market price. The firm faces infinitely elastic demand curve, which depicts that no matter how many units of output are supplied, the price will remain the same. Hence, we can conclude that under perfect competition market, an individual firm is a price taker and not a price maker.

Implication- No individual firm can influence the market price and all firms sell their individual output at a uniform market price.

2. ***Homogenous Product***

This implies that all the firms in perfect competitive market produces homogeneous product. This further implies that the product of each and every firm in the market is perfect substitute to others' product in terms of quantity, quality, colour, size, features, etc. This indicates that the buyers are indifferent between the products of different firms. Due to homogeneity of the products, existence of uniform price is guaranteed.

Implication- The products of different firms are qualitatively and quantitatively homogeneous.

3. ***Free Exit and Entry for Firms***

There is no restriction on the entry and exit of old and new firms. This feature is available only in the long run and not in the short run, as in the short run some factors are fixed, which obstructs the free entry and exit of firms. This feature has an

important implication that all the firms in the long run earn normal profit or zero economic profit. The zero economic profit should not be mistakenly as zero profit, as it implies that the firms are able to earn enough to continue their production. In other words, the zero economic profit measures the opportunity cost of the firms to continue production or shut down. If there exists abnormal profits in the short run, then the new firms will enter in the market in the long run. On the other hand, if the firms are earning abnormal losses, then some of the existing firms will exit the market in the long run. This free entry and exit of the firms ensures that in the long run no firm earns either abnormal losses or abnormal profits, i.e. all firms earns zero economic profit (normal profit), which covers their opportunity cost, thereby restricts them from leaving the market and simultaneously restricts the new firms to enter the market.

Implication- All firms in a perfect competitive market earn zero economic profit in the long run. Neither any firm earns abnormal profits nor does any firm earn abnormal losses.

4. ***Perfect Knowledge among Buyers and Sellers***

Both buyers as well as the sellers are fully aware of the conditions prevailing in the market. This implies that the buyers are fully aware of the prevailing market price of the product at different places and the sellers are also aware of at what prices are the buyers willing to buy the product. The implication of this feature is that if any individual firm is charging higher (or lower) price for the homogeneous product, then the buyers will shift their purchase to the other seller (or shift their purchase from other seller to the firm selling at lower price).

Implication- As the buyers and the sellers are fully aware of the market conditions so no seller can either sell their products at higher prices or at lower prices than the market price.

5. ***No Transport Costs***

This feature means that all firms have equal access to the market. The goods are produced and sold locally; therefore the firms need not to incur any transportation cost to transport the finished product from one part of the market to the other. This further strengthens the existence of uniform price.

Implication- No firm can charge additional price as transportation costs, thereby uniform market price is guaranteed.

6. ***Perfect Mobility of Factors of Production***

There exists geographically and occupationally perfect mobility of the factors of production. This implies that the factors of production can move from one place to another and can shift from one job to another.

Implication- This feature implies that the input price (wage) remains same throughout the industry (among all the firms).

7. ***No Promotional and Selling Costs***

There are no advertisements and promotional costs incurred by the firms. The selling costs under perfect competitive market are zero.

Implication- No firm can influence the buyers to purchase its product by the way of advertisements and promotions.

Pure Competition v/s Perfect Competition

Often, economists differentiate between Pure Competition and Perfect Competition Market on the basis of difference of the degree. The concept of the Pure Competition Market was initially suggested by Professor Chamberlin, who listed the following four main conditions to be necessary for Pure Competition Market structure.

1. Large number of buyers and sellers
2. Homogeneous product
3. Free entry and exit for firms
4. Independent decision making

The conditions and features of the Perfect Competitions market are more stringent and strict in the sense that they are very rare in the real world. Thus, the existence of Perfect Competition market is a myth, whereas, the Pure Competition market can be found in the world. On comparing the features of both the markets, we can conclude that the conditions of a Pure Competition market are more lenient than that of a Perfect Competition market.

Profit Maximisation Conditions for Perfect Competition

Objectives

After going through this chapter, you shall be able to understand the following concepts.

- Concept of Profit Maximisation and Producer's Equilibrium: TR-TC Approach and MR-MC Approach

- Profit Maximisation Conditions under Perfect Competition Market

Introduction to Profit Maximisation Conditions and Producer's Equilibrium

We have learnt that a rational consumer always attempts to maximise his/her satisfaction. In the similar way, a rational producer always tries to maximise his/her profit. Thus, the prime motive of any rational producer to undertake the production process is to earn profit and to maximise it. Maximisation of profit implies earning the highest possible amount of profit. The point where the producer is maximising his profit is known as producer's equilibrium.

Producer's Equilibrium is defined as a state where a producer is earning maximum possible profit by producing a particular level of output. It is referred to as 'equilibrium' because a producer has no incentive to move away from this point, as such deviation will reduce his/her profit.

Two Approaches to Producer's Equilibrium

There exist two approaches to explain the producer's equilibrium *viz*.

1. TR-TC Approach
2. MR-MC Approach

TR-TC Approach

According to this approach, a firm (or a producer) maximises its profit, where the difference between TR and TC is the maximum i.e.

Profit (π) = $TR - TC$

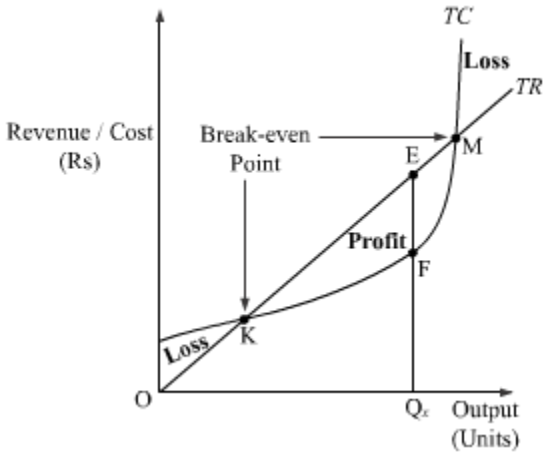
where, π represents Profit

TR represents Total Revenue

TC represents Total Cost

Output (in units)	***TR*** (in Rs)	***TC*** (in Rs)	**Profit** (π) = ***TR – TC*** (in Rs)
1	5	7	5 – 7 = –2
2	10	11	10 – 11 = –1
3	15	15	15 – 15 = 0
4	20	16	20 – 16 = 4
5	25	25	25 – 25 = 0

6	30	33	30 – 33 = –3



From the graph and the schedule we can analyse that TR is equal to TC at two points 'K' and 'M'. These points are called break-even points, where TR = TC, i.e. at these points, profits are zero. The maximum vertical distance 'EF' between TR and TC happens at output level of OQ_x. Therefore, it is the profit maximisation or the producer's equilibrium point. Increasing output beyond OQ_x level will reduce profit. On the other hand, if output level is reduced from OQ_x, then profit will be lesser then the equilibrium profit. Hence, point 'E' is the producer's equilibrium, where the producer has no incentive to deviate.

MR-MC Approach

According to this approach, the firm (or producer) will attains its equilibrium, where the following two necessary and sufficient conditions are fulfilled.

1. ***Necessary Condition or First Order Condition*** (FOC)

$MR = MC$

or,

$$\frac{d(TR)}{dx} = \frac{d(TC)}{dx}$$

where, we are differentiating *TR* and *TC* with respect to the output (x).

2. ***Sufficient Condition or Second Order Condition*** (SOC)

MC curve is rising and cuts *MR* curve from below

Slope of $MC > 0$

$$\therefore \frac{d(MC)}{dx} > 0$$

This implies that the slope of the *MC* curve should be positive at the point of intersection with the *MR* curve.

The first order condition is the necessary condition but not the sufficient condition. The sufficient condition is provided by the positive slope of MC curve at the point of intersection.

Summary of TR-TC Approach and MR-MC Approach

1.	TR-TC Approach	Profit will be maximised where the vertical distance between *TR* and *TC* curve is the maximum.
2.	MR-MC Approach	Profit will be maximised where the necessary and sufficient conditions are fulfilled. FOC or necessary condition; *MR* = *MC* SOC or sufficient condition; Slope of *MC* is positive.

Profit Maximisation Conditions/Producer's Equilibrium for Firm- Under Perfect Competition Market

Under Perfect Competition Market, a firm will attain its equilibrium and will maximise its profit when the following conditions are met.

1. Price (MR) = MC

2. MC is rising or the slope of the MC curve is greater than the slope of the MR curve at subsequent output levels beyond the point where MC = MR

3. (a) ***In short run***- Price must be greater than or equal to minimum of SAVC curve i.e. P ≥ minimum of SAVC curve at the equilibrium output.

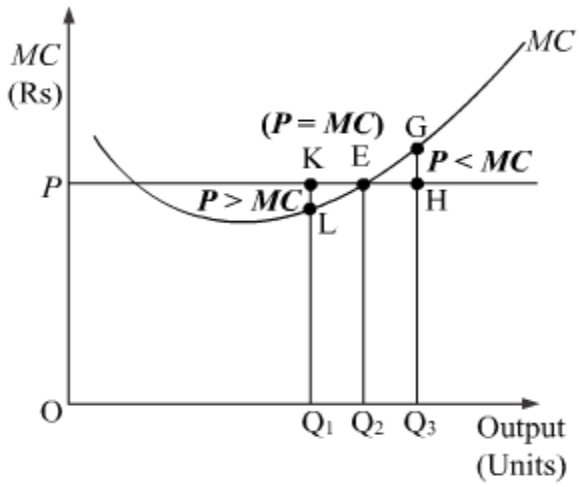
(b) ***In long run***- Price must be greater than or equal to minimum of LAC curve.

Now let us evaluate each of these conditions carefully.

Condition-1: Price (MR) = Marginal Cost

The first condition of the producer's equilibrium is that at equilibrium, price must be equal to the MC.

Case A*: *If Price* (*MR*) > *MC



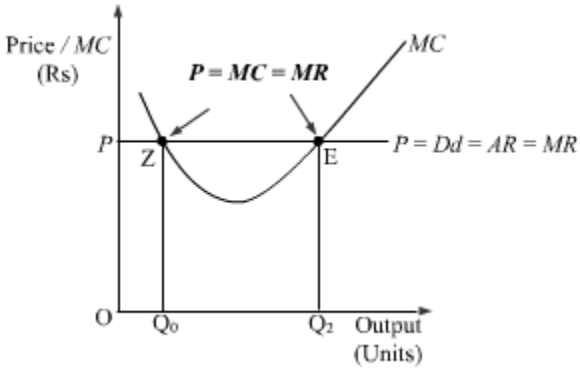
Let us analyse what happens if *price is greater than the MC*. At output OQ_1, price is KQ_1 and the marginal cost is LQ_1, such that $KQ_1 > LQ_1$. Therefore, OQ_1 is not the profit maximising output. This is due to the fact that the firm can increase its profit by increasing the production of output to OQ_2.

