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Unit 5: Market Equilibrium

Name: _____

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Equilibrium, Excess Demand, Excess Supply

An equilibrium is defined as a situation where the plans of all consumers and firms in the market match and the market clears. In equilibrium, the aggregate quantity that all firms wish to sell equals the quantity that all the consumers in the market wish to buy; in other words, market supply equals market demand. The price at which equilibrium is reached is called equilibrium price and the quantity bought and sold at this price is called equilibrium quantity. It is represented as:

$$q^D(p^*) = q^S(p^*)$$

If at a price, market supply is greater than market demand, we say that there is an excess supply in the market at that price and if market demand exceeds market supply at a price, it is said that excess demand exists in the market at that price. Therefore, equilibrium in a perfectly competitive market can be defined alternatively as zero excess demand-zero excess supply situation. Whenever market supply is not equal to market demand, and hence the market is not in equilibrium

Market Equilibrium: Fixed Number of Firms

Here SS denotes the market supply curve and DD denotes the market demand curve for a commodity. The market supply curve SS shows how much of the commodity firms would wish to supply at different prices, and the demand curve DD tells us how much of the commodity, the consumers would be willing to purchase at different prices. Graphically, an equilibrium is a point where the market supply curve intersects the market demand curve because this is where the market demand equals market supply.

If the prevailing price is p_1, the market demand is q_1 whereas the market supply is q'_1. Therefore, there is excess demand in the market equal to $q'_1 q_1$. Some consumers who are either unable to obtain the commodity at all or obtain it in insufficient quantity will be willing to pay more than p_1. The market price would tend to increase. All other things remaining constant as price rises, quantity demanded falls, quantity supplied increases and the market moves towards the point where the quantity that the firms want to sell is equal to the quantity that the consumers want to buy. At p^*, the supply decisions of the firms match with the demand decisions of the consumers.

If the prevailing price is p_2, the market supply (q_2) will exceed the market demand (q'_2) at that price giving rise to excess supply equal to $q'_2 q_2$. Under such a circumstance, some firms will not be able to sell their desired quantity; so, they will lower their price.

All other things remaining constant as price falls, quantity demanded rises, quantity supplied falls, and at p^*, the firms can sell their desired output since market demand equals market supply at that price. Therefore, p^* is the equilibrium price and the corresponding quantity q^* is the equilibrium quantity.
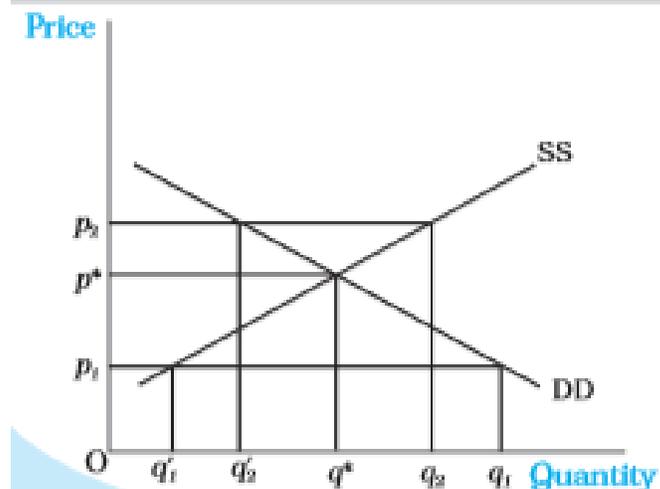
Example

Let us consider the example of a market consisting of identical1 farms producing same quality of wheat. Suppose the market demand curve and the market supply curve for wheat are given by:

$q^D = 200 - p$

$q^S = 120 + p$

where q^D and q^S denote the demand for and supply of wheat (in kg) respectively and p denotes the price of wheat per kg in rupees.

Since at equilibrium price market clears, we find the equilibrium price (denoted by p*) by equating market demand and supply and solve for p*.

$q^D(p^*) = q^S(p^*)$

$200 - p^* = 120 + p^*$

Rearranging terms, $2p^* = 80$

$p^* = 40$

Therefore, the equilibrium price of wheat is Rs 40 per kg. The equilibrium quantity (denoted by q*) is obtained by substituting the equilibrium price into either the demand or the supply curve's equation since in equilibrium quantity demanded and supplied are equal.

