3 The Laws of Demand and Supply

CHAPTER OUTLINE

We have noted in Chapter 2 that market mechanism plays a crucial role in solving the basic economic problems in a free market economy and that the entire market system functions in an orderly manner, though some aspects of it may not be desirable. The market system works in an

orderly manner because it is governed by certain **Fundamental Laws of Market** known as the **Laws of Demand and Supply**. The forces of demand and supply interact to determine the price of goods and services brought to the market. The laws of demand and supply are all pervasive in economic analysis. That is why (perhaps) Thomas Carlyle, the famous 19th century historian remarked, "It is easy to train an economist; teach a parrot to say Demand and Supply."[1] In fact, the most important function of microeconomics is to explain the laws of demand and supply, market mechanism and working of the price system. In this chapter, we explain the concept and the laws of demand and supply, price determination, and equilibrium of the commodity market.

3.1 THE CONCEPT OF MARKET

The word 'market' generally means a place or area where goods and services are bought and sold, e.g., Chandani Chowk, Karol Bagh, Connaught Place, Delhi Stock Exchange, Bombay Stock Exchange, Sabzi Mandi, etc. In economics, the word 'market' is used in a rather abstract sense. The market means a system by which sellers and buyers of a commodity interact to settle its price and the quantity to be bought and sold. According to Samuelson and Nordhaus[2], "A **market** is a mechanism by which buyers and sellers interact to determine the price and quantity of a good or service". Market for a commodity consists of the buyers and sellers who interact to settle its price and quantity to be transacted. The sellers and buyers may be individuals, firms, factories, dealers and agents.

Some important points in the market concept are :

(i) A market need not be situated in a particular place or locality. The geographical area of a market depends on how scattered are the buyers and sellers. It may be as small as a fish market in a corner of a city or as large as the entire world, e.g., the global markets for arms, cars, electronic goods, aeroplanes, computers, oil, medicines, etc.

(ii) Buyers and sellers need not come in personal contact with each other. The transactions can be effected through postal services, telephone, fax, agents, or e-mail, etc. People do buy many goods and services directly from the producers without having ever seen them.

(iii) The word 'market' may refer to a commodity or service (e.g., fruit market, car market, share market, money market, paper market, labour market, etc.) or to a geographical area, Bombay market, Indian market, Asian market, etc.

(iv) The economists distinguish between markets also on the basis of (a) nature of goods and services, e.g., factor market and commodity market or input market and output market; (b) number of firms and degree of competition, e.g., competitive market (large number of firms with homogenous products), monopolistic market (many firms with differentiated products); oligopolistic market and so on.

3.2 THE DEMAND SIDE OF THE MARKET

3.2.1 Meaning of Demand

Conceptually, demand can be defined as the desire for a good for whose fulfilment a person has sufficient purchasing power and willingness to pay for the good. In simple words, *demand is a desire for a good, backed by ability and willingness to pay*. A desire without sufficient resources (money income) is merely a wish. A desire with resources but without willingness to spend is only a potential demand.

[1] Samuelson attributes this statement to "anonymous" in his *Economics*, 13th Edn., p. 55.

[2] Samuelson, P. A and Nordhaus, W., *Economies*, 15th Edn., (McGraw-Hill, Inc., New York, 1995), p. 23.

A desire accompanied by ability and willingness to pay makes a real or effective demand.

Individual and market demand. *Individual demand* can be defined as the quantity of a commodity that a person is willing to buy at a given price over a specified period of time, say per day, per week, per month, etc. *Market demand* refers to the total quantity that all the users of a commodity are willing to buy at a given price over a specific period of time. In fact, market demand is the sum of individual demands. Individual and market demand curves are illustrated ahead in section 3.2.7.

3.2.2 The Law of Demand

The law of demand states the relationship between the quantity demanded and price of a commodity. Although quantity demanded of a commodity depends also on many other factors, e.g., consumer's income, price of the related goods, consumer's taste and preferences, advertisement, etc., price is the most important and the only determinant of demand in the short run.