Case B*: *If Price* (*MR*) < *MC

Let us analyse what happens if *price is less than the MC*. At output OQ_3, price is HQ_3 and the marginal cost is GQ_3, such that $HQ_3 < GQ_3$. Therefore, OQ_3 is not the profit maximising output. This is due to the fact that the firm can increase its profit by reducing its output level to OQ_2.

Thus, we can conclude that at profit maximisation output, the equilibrium price (or MR) must be equal to the MC curve and it cannot be greater or lesser than the MC curve.

Condition-2: MC curve should be rising at the point of intersection with MR



Let us analyse two different situations, where MC cuts MR. In the figure, the MC curve cuts the price line (or MR) at two different points i.e. at 'Z' and 'E'. The first order condition of profit maximisation, i.e. Price (or MR) = MC is fulfilled at both of these points. Now let us

evaluate which of the following two cases fulfils the second order condition of profit maximisation.

***Case A*: At point '*Z*'**

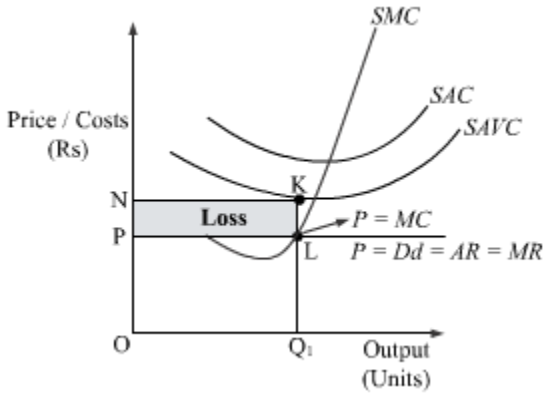
At point '*Z*', price is equal to MC but MC is falling and is negatively sloped. At this point, any output level slightly more than the OQ_0, the firm is facing price that exceeds the MC. This implies that the profit can be maximised by increasing output level beyond OQ_0. Therefore, OQ_0 is not a profit maximisation output.

***Case B*: At point '*E*'**

To the left of the point '*E*', if the firm produces slightly lesser level of output than OQ_2, then the firm is facing price that exceeds the MC. This implies that higher profits can be achieved by increasing the level of output to OQ_2. On the other hand, to the right of the point '*E*', if the firm produces slightly higher level of output than OQ_2, then the firm is facing price that falls short of the MC. This implies that higher profits can be achieved by reducing the output level to OQ_2. Thus, the point E is the producer's equilibrium and OQ_2 is the profit maximising output level, where Price = MC and also MC curve is rising.

Condition-3

***Case A*: In Short Run- Price ≥ minimum of SAVC**



Let us assume that OQ_1 is the short run profit maximising output and producer's equilibrium takes place at point K. At this point, price charged by the firm is OP and the corresponding output sold is OQ_1, so the total revenue of the firm at this price is:

TR = P × Q

TR = $OP \times OQ_1$

so, TR = area of rectangle OQ_1LP

Variable cost incurred to produced OQ_1 level of output is

TVC = SAVC × Quantity of Output produced

TVC = $ON \times OQ_1$

so, TVC = area of rectangle OQ_1KN

Profit earned by firm by selling OQ_1 level of output is

Profit = TR – TC = TR – (TVC + TFC)

Profit = TR – TVC – TFC

If the firm is **not** producing anything i.e. at zero level of output, firm's TR and TVC are zero but anyhow the firm has to incur TFC. Thus, at zero level of output, loss incurred by the firm is

Loss (π_1) = –TFC *(loss incurred at zero level of output)*

Now, if the firm produces OQ_1 level of output, then the profit earned is:

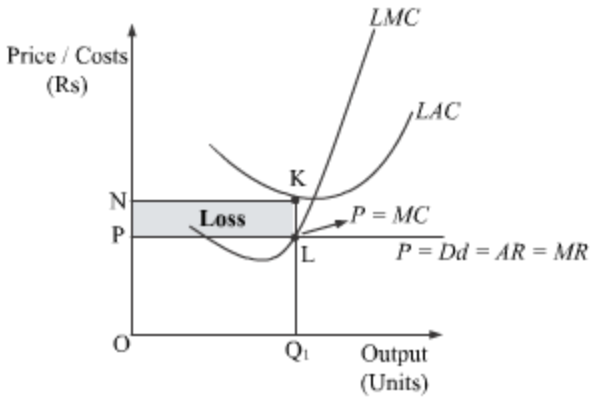
Loss (π_2) = TR – TVC – TFC

Loss (π_2) = area of rectangle OQ_1LP – area of rectangle OQ_1KN – TFC

Loss (π_2) = – area of rectangle $PLKN$ – TFC

This implies that loss (π_1) is greater than loss (π_2) and the firm incurs more amount of loss if it produces OQ_1 level of output than what is associated with producing zero level of output. Thus, ***the firm will stop production*** *whenever P ≤ minimum of SAVC. Hence, our supposition was wrong and OQ_1 cannot be the short run profit maximising level of output. Therefore, the short run producer's equilibrium will occur at that level of output, where the Price must be greater than or equal to the minimum of SAVC.*

***Case B*: In Long Run- Price must be greater than or equal to AC i.e. P ≥ minimum of LAC**



Let us assume that OQ_1 is the long run profit maximising output. At OQ_1 level of output, price charged by the firm is OP and the revenue generated by the firm is

LTR = P × Q

LTR = OP × OQ_1

so, TR = area of rectangle OQ_1LP

In order to produce OQ_1 level of output, the firm need to incur Long run Total Cost of:

LTC = LAC × Quantity of Output produced

LTC = $ON \times OQ_1$

so, LTC = area of rectangle OQ_1KN

Profit earned by firm by selling OQ_1 level of output is

Profit = LTR – LTC = area of rectangle OQ_1LP – area of rectangle OQ_1KN

Loss (π_1) = – area of rectangle $LKNP$

If the firm is producing **zero level of output**, then it needs to be bear a loss of:

Loss (π_2) = zero

Thus, as Loss (π_2) is lesser than the Loss (π_1), so we can conclude that our supposition was wrong and OQ_1 ***cannot*** *be the long run profit maximisation output level. Hence, the long run producer's equilibrium will occur at that level of output, where the Price must be greater than or equal to minimum of LAC.*

Equilibrium and Perfect Competition – Short Run and Long Run

Objectives

After going through this chapter, you shall be able to understand the following concepts.

- Short Run Equilibrium Condition of a Perfectly Competitive Firm- Supernormal Profit, Abnormal Profit, Normal Profit, Shut-down Point
- Long Run Equilibrium Condition of a Perfectly Competitive Firm- Zero Economic Cost

Introduction

Before exploring the short run and long run producer's equilibrium conditions of a firm under perfect competition market, let us quickly recapitulate the three conditions for profit maximisation under perfect competition.

1) $P = MC$
2) MC curve should be rising
3) $P \geq$ minimum of $SAVC$

} at equilibrium output

Short Run Producer's Equilibrium

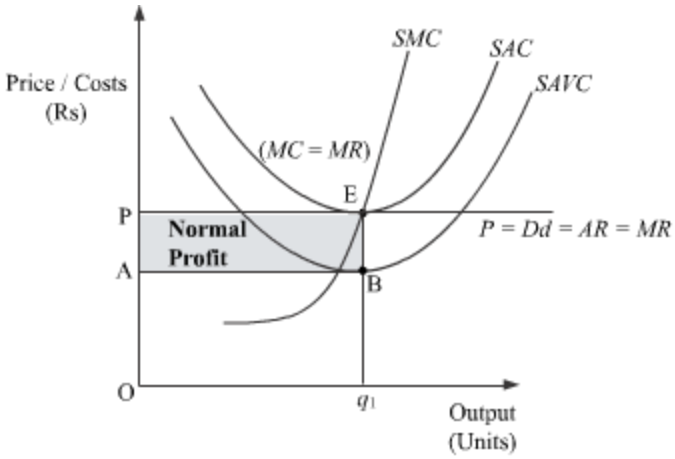
In short run because of the following criteria, the number of firms remains constant.

1. No new firms can ***enter*** into the industry, if there exists supernormal or abnormal profits
2. No existing firms can ***exit*** the industry, if there exists supernormal or abnormal losses.

Based on these conditions, in short run period, there exist four different situations and accordingly four different profit maximisation situations respectively.

1. When there exists normal profit
2. When there exists supernormal profit
3. When there exists normal loss
4. Shut-down point

Case 1: ***When there exists Normal Profit/Break-even Point/Zero Economic Profit (Price = minimum of SAC)***



The point E is equilibrium point as at this point, three profit maximisation conditions are met.