Wage Determination in Labour Market

The basic difference between a labour market and a market for goods is with respect to the source of supply and demand. In the labour market, households are the suppliers of labour and the demand for labour comes from firms whereas in the market for goods, it is the opposite.

The extra cost of hiring one more unit of labour is the wage rate (w). The extra output produced by one more unit of labour is its marginal product (MPL) and by selling each extra unit of output, the additional earning of the firm is the marginal revenue (MR) she gets from that unit. Therefore, for each extra unit of labour, she gets an additional benefit equal to marginal revenue times marginal product which is called Marginal Revenue Product of Labour (MRPL). Thus, while hiring labour, the firm employs labour up to the point where

$$w = MRP_L$$

Since we are dealing with a perfectly competitive firm, marginal revenue is equal to the price of the commodity and hence marginal revenue product of labour in this case is equal to the value of marginal product of labour (VMPL). If the VMPL is greater than the wage rate, the firm will earn more profit by hiring one more unit of labour, and if at any level of labour employment VMPL is less than the wage rate, the firm can increase her profit by reducing a unit of labour employed.

Given the assumption of the law of diminishing marginal product, the fact that the firm always produces at w = VMPL implies that the demand curve for labour is downward sloping. To maintain the wage-VMPL equality, VMPL should also increase. The price of the commodity remaining constant, this is possible only if MPL increases which in turn implies that less labour should be employed owing to the diminishing marginal productivity of labour.
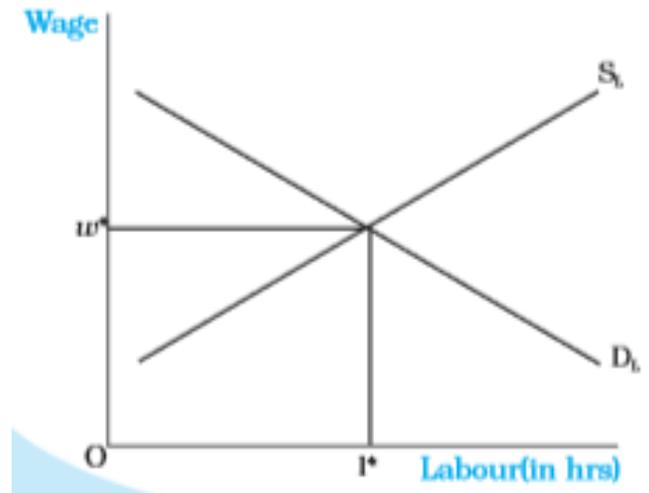
Given the assumption of the law of diminishing marginal product, the fact that the firm always produces at w = VMPL implies that the demand curve for labour is downward sloping. To explain why it is so, let us assume at some wage rate w_1, demand for labour is l_1. Now, suppose the wage rate increases to w_2. To maintain the wage-VMPL equality, VMPL should also increase.

The price of the commodity remaining constant, this is possible only if MPL increases which in turn implies that less labour should be employed owing to the diminishing marginal productivity of labour. Hence, at higher wage, less labour is demanded thereby leading to a downward sloping demand, curve.

So there is a trade-off between enjoying leisure and spending more hours for work. To derive the labour demand curve for a single individual, let us assume at some wage rate w_1, the individual supplies l_1 units of labour. Now suppose the wage rises to w_2. This increase in wage rate will have two effects:

First, due to the increase in wage rate, the opportunity cost of leisure increases which makes leisure costlier. Therefore, the individual will want to enjoy less leisure. As a result, they will work for longer hours.

Second, because of the increase in wage rate to w_2, the purchasing power of the individual increases. So, she would want to spend more on leisure activities.

The final effect of the increase in wage rate will depend on which of the two effects predominates. At low wage rates, the first effect dominates the second and so the individual will be willing to supply more labour with an increase in wage rate.