The law of demand can be stated as, ***all other things remaining constant, the quantity demanded of a commodity increases when its price decreases and decreases when its price increases.*** This law implies that demand and price are inversely related. Marshall states the law of demand as "the amount demanded increases with a fall in price and diminishes with a rise in price". This law holds under *ceteris paribus* assumption, that is, *all other things remain unchanged*. The law of demand can be illustrated through a ***demand schedule*** and a ***demand curve***.

3.2.3 The Demand Schedule

A *demand schedule* is a tabular presentation of different prices of a commodity and its corresponding quantity demanded per unit of time. A hypothetical market demand schedule is given in Table 3.1. This table presents price of shirts (P_x) and the corresponding number of shirts demanded (Q_x) per month.

Table 3.1 Demand Schedule for Shirts

P_x (price in Rs)	Q_x (Shirts in '000)
800	8
600	15
400	30
300	40
200	55
100	80

Table 3.1 illustrates the law of demand. As data given in the table shows, the demand for shirts (Q_x) increases as its price (P_x) decreases. For instance, at price Rs 800 per shirt, only 10 thousand shirts are demanded per month. When price decreases to Rs 400, the demand for shirts increases to 30 thousand and when price falls further to Rs 100, demand rises to 80 thousand. This relationship between price and quantity demanded gives the law of demand.

3.2.4 The Demand Curve

A *demand curve* is a graphical presentation of the demand schedule. A demand curve is obtained by plotting a demand schedule. For example, when the data given in the demand schedule (Table 3.1) i

...resented graphically as in Fig. 3.1, the resulting curve DD' is the demand curve. The curve DD' in Fig. 3.1 depicts the law of demand. It slopes downward to the right. It has a negative slope. The negative slope of the demand curve DD' shows the *inverse relationship* between the price of shirt and its quantity demanded. It shows that demand for shirts increases with the decrease in its price and decreases with rise in its price. As can be seen in Fig. 3.1, downward movement on the demand curve DD' from point D towards D' shows fall in price and rise in demand. Similarly, an upward movement from point D' towards D reads rise in price and fall in demand.

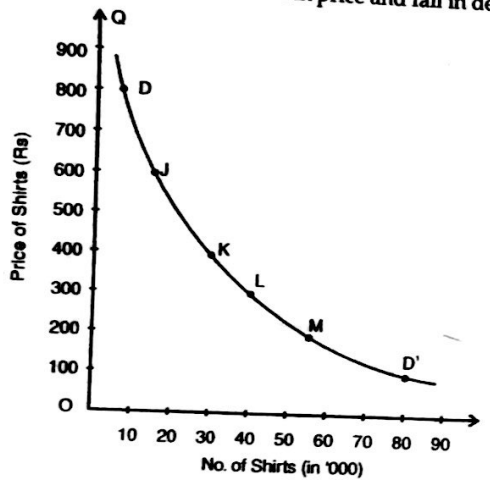

Fig. 3.1 The Demand Curve

The law of demand is based on an empirical fact. For example, when prices of cell phones and personal computers (PCs), specially of the latter, were astronomically high, only few rich persons and big firms could afford them. Now with the revolution in computer cell phone technology and the consequent fall in their prices, demand for these goods has shot up in India.

3.2.5 Why Demand Curve Slopes Downward to the Right

Figure 3.1 shows that *demand curve slopes downward to the right*. Why does it happen? The reasons behind the law of demand are following:

(i) Income effect. When price of a commodity falls, real income of its consumers increases in terms of this commodity. In other words, their purchasing power increases since they are required to pay less for the same quantity. According to another economic law, increase in real income (or purchasing power) increases demand for goods and services in general and for the goods with reduced price in particular. The increase in demand on account of increase in real income is called *income effect*.

It should however be noted that the *income effect* is negative in case of *inferior goods*. In case price of an *inferior good* accounting for a considerable proportion of the total consumption expenditure falls substantially, consumers' real income increases. Consequently, they substitute superior goods for inferior ones. Therefore, *income effect* on the demand for inferior goods becomes *negative*.