1. MR = MC

2. MC curve is upward sloping at the point of intersection

3. Equilibrium Price ≥ minimum of SAVC

Thus, the producer's equilibrium is at point E with equilibrium price OP and equilibrium output level at Oq_1. The equilibrium price OP is greater than the minimum of SAVC but is equal to the minimum of SAC. This is known as *break-even point* and at this point the firm is earning zero economic profit.**

Total Revenue earned by the firm is:

TR = Price × Quantity of output sold = $OP \times Oq_1$

so, TR = area of rectangle Oq_1EP

The total cost of producing Oq_1 level of output is:

TC = SAC × Quantity of Output produced = $OP \times Oq_1$

so, TC = area of rectangle Oq_1EP

Total Variable Cost = SAVC × Quantity of Output sold = $OA \times Oq_1$

so, TVC = area of rectangle $OABq_1$

Profit (π) = TR – TC = area of rectangle Oq_1EP – area of rectangle Oq_1EP = 0

Thus, the firm is earning *zero economic profit. But this should not be misunderstood as zero profits, rather the firm is earning normal profit.***

Normal Profit = TR – TVC = area of rectangle Oq_1EP – area of rectangle Oq_1BA

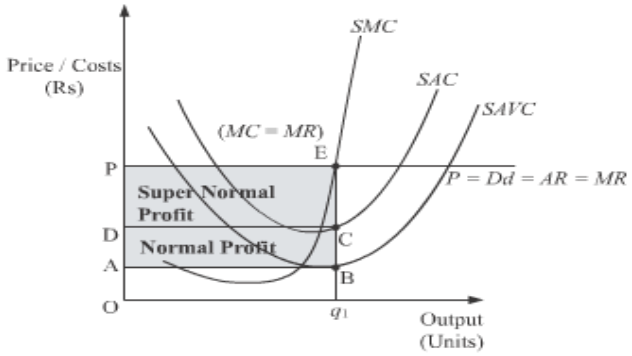
Hence, the Normal Profit = area of rectangle *ABEP*

Important Notes:

1. ** *Zero economic profit or Normal Profit implies that only the supernormal profits are zero. In other words, zero economic profit implies that there is the firm is earning the exact amount of revenues needed to meet its fixed as well as variable costs.*
2. *While normal profit is graphically determined by the area above the minimum of SAVC curve, supernormal profit is graphically determined by the area above the minimum of SAC curve.*

Case 2: *When there exists Supernormal Profit (Price ≥ minimum of SAC)*

As we know that when price is equal to the minimum of SAC, then the firm is earning normal profit, so what happens when the price is above (greater) than the minimum of SAC? Let us consider a case, when the price is above the minimum of SAC. In such case, a firm earns supernormal profit in excess to the normal profit. Thus, when the price is above the minimum of SAC, then the total profit of firm will be the summation of supernormal profit and normal profit. The following figure depicts the condition when a perfectly competitive firm is experiencing supernormal profit.



The point E is equilibrium point as at this point, three profit maximisation conditions are met. The equilibrium price is *OP*, which is greater than the minimum of SAC and the equilibrium output level is Oq_1.

Total Revenue = Price × Quantity of Output sold = $OP \times Oq_1$

so, TR = area of rectangle Oq_1EP

Total Cost = SAC × Quantity of Output sold = $OD \times Oq_1$

so, TC = area of rectangle $ODCq_1$

Total Variable Cost = SAVC × Quantity of Output sold = $OA \times Oq_1$

so, TVC = area of rectangle $OABq_1$

Supernormal profit is the excess profit to the normal profit. As mentioned above supernormal profit is determined by the area above the minimum of SAC curve, so the supernormal profit is:

Supernormal Profit (or Profit) = TR – TC = area of rectangle Oq_1EP – area of rectangle $ODCq_1$

so, Supernormal Profit (or Profit) = area of rectangle $PECD$

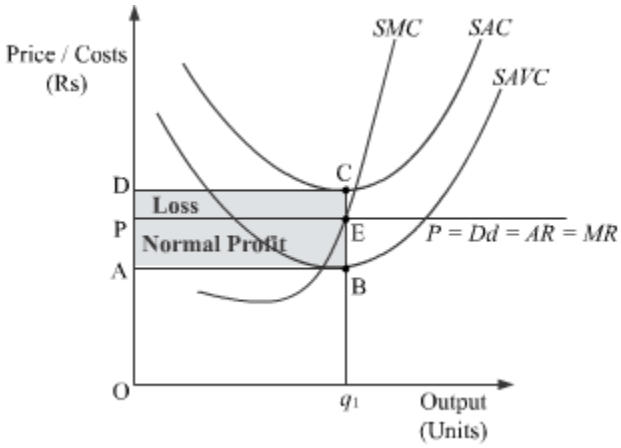
And Normal Profit = area of rectangle $DABC$

Thus, Total Profit = Supernormal Profit + Normal Profit

Total Profit = area of rectangle $PECD$ + area of rectangle $DABC$ = area of rectangle $ABEP$

Case 3: *When there exists Normal Losses (minimum of SAC > Price ≥ minimum of SAVC)*

Let us consider a case, when a firm is facing price that is below the minimum of SAC but is greater than the minimum of SAVC



In this particular case, the prevailing market price is so low that firm is not able to cover its fixed costs fully (as price is below the minimum of SAC) but the firm is able to cover its variable costs (as the price is above the minimum point of SAVC). A particular firm will continue to produce output till the moment; it is able to cover its variable cost. Thus, the firm will produce Oq_1 amount of output and will generate total revenue of:

TR = Price × Quantity of Output sold

so, TR = $OP \times Oq_1$ = area of rectangle $OPEq_1$

The cost of producing Oq_1 level of output is:

TC = SAC × Quantity of Output produced = $OD \times Oq_1$

so, TC = area of rectangle $ODCq_1$

Variable cost incurred to produce Oq_1 level of output is:

TVC = SAVC × Quantity of Output produced = $OA \times Oq_1$

so, TVC = area of rectangle $OABq_1$

Profit = TR – TC

i.e. Profit = area of rectangle $OPEq_1$ – area of rectangle $ODCq_1$

Normal Loss = – area of rectangle $DCEP$

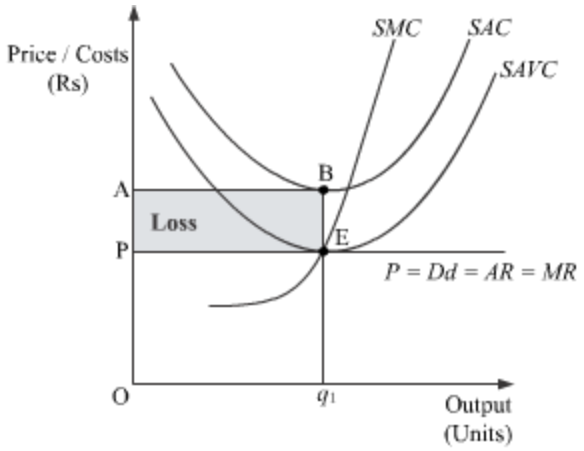
Normal Profit = TR – TVC = area of rectangle $OPEq_1$ – area of rectangle $OABq_1$

so, Normal Profit = area of rectangle $PEBA$

Thus, at equilibrium price OP, the firm is incurring normal loss equal to the area of rectangle $DCEP$ and is also earning normal profit equal to the area of rectangle $PEBA$.

Case 4: *Shut-down Point (Price = minimum of SAVC)*

Let us consider a case, when a firm is facing a price that is equal to the minimum of SAVC. In such a situation, the firm is incurring the maximum losses associated with the production.



In this case, the price is so low that firm is unable to cover any part of the fixed cost incurred. The minimum point of SAC is above the market price, which ensures that the firm is earning losses. As the price is equal to the minimum of SAVC, so it indicates that the total revenue earned by the firm is just enough to cover only the variable cost incurred. Thus, the total loss incurred by the firm is equal to the amount fixed cost incurred.

At equilibrium point E, equilibrium output is Oq_1 units and equilibrium price is *OP.* The total revenue earned by the firm is:

TR = Price × Quantity of Output sold

i.e. TR = $OP \times Oq_1$ = area of rectangle $OPEq_1$

Total cost of producing Oq_1 level of output is:

TC = SAC × Quantity of Output produced

TC = $OA \times Oq_1$ = area of rectangle $OABq_1$

Profit = TR – TC

i.e. Profit = area of rectangle $OPEq_1$ – area of rectangle $OABq_1$

so, Profit (Loss) = – area of rectangle *ABEP*

The loss incurred by the firm is equal to the fixed cost incurred, so

Fixed Cost = Amount of loss = area of rectangle *ABEP*

This point is also known as ***shut-down point.*** This is because if price falls below *OP*, then the firm will not be able to cover its variable costs as well as the fixed costs, therefore, it should stop production. This is because by producing nothing it will face lesser amount of

losses (which will consists of only fixed cost) as compared to losses associated with producing any positive level of output (which will consist of both fixed and variable costs).

Long-Run Equilibrium

The three conditions for producer's equilibrium in long run are:

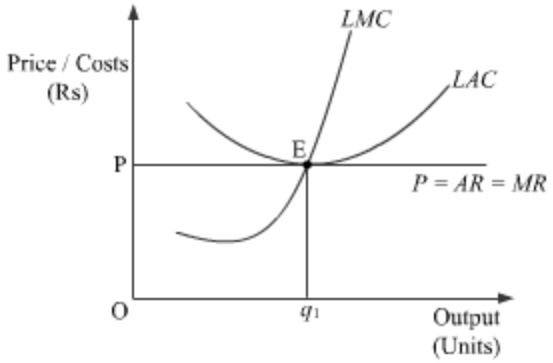
$$\left.\begin{array}{l} 1)\ P = LMC = LMR \\ 2)\ LMC \text{ curve should be rising} \\ 3)\ P \geq \text{minimum of } LAC \end{array}\right\} \text{ at equilibrium output}$$

Unlike short run, in long run because of the following criteria, the number of firms is ***not*** fixed.

1. New firms can ***enter*** into the industry, if there exists supernormal or abnormal profits
2. Existing firms can ***exit*** the industry, if there exists supernormal or abnormal losses.

If the existing firms are earning supernormal or abnormal profits, then this high profit will attract new firms into the industry in the long run. Consequently the total industry's output will be increased. This will lead the price to fall and the price will continue to fall until it becomes equal to the minimum of LAC. The equality of price and LAC implies wiping-out of the abnormal profits. Once the market price becomes equal to minimum of LAC, no new firms will enter as there is no abnormal profit and all the existing firms (including old and new entrants) will earn zero economic profit (normal profit). In the figure below, the firm attains its equilibrium at point E with OP as the equilibrium market price and Oq_1 as the equilibrium level of output.

On the other hand, if the firms are incurring losses, then the existing (old) firms start leaving the industry in the long run. Consequently, the total industry's output will fall which in turn will push up the market price. The firms will continue to exit the industry until the price becomes equal to the minimum of LAC. The equilibrium will take place at that point where the price is equal to the minimum of LAC. In the figure below, the firm attains its equilibrium at point E with OP as the equilibrium market price and Oq_1 as the equilibrium level of output.



Total Revenue earned by the firm is:

TR = Price × Quantity of output sold = $OP \times Oq_1$

so, TR = area of rectangle Oq_1EP

The total cost of producing Oq_1 level of output is:

TC = LAC × Quantity of Output produced = $OP \times Oq_1$

so, TC = area of rectangle Oq_1EP

Normal Profit (π) = TR – TC = area of rectangle Oq_1EP – area of rectangle Oq_1EP = 0 = zero economic profit

It should not be misunderstood, that as the firm is earning zero economic profit (normal profit), so the firm will stop production and will move out of the industry. This is not true, as the firm is earning zero economic profit which implies that it is earning normal profits.