Fig. 5.2
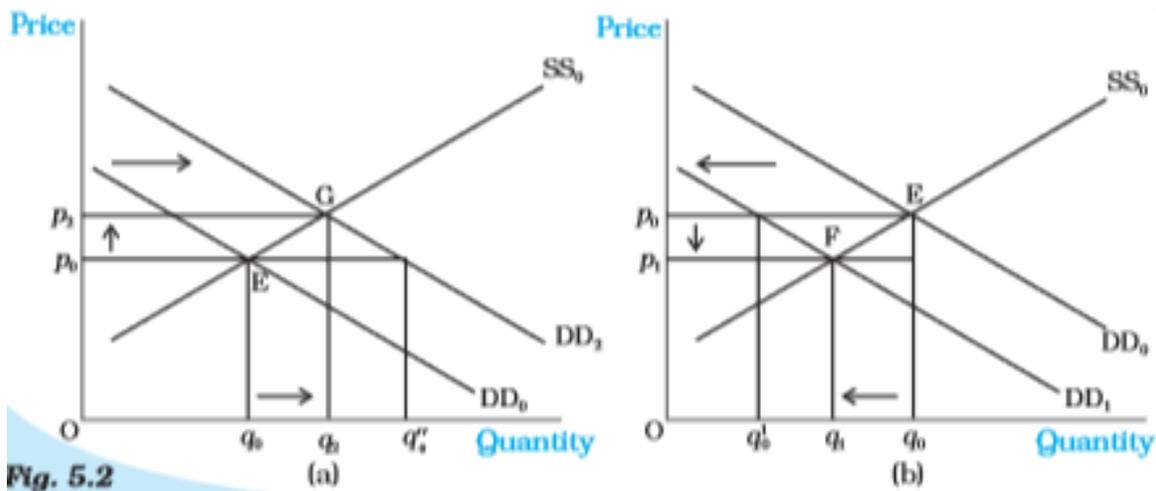
Demand Shift

Here, the initial equilibrium point is E where the market demand curve DD_0 and the market supply curve SS_0 intersect so that q_0 and p_0 are the equilibrium quantity and price respectively.

Now suppose the market demand curve shifts rightward to DD_2 with supply curve remaining unchanged at SS_0, as shown in panel (a).

This shift indicates that at any price the quantity demanded is more than before. Therefore, at price p_0 now there is excess demand in the market equal to $q_0q''_0$. In response to this excess demand some individuals will be willing to pay higher price and the price would tend to rise.

The new equilibrium is attained at G where the equilibrium quantity q_2 is greater than q_0 and the equilibrium price p_2 is greater than p_0.

Similarly, if the demand curve shifts leftward to DD_1, as shown in panel (b), at any price the quantity demanded will be less than what it was before the shift. Therefore, at the initial equilibrium price p_0 now there will be excess supply in the market equal to q'_0q_0 in response to which some firms will reduce the price of their commodity so that they can sell their desired quantity.

The new equilibrium is attained at the point F at which the demand curve DD_1 and the supply curve SS_0 intersect and the resulting equilibrium price p_1 is less than p0 and quantity q_1 is less than q_0.

Suppose due to some reason, there is increase in the number of consumers in the market for clothes. As the number of consumers increases, other factors remaining unchanged, at each price, more clothes will be demanded. Thus, the demand curve will shift rightwards. But this increase in the number of consumers does not have any impact on the supply curve since the supply curve may shift only due to changes in the parameters relating to firms' behavior or with an increase in the number of firms