(ii) Substitution effect. When price of a commodity falls, it becomes cheaper compared to its substitutes, their prices remaining constant. In other words, when price of a commodity falls, price

of its substitutes remaining the same, its substitute becomes relatively costlier. Consequently, rational consumers tend to substitute cheaper goods for costlier ones within the range of normal goods—goods whose demand increases with increase in consumer's income—other things remaining the same. Therefore, demand for the relatively cheaper commodity increases. The increase in demand on account of this factor is known as ***substitution effect***.

(iii) Diminishing marginal utility. Marginal utility is the utility derived from the marginal unit consumed of a commodity. Diminishing marginal utility is also responsible for increase in demand for a commodity when its price falls. When a person buys a commodity, he exchanges his money income with the commodity in order to maximise his satisfaction. He continues to buy goods and services so long as marginal utility of his money (MU_m) is less than the marginal utility of the commodity (MU_c). Given the price (P_c) of a commodity, the consumer adjusts his purchases so that $MU_c = MU_m$. This proposition holds under both constant MU_m and diminishing MU_m.

If MU_m is assumed to be constant, then $MU_m = P_c$. Under this condition, utility maximising consumer makes his purchases in such quantities that

$$MU_m = P_c = MU_c$$

When price falls, $(MU_m = P_c) < MU_c$. The only way to regain his equilibrium is to reduce MU_c. So the consumer purchases more of the commodity. When the stock of a commodity increases, MU_c decreases. As a result, demand for a commodity increases when its price decreases.

This conclusion holds also under diminishing MU_m. When price of a commodity falls and consumer buys only as many units as before the fall in price, he saves some money on this commodity. As a result, his stock of money increases and his MU_m decreases, whereas MU_c remains unchanged because his stock of commodity remains unchanged. Since MU_m is less than MU_c, the utility maximizing consumer exchanges money with commodity to equate MU_m with MU_c, with a view to maximising his satisfaction. Consequently, demand for a commodity increases when its price falls.

3.2.6 Exceptions to the Law of Demand

The law of demand is one of the fundamental laws of economics. The law of demand, however, does not apply to the following cases:

(i) Expectations regarding future prices. When consumers expect a continuous increase in the price of a durable commodity, they buy more of it despite increase in its price, to avoid the pinch of still higher price in future. Similarly, when consumers anticipate a considerable decrease in the price in future, they postpone their purchases and wait for the price to fall further, rather than buy the commodity when its price initially falls. Such decisions of the consumers are contrary to the law of demand.

(ii) Prestigious goods. The law does not apply to the commodities which serve as a 'status symbol', enhance social prestige or display wealth and richness, e.g., gold,[1] precious stones, rare paintings and antiques, etc. Rich people buy such goods mainly because their prices are high.

(iii) Giffen goods. An exception of this law, is also the classic case of Giffen goods named after a British economist Sir Robert Giffen, (1837–1910). A Giffen good does not mean any specific commodity. It may be any essential commodity much cheaper than its substitutes, consumed mostly by the poor households and claiming a large part of their income. If price of such goods increases (price of its substitute remaining constant), its demand increases instead of decreasing. For instance, let us suppose that the *monthly minimum* consumption of foodgrains by a poor household is 30 kgs

1. Goods of this category are also accumulated to store value.

including 20 kgs of *bajra* (an inferior good) and 10 kgs of wheat (a superior good). Suppose also that *bajra* sells at Rs 5 a kg and wheat Rs 10 a kg. At these prices, the household spends Rs 200 per month on food grains. That is the maximum it can afford. Now, if price of *bajra* increases to Rs 6 per kg, the household will be forced to reduce its consumption of wheat by 5 kgs[1] and increase that of *bajra* by the same quantity in order to meet its minimum monthly consumption requirement within Rs 200 per month. Obviously, household's demand for *bajra* increases from 20 to 25 kgs per month despite increase in its price and that of wheat falls to 5 kgs.