Important Notes:

1. *Unlike the short run, in long run there is no concept of fixed costs. This is because in the long run all factors are variable.*
2. *In long run no firm in an industry can earn losses.*

Firm Supply Curve – Short Run and Long Run and Its Determinants Market Supply Curve

Objectives

After going through this chapter, you shall be able to understand the following concepts.

- Concept of Supply Curve, Short Run Supply Curve and Long Run Supply Curve
- Determinants of Firm's Supply Curve

Introduction

Supply of output implies quantity of produced output offered for sale at various prices in a market at a particular point of time. The graphical presentation of the relationship between various quantities of output offered for sale and various prices of the output is called supply curve. A supply curve is a positively sloped curve, which ensures the positive relationship between the quantity supplied and price of the output. Higher the price of an output, higher is the profit associated with its sale, thereby higher is the supply of the output.

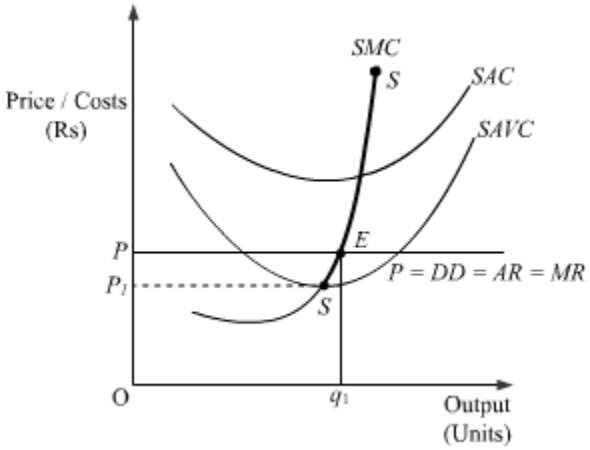
Supply Curve of a Firm

Supply curve of an individual firm depicts the graphical presentation of different output quantities (plotted on the *x*-axis) that the firm wants to supply at the corresponding different prices (plotted on the *y*-axis). In order to derive the firm's supply curve, we need to consider firm's responses to different market prices in different time-horizons; Short run and long run. Let us consider the firm's supply curve in the short run.

Short Run Supply Curve of a firm

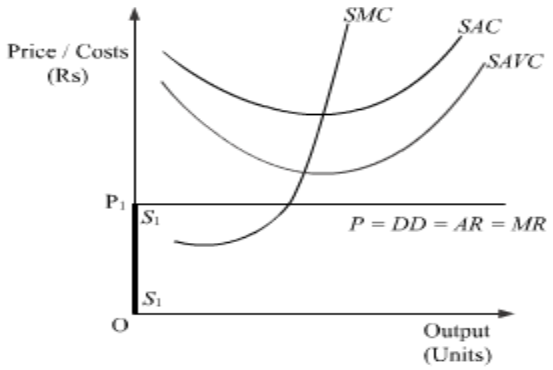
The derivation of a firm's short run supply curve involves the following two stages.

***Stage 1*: *When Price is greater than or equal to minimum SAVC* (*P ≥ minimum of SAVC*)**



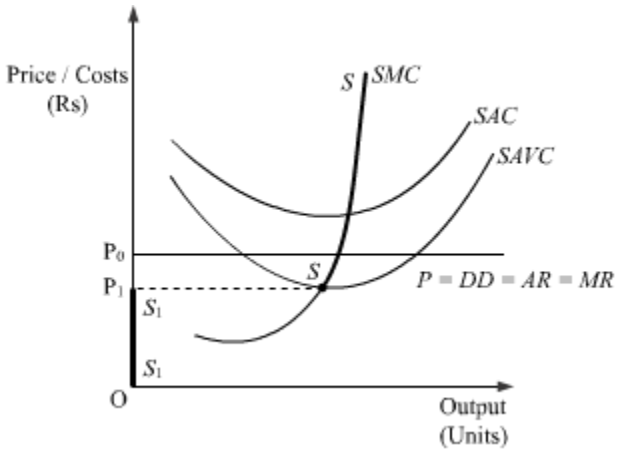
Let us consider the case when a perfect competitive firm is facing a market price *OP* which exceeds the minimum of SAVC. The point E is the short run equilibrium point for the firm, where MC = MR and the MC is upward sloping at this point of intersection. Thus, the firm is producing the profit maximising output Oq_1. As the firm is producing Oq_1 level of output at the given market price of OP, so it can be said that the firm is supplying Oq_1 quantities of output. Therefore, the part of short run supply curve of the firm is regarded as the *upward sloping part of SMC above the minimum point of SAVC*, i.e. SS. The supply curve is indicated by SS (darkened part of SMC) for the situation when the market price is greater than or equal to the minimum of SAVC.

***Stage 2*: *When Price is lesser than the minimum SAVC* (*P < minimum of SAVC*)**



Now, let us assume that the firm is facing price OP_1, which is lesser than the minimum of SAVC. We know that a price is lesser than the minimum of SAVC, At this price, the firm is incurring losses and cannot cover the fixed costs as well as the variable costs. Therefore, to in order to minimise the losses, the firm should stop production. This is because the losses incurred by producing zero units of output (equal to the fixed costs) is *lesser* than the losses incurred by producing any positive units of output (i.e. fixed costs + variable costs). Thus, the firm will not produce anything at this price, thereby the supply will be zero. The firm's supply curve is indicated by the darkened vertical line S_1S_1.

By superimposing the above two figures in a single graph, we get the firms' supply curve in short run.



Summary

When Price ≥ minimum of SAVC	Upward sloping part of SMC above the minimum point of SAVC	When firm operates

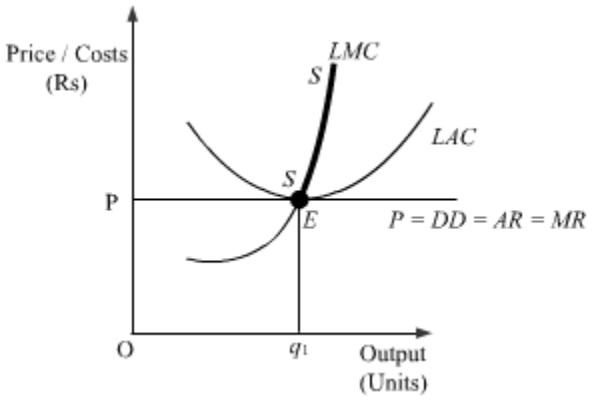
When Price < minimum of SAVC	Vertical part of the price-axis	When firm shuts down

Long Run Supply Curve of a Firm

Similar to the derivation of firm's supply curve in the short run, the derivation of firm's long run supply curve is divided in the following two stages.

***Stage 1*: *When Price is equal to the minimum of LAC* (*P = minimum of LAC*)**

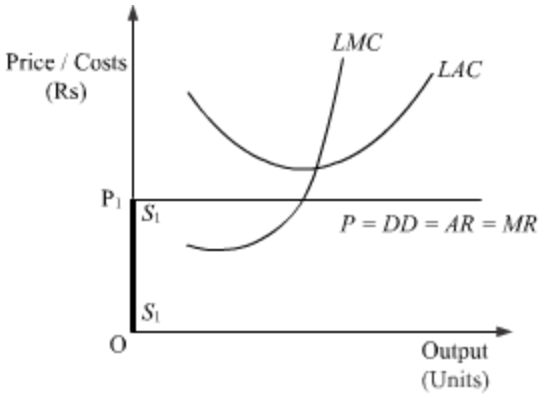
Let us suppose that a perfect competitive firm is facing a market price *OP* which is equal to the minimum of *LAC*. The point *E* is the long run equilibrium point for the firm, where *LMC* = *LMR* and the *LMC* is upward sloping at this point of intersection. Thus, the firm is supplying the profit maximising output Oq_1 in the long run. Therefore, the long run supply curve of the firm is regarded as the *upward sloping part of LMC above the minimum point of LAC*, i.e. *SS*. The part of the long run supply curve is indicated by *SS* (darkened part of *LMC*) for the situation when the market price is equal to the minimum of *LAC*.



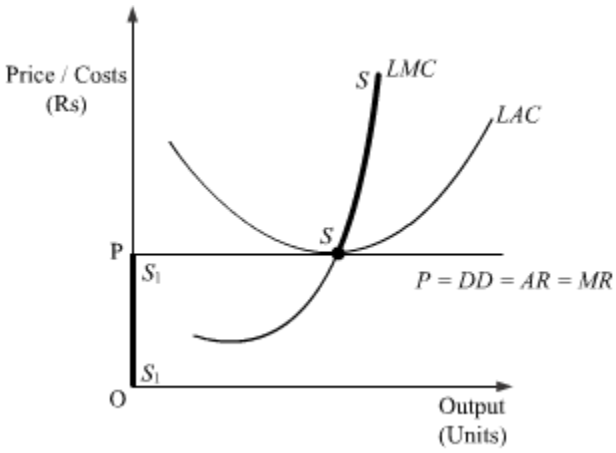
An important point to be noted here, is that while in the short run, the upward portion of ***SMC*** which was above the minimum of *SAVC* was regarded as a portion of the firm's supply curve, on the other hand in the long run, *as there are no fixed costs*, so the supply curve is the upward portion of ***LMC*** above the minimum point of *LAC*.

***Stage 2*: *When Price is less than minimum of LAC* (*P < minimum of LAC*)**

Now, let us assume that the firm is facing price OP_1, which is lesser than the minimum of *LAC*. As the price is below the minimum of *LAC*, so the firm would not produce anything as it will incur losses. Therefore, the long run supply curve of the firm in this case is indicated by the darkened vertical part of the price-axis, i.e. S_1S_1.



By superimposing the above two figures in a single graph, we get the firms' supply curve in long run.



Summary

When Price = minimum of *LAC*	Upward sloping part of *LMC* above the minimum point of *LAC*	When firm operates
When Price < minimum of *LAC*	Vertical part of the price-axis	When firm stops production

Determinants of a Firms Supply Curve

As we explored in the above section that firm's supply curve (short run or long run) is derived from the marginal cost (MC), so the factors that influence the MC will also affect the firm's supply curve. The supply function of a firm can be algebraically presented as:

$S_x = f(P_i, T, G)$

where,

S_x = Supply of output x

P_i = Price of inputs or cost of production

T = State of technology

G = Government policies and Tax policies

1. Price of inputs (P_i)/Cost of Production

A change in the cost of production i.e. prices of the factors of production ***negatively*** affects the supply of the firm. A rise in the input prices (such as, rise in wages, rise in price of raw materials) will lead the average cost to increase, which simultaneously is accompanied by an upward (leftward) shift of the MC curve. This implies that for positive levels of output (i.e. when the price is greater than or equal to minimum of the AC curve), the supply curve will also shift upwards (leftwards) and at a given market price level, firm cuts down its supply. Thus, a rise (or fall) in the input prices will result in fall (or rise) in the supply of the firm.