The demand curve DD_0 shifts rightward to DD_2, the supply curve remaining unchanged at SS_0. The figure clearly shows that compared to the old equilibrium point E, at point G which is the new equilibrium point, there is an increase in both price and quantity demanded and supplied.
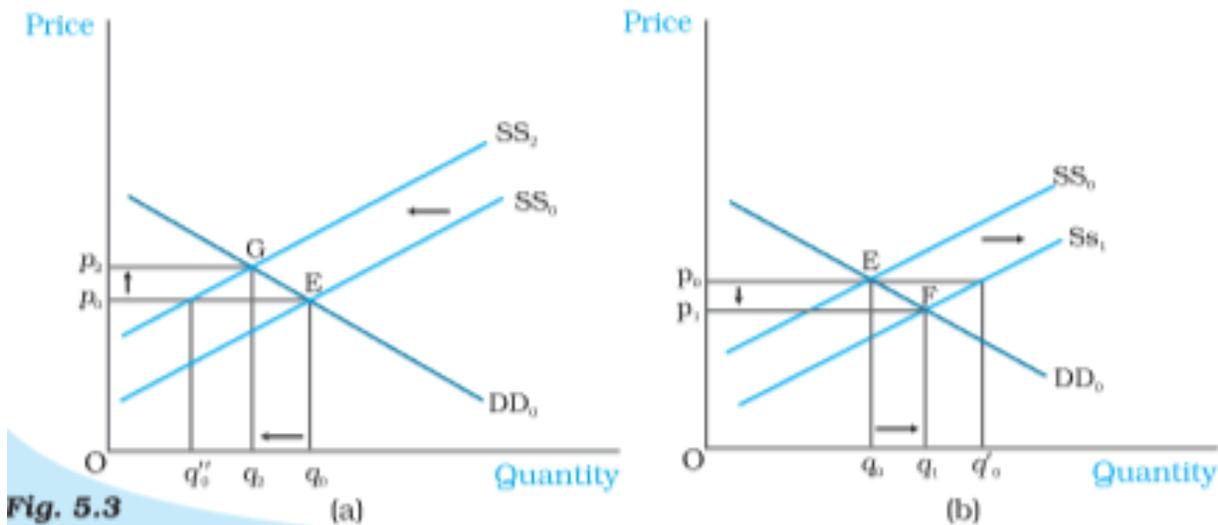
Fig. 5.3 (a) (b)

Supply Shift

Suppose, initially, the market is in equilibrium at point E where the market demand curve DD_0 intersects the market supply curve SS_0 such that the equilibrium price is p_0 and the equilibrium quantity is q_0.

Suppose due to some reason, the market supply curve shifts leftward to SS_2 with the demand curve remaining unchanged, as shown in panel (a). Because of the shift, at the prevailing price, p_0, there will be excess demand equal to q''_0q_0 in the market. Some consumers who are unable to obtain the good will be willing to pay higher prices and the market price tends to increase.

The new equilibrium is attained at point G where the supply curve SS_2 intersects the demand curve DD_0 such that q_2 quantity will be bought and sold at price p_2. Similarly, when supply curve shifts rightward, as shown in panel (b), at p_0 there will be supply excess of goods equal to $q_0q'_0$.

In response to this excess supply, some firms will reduce their price and the new equilibrium will be attained at F where the supply curve SS_1 intersects the demand curve DD_0 such that the new market prices are p_1 at which q_1 quantity is bought and sold. Notice the directions of change in price and quantity are opposite whenever there is a shift in supply curve.

There is an increase in the price of an input used in the production of a commodity. This will increase the marginal cost of production of the firms using this input. Therefore, at each price, the market supply will be less than before. Hence, the supply curve shifts leftward. In the diagram, this is shown by a shift in the supply curve from SS_0 to SS_2. But this increase in input price has no impact on the demand of the consumers since it does not depend on the input prices directly. Therefore, the demand curve remains unchanged.

Simultaneous Shifts of Demand and Supply

The simultaneous shifts can happen in four possible ways:

(i)   Both supply and demand curves shift rightwards.
(ii) Both supply and demand curves shift leftwards.
(iii) Supply curve shifts leftward and demand curve shifts rightward.
(iv) Supply curve shifts rightward and demand curve shifts leftward.