2. State of Technology (T)

With a given level of capital and labour, if the technology available to a firm appreciates (or depreciates), then the firm can produce more (or lesser) units of output. Due to the technological innovations and advancements, the firm will experience lower cost of production, which is indicated by the rightward or downward shift of MC curve. The rightward shift of the MC curve implies a rightward shift of firm's supply curve. Therefore, due to the technological improvement, the firm will supply more units of output at a given level of market price. Hence, the change in the technological level ***positively*** affects the firm's supply.

3. Government Polices or Tax Policies

Strict government policies and stringent tax laws also affect the firm's supply curve. If government levies high rate of taxes on the firm, then this will raise the cost of production, consequently, the firm will supply lesser units of output.

Let us consider a case, when the government levies a high rate of unit tax is levied on the firm's per unit of output sold. Suppose that a firm is facing price of OP_1. LAC_1 and LMC_1 are the long run average cost curve and long run marginal cost curve. Now, if the government imposes an unit tax of Rs 'k' per unit of output, then this will raise the cost of production as the firm need to pay an extra amount of Rs k on each output supplied. Consequently, the cost curves will shift leftwards (upwards) to LMC_2 and LAC_2. The magnitude of the shift in the cost curves is equal to Rs k. Now, as the supply curve is a part of LMC, so the supply

curve in the figure (ii) will also shift leftward upwards from S_1 to S_2. This shows that the firm will now supply lesser units of of output due to imposition of tax.

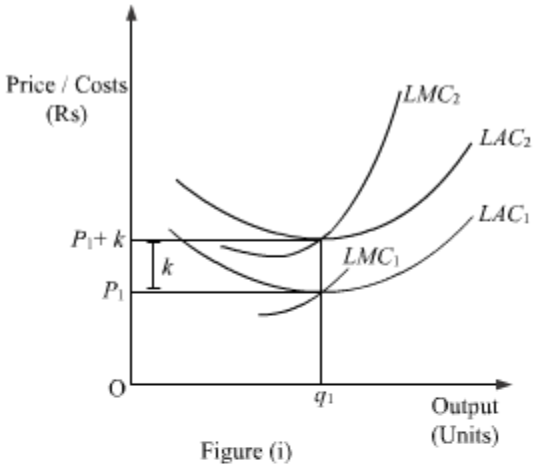


Figure (i)

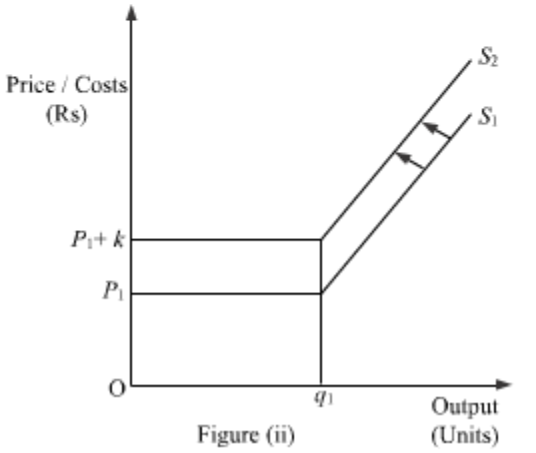


Figure (ii)

Supply

Objectives

After going through this chapter, you shall be able to understand the following concepts.

- Supply Schedule- Individual and Market Supply Schedule
- Supply Curve- Individual and Market Supply Curve
- Law of Supply- Assumptions and Exceptions
- Determinants of Supply
- Change in Quantity Supplied and Change in Supply (Movement along v/s Shift of Supply Curve)

Supply and Quantity Supplied

While supply refers to *different quantities* of a commodity offered for sale at *different prices*, on the other hand, the quantity supplied refers to a *particular amount offered for sale at a specific price*. For example, in the table below, supply means the quantities that are tabulated against different prices at which they are offered for sale. In other words, the whole table is known as *supply/supply schedule*. If in particular we are concerned about the quantity of 10 units that is offered for sale at Rs 2, or quantity of 25 units offered at Rs 5, then we means quantity supplied.

Price (in Rs)	**Quantity** (in units)
1	5
2	10
3	15
4	20
5	25

Supply or Supply Schedule

It is a tabular presentation representing different quantities of a commodity offered for sale corresponding to the different prices at which these quantities are offered for sale. The following table is supply schedule/supply.

Price (in Rs)	**Quantity** (in units)
1	5
2	10
3	15
4	20
5	25

There are two types of supply schedule.

1. Individual supply schedule
2. Market supply schedule

Individual Supply Schedule

It refers to the supply schedule of an individual producer or a firm. This schedule represents the different quantities supplied at different prices by an individual firm or producer.

Individual Supply Schedule

Price (in Rs)	Quantity Supplied (in units)
1	10
2	20
3	30
4	40
5	50

Market Supply Schedule

It refers to the supply schedule of all the producers or firms in a market. It is a tabular presentation of sum total of quantities supplied by all the firms in the market at different price level. It represents the supply schedule of market as a whole.

Market Supply Schedule			
Price (in Rs) *A*	**Quantity Supplied by Firm 1 (f_1)** (in units) *B*	**Quantity Supplied by Firm 2 (f_2)** (in units) *C*	**Market Supply M = $f_1 + f_2$** (in units) *D = B + C*
1	5	10	5 + 10 = 15
2	10	20	10 + 20 = 30
3	15	30	15 + 30 = 45
4	20	40	20 + 40 = 60
5	25	50	25 + 50 = 75
6	30	60	30 + 60 = 90

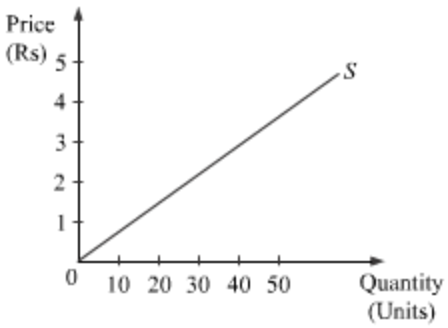
Supply Curve

It is graphical presentation of supply schedule showing different quantities of a commodity at offered to sale at different prices. It is an upward sloping curve depicting the positive relationship between the price and quantity supplied. There are two types of supply curve.

1. Individual Supply Curve
2. Market Supply Curve

Individual Supply Curve

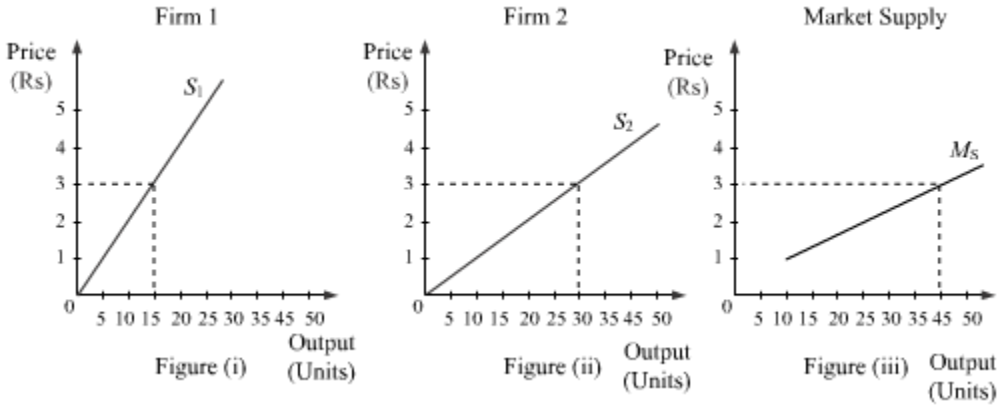
It refers to the graphical presentation of quantities supplied by an individual firm or producer (plotted on the *x*-axis) and different prices (plotted on the *y*-axis) at which the quantities are offered for sale. In other words, it is a graphical presentation of the individual supply schedule, in a price-quantity supplied plane. Plotting the above individual supply schedule on a graph, we get the following individual supply curve.



Market Supply Curve

It refers to the graphical presentation of aggregate quantities supplied by all the firms or producers (plotted on the *x*-axis) and different prices (plotted on the *y*-axis) at which the quantities are offered for sale. In other words, it is the horizontal summation of the individual supply curves of all the firms in a market. Thus, we can say that market supply curve is a graphical presentation of the market supply schedule.

In the figure (i) and figure (ii), we have plotted the individual supply of the firm 1 and firm 2. Horizontally summing the individual supply curve of both the firms, we get the market supply curve in the figure (iii). At price of Rs 3, firm 1 is supplying 15 units of output and firm 2 is supplying 30 units of output, consequently the quantity supplied in the market at price Rs 3 is 45 units (i.e. 15 units + 30 units).



Derivation of Market Supply Curve- with the help of Supply Function

Supply function denotes the level of output that an individual firm is willing to supply at different prices.

Let us suppose that there exist only two firms namely, firm 1 and firm 2 in an industry. The two firms have different cost structures and supply functions.

Let the supply function for firm 1 is defined as follows.

For firm 1	$S_1(p)$	0	for $p < 10$
		$p - 10$	for $p \geq 10$

The supply function for firm 1 denotes that for any price less than Rs 10 per unit, the firm will not supply any output. On the other hand, for any price equal to or greater than Rs 10 per unit, the firm will supply output according to the supply function '$p - 10$'.

Now, let the supply function for firm 2 is defined as follows.

For firm 2	$S_2(p)$	0	for $p < 15$
		$p - 15$	for $p \geq 15$

The supply function of firm 2 denotes that for any price less than Rs 15 per unit, the firm will not supply any output. However; for any price equal to or greater than Rs 15 per unit, it will supply according the supply function '$p - 15$'.