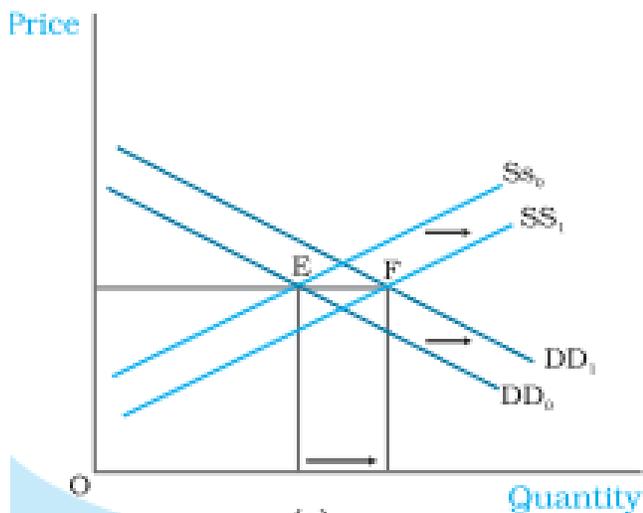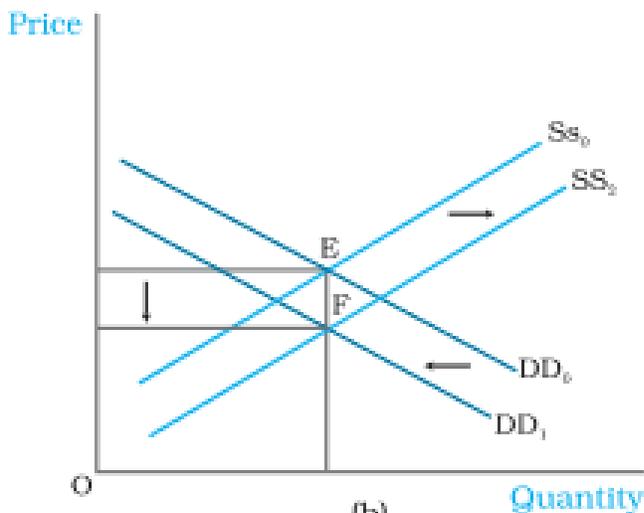| Shift in Demand	Shift in Supply	Quantity	Price
Leftward	Leftward	Decreases	May increase or decrease or remain unchanged.
Rightward	Rightward	Increases	May increase, decrease, or remain unchanged
Leftward	Rightward	May increase, decrease, or remain unchanged	Decreases
Rightward	Leftward	May increase, decrease, or remain unchanged	Increases

Fig. 5.4

Market Equilibrium: Free Entry and Exit

In equilibrium no firm earns supernormal profit or incurs loss by remaining in production; in other words, the equilibrium price will be equal to the minimum average cost of the firms. The possibility of earning supernormal profit will attract some new firms which will lead to a reduction in the supernormal profit and eventually supernormal profit will be wiped out when there is a sufficient number of firms. At this point, with all firms in the market earning normal profit, no more firms will have incentive to enter.
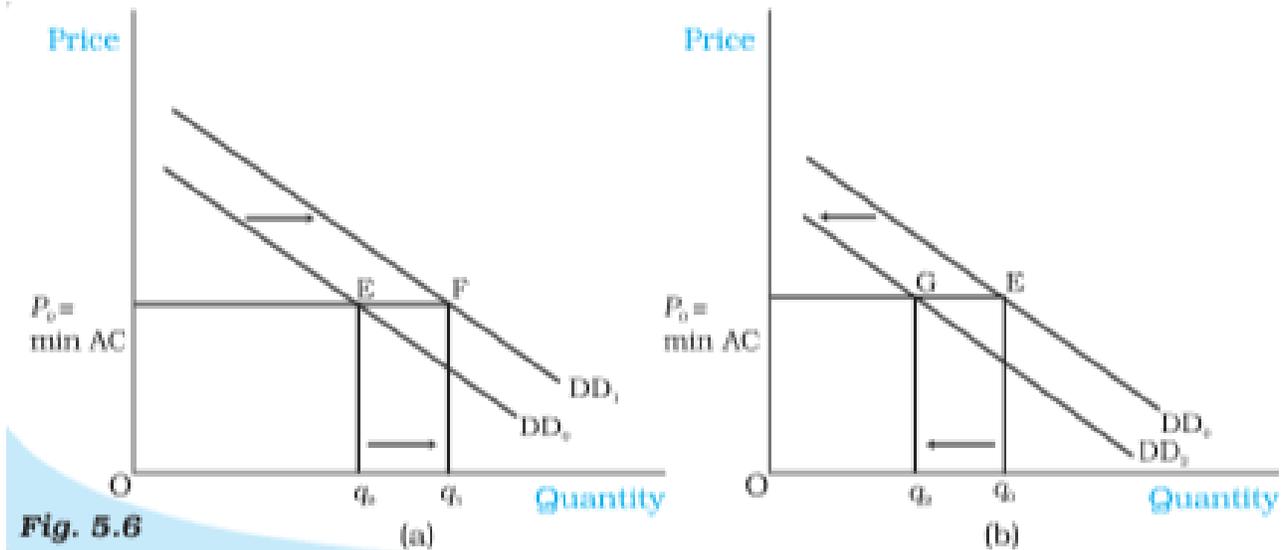
At prices greater than the minimum average cost, new firms will enter, and at prices below minimum average cost, existing firms will start exiting. At the price level equal to the minimum average cost of the firms, each firm will earn normal profit so that no new firm will be attracted to enter the market. Also the existing firms will not leave the market since they are not incurring any loss by producing at this point. So, this price will prevail in the market. Therefore, free entry and exit of the firms imply that the market price will always be equal to the minimum average cost, that is

$$p = min\ AC$$

From the above, it follows that the equilibrium price will be equal to the minimum average cost of the firms. In equilibrium, the quantity supplied will be determined by the market demand at that price so that they are equal.

At p_0 = min AC each firm supplies same amount of output, say q_{0f}. Therefore, the equilibrium number of firms in the market is equal to the number of firms required to supply q_0 output at p_0, each in turn supplying q_{0f} amount at that price. If we denote the equilibrium number of firms by n_0, then

$$n_0 = \frac{q_0}{q_{of}}$$

Fig. 5.6 (a) (b)

Shifts in Demand

In the diagram, DD_0 is the market demand curve which tells us how much quantity will be demanded by the consumers at different prices and p_0 denotes the price which is equal to the minimum average cost of the firms. The initial equilibrium is at point E where the demand curve DD_0 cuts the p_0 = min AC line and the total quantity demanded and supplied is q0. The equilibrium number of firms is n_0 in this situation.

The entry of these new firms will eventually wipe out the supernormal profit and the price will again reach p_0. Now higher quantity will be supplied at the same price. From the panel (a), we can see that the new demand curve DD_1 intersects the p_0 = min AC line at point F such that the new equilibrium will be (p_0, q_1) where q_1 is greater than q_0. The new equilibrium number of firms n_1 is greater than n_0 because of the entry of new firms.

Similarly, for a leftward shift of the demand curve to DD_2, there will be excess supply at the price p_0. In response to this excess supply, some firms, which will be unable to sell their desired quantity at p_0, will wish to lower their price. The price tends to decrease which will lead to the exit of some of the existing firms and the price will again reach p_0.

In the new equilibrium, less quantity will be supplied which will be equal to the reduced demand at that price. This is shown in panel (b) where due to the shift of demand curve from DD0 to DD_2, quantity demanded and supplied will decrease to q_2 whereas the price will remain unchanged at p_0.

Here, the equilibrium number of firms, n_2 is less than n_0 due to the exit of some existing firms. Thus, due to a shift in demand rightwards (leftwards), the equilibrium quantity and number of firms will increase (decrease) whereas the equilibrium price will remain unchanged.

Applications

Often, it becomes necessary for the government to regulate the prices of certain goods and services when their prices are either too high or too low in comparison to the desired levels.

Price Ceiling: The government-imposed upper limit on the price of a good or service is called price ceiling.

The equilibrium price and quantity of wheat are p* and q* respectively. When the government imposes price ceiling at pc which is lower than the equilibrium price level, the consumers demand q_c kilograms of wheat whereas the firms supply q'_c kilograms.

Therefore, there will be an excess demand for wheat in the market at that price. Price ceiling accompanied by rationing of the goods may have the following adverse consequences on the consumers:

(a) Each consumer must stand in long queues to buy the good from ration shops.

(b) Since all consumers will not be satisfied by the quantity of the goods that they get from the fair price shop, some of them will be willing to pay higher price for it. This may result in the creation of black market.

Price Floor: The government imposed lower limit on the price that may be charged for a good or service is called price floor.

The market equilibrium here would occur at price p* and quantity q*. But when the government imposes a floor higher than the equilibrium price at p_f, the market demand is q_f whereas the firms want to supply q'_f, thereby leading to an excess supply in the market equal to $q'_f q_f$.