As we know that the market supply is the aggregation of the individual supplies of all the firms in the industry, so the market supply function for this industry is:

Market Supply $(S_m) = S_1(p) + S_2(p)$

where,

S_m represents the Market Supply function

S_1 represents the Supply function of the Firm 1

S_2 represents the Supply function of the Firm 2

Price	**Output Supplied by Firm 1 (S_1)**	**Output Supplied by Firm 2 (S_2)**	**Market Supply Function ($S_1 + S_2$)**
For any price less than Rs 10 **($P <$ Rs 10)**	Zero	Zero	Zero + Zero = Zero
For any price more than or equal to Rs 10 but less than Rs 15 **(Rs 10 ≤ $P <$ Rs 15)**	$(p - 10)$	Zero	$(p - 10)$ + Zero = $(p - 10)$

For any price more than or equal to Rs 15 **($P \geq$ Rs 15)**	$(p - 10)$	$(p - 15)$	$(p - 10) + (p - 15)$ $= p - 10 + p - 15$ $= 2p - 25$

Let us now derive the market supply curve graphically.

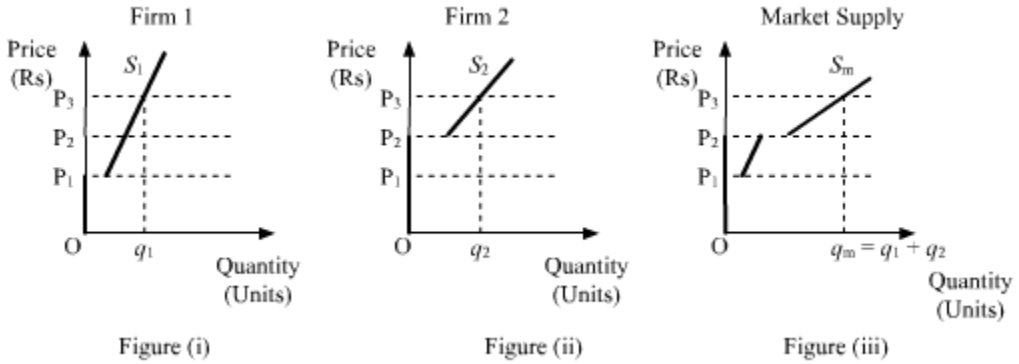


Figure (i) Figure (ii) Figure (iii)

The supply curve of firm 1 is denoted by S_1S_1 in the figure (i) and that of firm 2 is denoted by S_2S_2 in the figure (ii) and the market supply curve is denoted by S_mS_m in the figure (iii).

From the figure, we can observe that for any price which is less than Ts 10 per unit, the two firms will not supply any output. Thus, the supply curve of both the firms will be a vertical straight line along the *y*-axis (denoted by the darkened vertical line on the *y*-axis). Horizontally summing up both the supply curves, the market supply for any price less than Rs 10 is also zero and the market supply curve is a vertical straight line along the *y*-axis (in the figure iii).

Assume that if the price rises above Rs 10 per unit but is less than Rs 15 per unit. At this price level, the firm 1 will supply a positive level of output according to its supply function. Accordingly, its supply curve is an upward sloping line. However, as the price is less than Rs 15 per unit, so the firm 2 still produces zero units of output. Horizontally summing up both the supply curves, the market supply is the supply curve of the firm 1 (as firm 2 is producing nothing).

If the price rises above Rs15 per unit, then both the firms will supply a positive level of output as per their respective supply functions. Both the firms face an upward sloping supply curve. Accordingly, the market supply curve is also upward sloping.

Assumptions to Law of supply

The following are the assumptions on which the law of supply is based.

1. Price of the related goods (such as, substitute goods and complementary goods) remains same $(\overline{P}_y)$.
2. Price of inputs or firm's cost of production remains same $(\overline{P}_i)$.
3. State of technology does not change, i.e. there is neither appreciation nor depreciation of the existing technology $(\overline{T})$.
4. Government Policies remains unchanged $(\overline{G})$.
5. The objective of firm remains unchanged.
6. There is no change in the natural factors and there is no advent of any natural calamity such as earthquake, etc.

Law of Supply

According to the law of supply, quantity supplied of a commodity is positively related to the price of the commodity, other things remaining constant. In other words, when the price of a commodity rises (or falls), then the quantity supplied will increase (or decrease), other things remaining unchanged. Algebraically, the law of supply can be expressed as:

$$Q_x = f(P_x, \overline{P}_y, \overline{T}, \overline{P}_i, \overline{G}, \overline{G}_F, \overline{N}_F)$$

where,

Q_x = Quantity supplied of commodity '*x*'

P_x = Price of commodity *x*

P_y = Price of related goods (Substitutes or complementary goods)

T = State of technology

P_i = Price of inputs, raw materials or cost of production

G = Government policy

N_F = Natural factors

G_F = Goal of the firm

Important Note- The bar over the variables represents that they are constant, i.e. ceteris *paribus* (remains same)

Exceptions to the law of supply

1. ***Artistic Goods***- The artistic goods are goods of high quality such as, paintings, etc. do not support law of supply. This is because such goods are limited availability
2. ***Perishable Goods***- The perishable goods such as, milk, meat, etc. do not support law of support the law of supply. This is because these products have very-short period of life, therefore more units of these goods are sold at lower prices.
3. Law of supply is not applicable in the underdeveloped and backward countries which faces lack of sufficient productive resources.
4. ***Agricultural Sector***- The law does not apply to the agricultural products due to high degree of uncertainty attached to them. For example, no matter whatever be the price, the supply of wheat cannot be increased in the short run, in the event of any natural calamity or crop failure.

Why supply curve is upward sloping?

The supply curve slopes upward because of the following two reasons:-

1. ***Law of Diminishing Marginal Productivity***- According to the law of diminishing marginal productivity, as more and more units of variable factors are employed, a point is reached beyond which the additional returns to the variable factor starts falling. This raises the marginal and average costs. Therefore, the supplier will supply more units of output at higher prices so as to cover the higher cost of production. Hence, the supply curve slopes upwards.
2. ***Profit Maximisation Goal of Firm***- The main motive that drives the producer to undertake production process is to earn profits and maximise them. For a given cost of production, if the producer charges higher prices, then it implies higher profits for the producer, thereby higher supply of the outputs.

Determinants of Supply

The supply of a commodity depends on different variables other than the price of that commodity. The relationship between these variables and the supply of a commodity can be expressed in a functional form known as *supply function*.

$$Q_x = f(P_x, P_y, P_i, T, G, G_F, N_F)$$

where,

Q_x = Quantity supplied of commodity 'x'

P_x = Price of commodity x

P_y = Price of related goods (Substitutes or complementary goods)

T = State of technology

P_i = Price of inputs, raw materials or cost of production

G = Government policy

N_F = Natural factors

G_F = Goal of the firm

1. ***Price of Commodity***- Other higher remaining constant, at higher prices the producers prefer to increase their sale by increasing their supply and vice-versa. Thus, there exists a direct relationship between the price and the supply of a commodity.
2. ***Price of Related Goods***- A rise in price of substitute goods will make the production of those goods profitable for a producer, hence, the producer will try to increase the production of those goods (the subsititute ones). This will leave the producer with lesser amount of resources to be allocated to the production of other goods, hence, the supply of the other goods will fall. For example, if a producer produces both tea and coffee and in case, the price of coffee rises, then the producer tries to allocate more of the available resources to the production of coffee, which will automatically reduce the production (and supply) of tea. In this way, there exists a negative relationship between price change of a substitute good and supply of other goods. Similar to the substitute goods, complementary goods also affect the supply of a good. A rise in the price of a complementary good, will encourage a producer to produce more of the related goods. For example, suppose that price of ink increases, then it will be more profitable for a pen-producing firm to produce more pens. Hence, there will a rise in the supply of pen (due to rise in the price of ink). Thus, there exists a positive relationship between price change of a complementary good and supply of related goods.
3. ***Price of Inputs***- If the price of inputs increases, then the cost of production also increases, other things remaining the same. Due to the rise in the cost of productions, it becomes relatively lesser profitable for a producer to produce, consequently, lesser quantity is supplied at the given price. On the other hand, if the input prices falls, then the cost of production also falls, thereby, the producer supplies more quantities of output at the given price. Thus, change in the input prices negatively affects the supply of a product.
4. ***State of Technology***- Other things remaining the same, if the level of available technology appreciates, then the per unit cost of production goes down, which implies higher supply of output and vice-versa.
5. ***Government Policy***- Other things remaining constant, if the government policies are more stringent and strict such as high rate of tax, then the cost of production will be high. The high cost of production will discourage the producer, thereby supply will decrease.
6. ***Goal of Firm***- The goal of a particular firm can either be maximisation of profits or maximisation of sales. If a particular firm aims at maximising its profit, then more units of output will be supplied at higher price and as a result higher profit. On the other hand, if the firm aims at maximisation of sales, then more of output will be sold at same price to maximise sales.

7. ***Natural Factors***- Other things remaining the same, in the event of any natural calamity such as, earthquake, flood, etc., the supply of output will fall. For example, the supply of agricultural product is adversely affected in case of flood and crop failure.

Change in Quantity Supplied (Graphical known as Movement along Supply Curve)

The change in quantity supplied is associated with the change in the price of good ***P_x only***, assuming other determinants remaining unchanged. The change in the quantity supplied is graphically known as the movement along the supply curve.

If the supply function is written as:

$Q_x = f(P_x, P_y, P_i, T, G, G_F, N_F)$

Then, the movement along the supply curve implicitly implies that all the other determinants other than the price of good (P_x) are constant and the change in Q_x is totally because of the change in the price of the good (P_x), i.e.

$$Q_x = f\left(P_x, \overline{P}_y, \overline{T}, \overline{P}_i, \overline{G}, \overline{G}_F, \overline{N}_F\right)$$

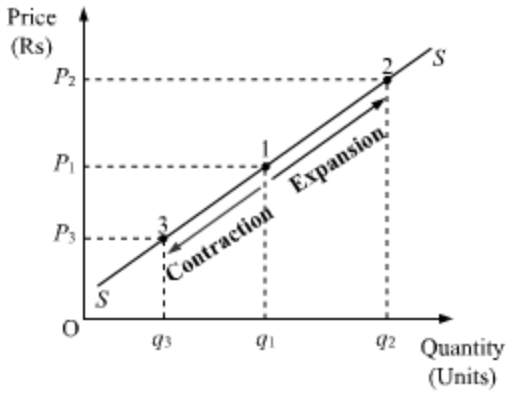
The bar above the variables denotes that they are non-changing (or constant).

Movement along the supply curve are of two types:

1. Expansion of Supply
2. Contraction of Supply

Expansion of supply refers to the rise in the supply of output due to the rise in price of that particular output, whereas, contraction of supply refers to the fall in supply of output due to the fall in price of that output.

In the following graph, the expansion of supply is represented by an upward movement from point 1 to point 2, whereas, the contraction of supply is represented by downward movement from point 1 to point 3.



Change in Supply (Graphically known as Shift in the Supply Curve)

Unlike the movement along the supply curve, the change in supply is caused due to the change in all other variables other than the price of a good (i.e. *price of the good remains same*).

The change in the supply is algebraically represented as:

$$Q_x = f\left(\overline{P}_x, P_y, P_i, T, G, G_F, N_F\right)$$

The change in supply is graphically known as *Shift in the supply curve*. The shift in the curve can be of following two types:

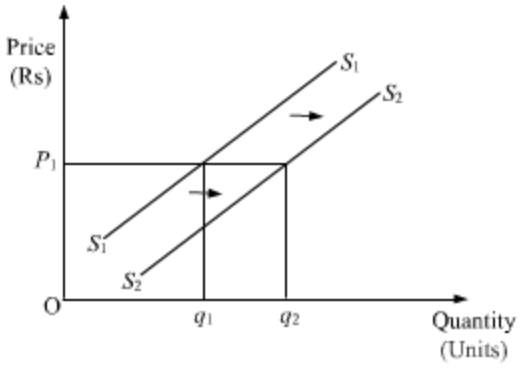
1. Increase in Supply
2. Decrease in Supply

Increase in supply refers to the increase in supply due to the favourable changes in the determinants other than the price of the good.

The following are the causes for the increase in supply.

1. Fall in price of the substitute goods **($P_y \downarrow$)**
2. Rise in the price of complementary good **($P_y \uparrow$)**
3. Fall in the input prices **($P_i \downarrow$)**
4. Appreciation of technology level **($T \uparrow$)**
5. Fall in the tax rates or liberal government policies **($G \downarrow$)**
6. Shift in the goal of the firm from profit maximisation objective to sales maximisation objective.

The increase in supply is graphically shown in the following figure, by parallel rightward shift in the supply curve from S_1S_1 to the new supply curve S_2S_2. It can be analysed from the figure that due to the increase in the supply, ***higher quantity of output is supplied at the given price level of OP_1***.



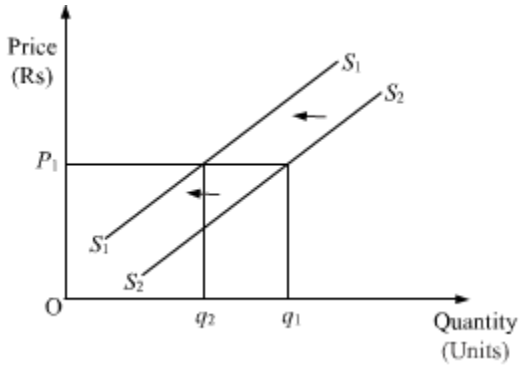
(b) Decrease in supply

Decrease in supply refers to the fall in the supply due to unfavourable changes in the determinants other than price of a good (i.e. *price of the good remains same*).

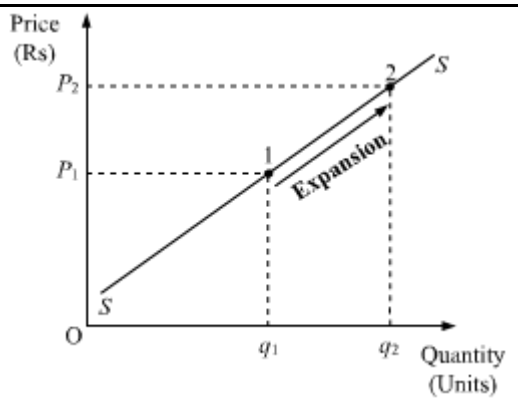
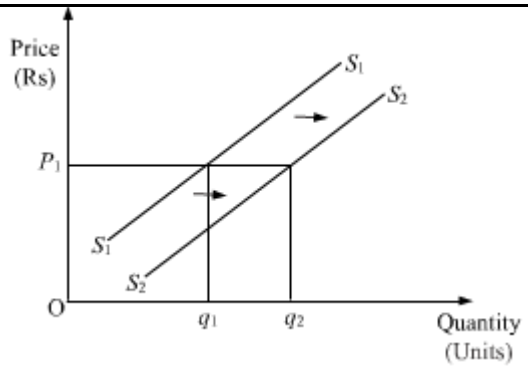
The following are the causes for the decrease in supply.

1. Increase in the price of substitute goods **($P_y \uparrow$)**
2. Decrease in the price of complementary goods **($P_y \downarrow$)**
3. Increase in input prices **($P_i \uparrow$)**
4. Depreciation of technology used or use of obsolete technology **($T \downarrow$)**.
5. Increase in the tax rates or strict government policies **($G \uparrow$)**
6. Shift in the goal of the firm from sales maximisation objective to profit maximisation objective.

The decrease in supply is graphically shown in the following graph. The leftwards upward shift of the supply curve from S_1S_1 to the new supply curve S_2S_2 depicts decrease in supply. It can be analysed from the figure that due to the decrease in the supply, ***lower quantity of good is supplied at the given price level of*** OP_1.

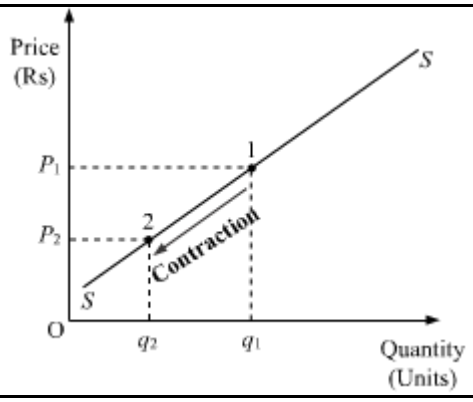
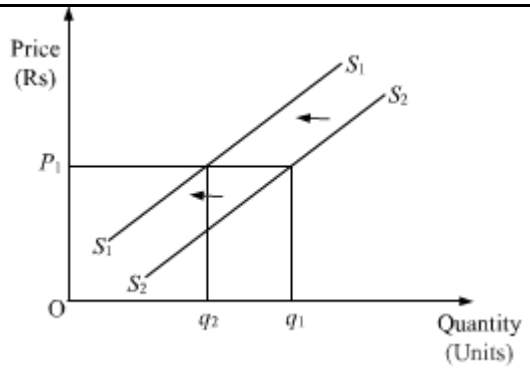


Difference between Expansion of Supply and Increase in Supply

Basis of Difference	Expansion of Supply	Increase in Supply
Reasons/Causes	It is caused due to the rise in the price of that particular good.	It is caused by the factors other than price of the good. Rise in price of the substitute goods **($P_y \uparrow$)** Fall in the price of complementary good **($P_y \downarrow$)** Fall in the input prices **($P_i \downarrow$)** Appreciation of technology level **($T \uparrow$)** Fall in the tax rates or liberal government policies **($G \downarrow$)** Shift in the goal of the firm from profit maximisation objective to sales maximisation objective.
Graphically shown as	It is shown by upward movement along the same supply curve.	It is shown by parallel rightward shift of the supply curve.
Price	Price rises.	Price remains the same.
Diagrammatically		

Difference between Contraction of Supply and Decrease in Supply

Basis of Difference	Contraction of Supply	Decrease in Supply

Reasons/Causes	It is caused due to the fall in the price of that particular good.	It is caused by the factors other than price of the good. Decrease in the price of complementary goods **($P_y \downarrow$)** Increase in the price of substitute goods **($P_y \uparrow$)** Increase in input prices **($P_i \uparrow$)** Depreciation of technology used or use of obsolete technology **($T \downarrow$)**. Increase in the tax rates or strict government policies **($G \uparrow$)** Shift in the goal of the firm from sales maximisation objective to profit maximisation objective.
Graphically shown as	It is shown by downward movement along the same supply curve.	It is shown by parallel leftward shift of the supply curve.
Price	Price falls.	Price remains the same.
Diagrammatically		

Elasticity of Supply (Es)

Objective

After going through this chapter you shall be able to understand the following concepts

- Concept of Price Elasticity of Supply
- Measurement of Price Elasticity of Supply
- Factors Affecting Elasticity of Supply

Introduction to Price Elasticity of Supply

We know that supply of a commodity shares a positive relationship with the price of the commodity. A rise in the price of a commodity leads to a rise in its quantity supplied and a fall in the price of a commodity leads to a fall in its quantity supplied. The concept of price elasticity of supply helps us in judging exactly how does the supply of a commodity respond to the changes in its price. In other words, elasticity of supply helps us in measuring the relative change in the supply to a given change in the price.

***Price Elasticity of Supply* (E_s)** *measures the responsiveness of quantity supplied of a commodity to the change in its price. It assists us in knowing the magnitude of the change in supply due to the change in its price. In other words, it shows how (sluggishly) or how fast (quickly) the supply responds to the change in the price.*

Algebraically, it is calculated as:

$$E_s = \frac{\text{Percentage Change in Quantity Supplied}}{\text{Percentage Change in Price}}$$

$$= (+) \frac{\frac{\Delta Q}{Q_1} \times 100}{\frac{\Delta P}{P_1} \times 100}$$

$$= (+) \frac{\Delta Q}{Q_1} \times \frac{P_1}{\Delta P}$$

$$= (+) \frac{\Delta Q}{\Delta P} \times \frac{P_1}{Q_1}$$

where,

ΔQ represents change in the quantity supplied i.e. $(Q_2 - Q_1)$

ΔP represents change in the price i.e. $(P_2 - P_1)$

P_1 represents the initial price

P_2 represents the final price

Q_1 represents the initial quantity supplied

Q_2 represents the final quantity supplied

***Note**: The plus* (+) *sign in the formula of Elasticity of Supply confirms the positive relationship between the supply of a commodity and its price.*

Measurement of Price Elasticity of Supply

The price elasticity of supply can be measured by the following two methods *namely*:

1. Proportionate Method

2. Geometric Method

Proportionate or Percentage Method

According to this method, the price elasticity of supply is given by the ratio of percentage change in the quantity supplied and percentage change in the price of commodity.

Algebraically, it can be expressed as:

$$E_s = \frac{\text{Percentage Change in Quantity Supplied}}{\text{Percentage Change in Price}}$$

$$\text{or, } E_s = (+)\frac{\frac{\Delta Q}{Q}\times 100}{\frac{\Delta P}{P}\times 100}$$

$$\text{or, } E_s = (+)\frac{\Delta Q}{\Delta P}\times\frac{P}{Q}$$

Example

Let us understand the concept of the price elasticity of supply with the help of following numerical example.

Suppose the supply curve of a firm is expressed by the following supply function.

$Q_s = 20 + P$

Let the initial price i.e. P_1 be Rs 10

and the initial quantity supplied i.e. Q_1 be 30 units (i.e. $Q_1 = 20 + 10 = 30$ units)

Now, assume that the price increases (P_2) i.e. Rs 30

So, the quantity supplied at the new price increase to $Q_2 = 50$ units (i.e. $Q_2 = 20 + 30 = 50$ units)

Thus, the change in the quantity supplied i.e. $\Delta Q = Q_2 - Q_1 = 50 - 30 = 20$ units

and the change in the price i.e. $\Delta P = P_2 - P_1 = 30 - 10 = \text{Rs } 20$

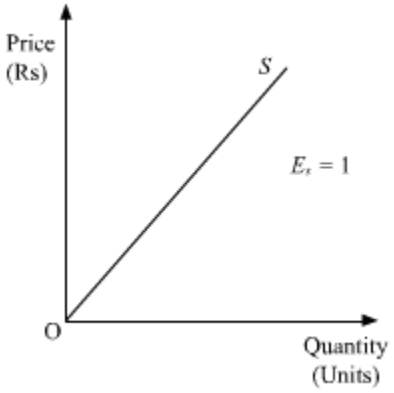
$$E_s = \frac{\Delta Q}{\Delta P} \times \frac{P_1}{Q_1}$$

$$\text{or, } E_s = \frac{20}{20} \times \frac{10}{30} = (+)0.33$$

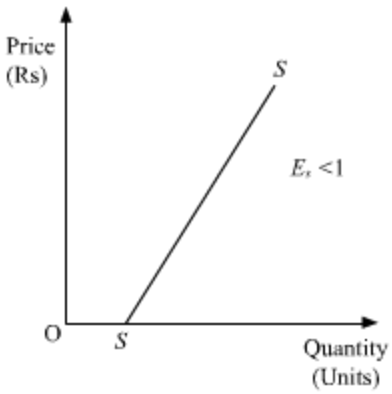
Geometric Method

The geometric method is a graphical presentation of the elasticity of the supply. This method does not involve any calculation part. Just by looking at the shape of the supply curve, we can infer about the degree of the elasticity of the supply. The degree of the price elasticity of supply depends on the ***slope*** and ***origin*** position of the supply curve. There are following five possible situations.

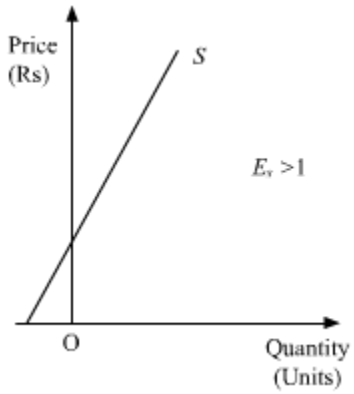
a. ***Unitary Elasticity of Supply*** **(E_s=1)**- If the straight line supply curve originates from the ***origin,*** then irrespective of the angle of inclination of the supply curve, the elasticity of supply will always be equal to one i.e. **(E_s=1)**. Such a supply curve is called unitary elastic supply curve.



b. ***Less Elastic Supply*** **(E_s < 1)**- If the supply curve originates from the ***horizontal intercept*** of quantity-axis, then irrespective of the angle of inclination of the supply curve, the elasticity of the supply curve will be less than one i.e. **(E_s < 1)**.



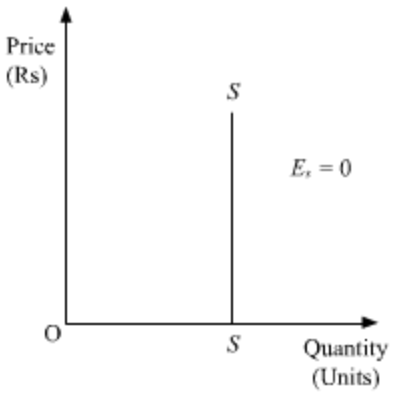
c. ***More Elastic Supply*** **(E_s > 1)**- Unlike the less elastic supply curve, the relatively more elastic supply curve originates from the ***vertical intercept*** of price-axis. The value of elasticity of supply originating from the vertical intercept is greater than one, i.e. **(E_s > 1)**.



Two Extreme Cases- Perfectly Elastic Supply and Perfectly Inelastic Supply

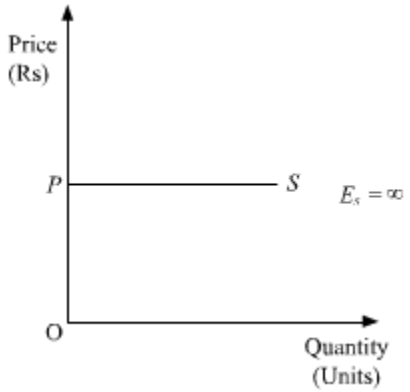
d. ***Perfectly Inelastic Supply/Zero Elasticity of Supply***

In this particular case, the quantity supplied is ***totally unresponsive*** to the change in price of a good. In other words, no matter whatever the price level is, the quantity supplied ***does not*** change at all. In such a situation, the supply curve originates from the horizontal intercept of the quantity-axis and remains ***vertically parallel to the price axis.*** In the following figure, *SS* is a perfectly inelastic supply curve which is vertically parallel to the price-axis. In this case, the value of elasticity of supply is zero, i.e. E_s = 0, therefore, also known as zero elasticity of supply or perfectly inelastic supply.



e. ***Perfectly Elastic Supply/Infinite Elasticity of Supply***

On the contrary to the perfectly inelastic supply, perfectly elastic supply implies a situation, where the quantity supplied is fully (or highly) responsive to the change in the price of the good. In this particular case, a very small change in the price leads to an infinite change in the quantity supplied. A perfectly elastic supply curve originates from the vertical intercept of price-axis and remains ***horizontally parallel to the quantity axis.*** In the following figure, *SS* represents a perfectly elastic supply curve, which is horizontally parallel to the quantity-axis. The value of the elasticity of supply is infinite, i.e. $E_s = \infty$, therefore, also known as infinite elastic supply.



Value of Price Elasticity of Supply and its Degree

The value of price elasticity of supply lies in the range of ***zero to infinity*** i.e. **zero ≤ E_s ≤ ∞**. Based on the degree of responsiveness of supply to change in price, we can differentiate between the three possible situations.

1. ***Elastic Supply***- When supply of a good is *highly responsive* to the changes in its price, then the supply of the good is said to be price elastic. In this case, the percentage change in the supply is ***greater*** than the percentage change in the price. Hence, the value of price elasticity of supply is greater than one, i.e. **E_s > 1**.

2. ***Unitary Elastic***- When supply of a good is *equally responsive* to the change in the price, then the supply of the good is said to be unitary elastic. In this case, the percentage change in the supply is ***equal*** to the percentage change in the price. Hence, the value of the price elasticity of supply is equal to one, i.e. $E_s = 1$.
3. ***Inelastic Supply***- When supply of a good is *less responsive* to the changes in its price, then the supply of the good is said to be price inelastic. In this case, the percentage change in the supply is relatively lesser than the percentage change in the price. Hence, the value of the price elasticity of supply is less than one, i.e. $E_s < 1$.
4. ***Perfectly inelastic supply***-When supply of a good is *extremely unresponsive* to the changes in the price, then the supply of the good is said to be perfectly inelastic. In this case, irrespective of the change in the price, the supply of the good remains same and unchanged. The value of the price elasticity of supply is zero, i.e. $E_s = 0$.
5. ***Perfectly elastic Supply***- When supply of a good is *extremely responsive* to the changes in the price, then the supply of the good is said to be perfectly elastic. In this case, even a small change in the price leads to an infinite change in the supply. Hence, the value of the price elasticity of supply is infinity, i.e. $E_s = \infty$.

Factors Affecting Elasticity of Supply

The price elasticity of supply of a good depends on a variety of factors. The following are the factors which affect the elasticity of supply.

1. ***Nature of the commodity***- A commodity can be a perishable commodity or a durable commodity. Perishable goods (such as food grains, milk products, etc.) cannot be stored for a longer time, therefore, their supply cannot be changed immediately. Accordingly, such goods have ***more inelastic supply***. As against this, durable goods (such as furniture, T.V, etc.) can be stored for a comparatively longer period of time. Accordingly, such goods have ***more elastic supply***.
2. ***Production Inputs***- If the inputs used for the production of the commodity are commonly and easily available, then the supply of the commodity is ***elastic***. On the other hand, if the production of the commodity requires certain specialised inputs that are scarcely available, then the supply of the commodity will be ***inelastic***.
3. ***Time Factor***- The longer time period implies that the producer is having sufficient time to adjust the factors of production to change the supply of the goods. On the other hand, shorter time period implies that the producer will have comparatively lesser time to change the supply. As in the long run, the supply can be easily changed, so the supply is ***more elastic***. On the contrary, in the short run, the supply cannot be changed easily, so the supply is ***less elastic***.
4. ***Cost* Behaviours-** When total cost of production increases at decreasing rate, then the supply will be ***more elastic*** as this will encourage the seller to supply more units of output in response to a price rise. On the other hand, if total cost rises at increasing rate, then the supply will be ***less elastic***.
5. ***Risk Factor***- If, the entrepreneurs are daring and are ready to undertake risk, then the supply will be ***more elastic***. On the other hand, if the entrepreneurs fears to take risk due

to lack of incentive or because of strict government policies, then the supply will be ***less elastic***.

6. ***Production Techniques and Methods***- If the production technology or methods of production employed by a particular firm is highly sophisticated and complicated, then the supply will be ***inelastic***. On the other hand, if the production method is easy and simple, then the supply of the output will be relatively ***more elastic***.
7. ***Factor Mobility***- If the factors of production are mobile (i.e. can change place such as labour), then the supply of the output will be ***more elastic***, whereas, if the factors of productions are immobile or comparatively lesser mobile, then the supply of the output will be ***more inelastic***.
8. ***Price Expectation***- If the producers expect that in the near future the price will rise, then they may hold back the present supply and supply lesser quantity at present price in order to supply more quantities in the future at higher price. This implies that the supply of goods will be ***more inelastic***. On the other hand, if the producer expects the price to fall in the future, then the supply will be ***more elastic***.