3.2.7 The Concept of Market Demand

Market demand for a commodity is the sum of all individual demands for the commodity at a given price, per unit of time. Suppose, there are only three consumers (*A*, *B* and *C*) of Pepsi and their weekly individual demand for Pepsi at its different prices is given as in Table 3.2. The last column of the table shows the market demand, i. e., the aggregate of individual demands for Pepsi.

Table 3.2 Individual and Market Demand for the Pepsi Cans

Price (Rs)	No. of Pepsi Cans demanded by			Market demand = A + B + C
	A	B	C	
12	0	0	0	0
10	0	0	4	4
8	0	4	8	12
6	3	8	12	23
4	5	12	16	33
2	8	16	20	44
0	11	20	24	55

The last column of Table 3.2 shows weekly market demand for Pepsi. The *market demand curve* can be obtained by plotting the data in the last column of the table.

Graphical Derivation. Alternatively, market demand curve can be derived graphically by horizontal summation of the individual demand curves at each price of Pepsi. Graphical derivation of the market demand curve is illustrated in Fig. 3.2. The individual demand curves of buyers *A*, *B* and *C* are shown by the demand curves D_A, D_B and D_C, respectively. Horizontal summation of these demand curves produces weekly *market demand curve* for Pepsi as shown by the curve D_M. Thus, a *market curve is horizontal summation of individual demand curves at different prices.*

It is ***important*** to note here that there is a significant difference between the individual demand curves and the market demand curve. The individual demand curves may not slope downward in case of many consumer goods, e.g., a book by an author, umbrella, cinema ticket for a show, or a passenger ticket, etc. But market demand for all such goods, slopes downward following the decrease in their prices, due to increase in the number of consumers.

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1 The increase in demand for *bajra* by 5 kgs can be worked out as follows. Suppose the household maintains its food consumption at its minimum level of 30 kgs. For this, it will be required to substitute *x* kgs of *bajra* for the same quantity of wheat (*x* kgs). Its food consumption basket may be expressed as (20 + *x*) kgs of bajra + (10 – *x*) kgs of wheat = 30 kgs. Since household can afford only Rs 200 per month, its budget equation can be written as 6(20 + *x*) + 10(10 – *x*) = Rs 200. Solving this equation for *x*, we get *x* = 5 kgs.

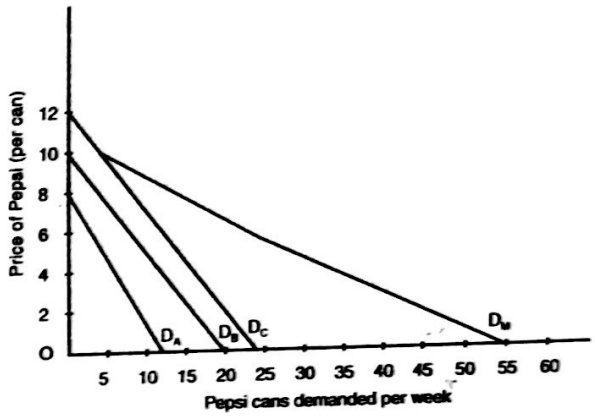

Fig. 3.2 Derivation of Market Demand Curve

3.2.8 Other Determinants of Market Demand

In the short run, price of a commodity is the main determinant of its market demand. In the long run, however, market demand for a product is determined by the number of other factors. We will discuss here, some other important quantifiable and non-quantifiable determinants of demand for a product.

(i) Price of substitutes and complementary goods. The demand for a commodity depends also on the prices of its substitutes and complementary goods. Two commodities are deemed to be ***substitutes*** for one another, if change in price of one affects the demand for the other in the same direction. For instance, commodities *X* and *Y* are, in economic sense, substitutes for one another if a rise in the price of *X* increases the demand for *Y*, and *vice versa*. Tea and coffee, hamburger and hot-dog, wheat and rice, alcohol and drugs are some common examples of common substitutes. By definition, the relation between demand for a product and price of its substitute is of positive nature. When price of a product (say, tea) falls (or increases), then demand for its substitute (coffee) falls (or increases). The relationship of this nature is given in Fig. 3.3 (a).

A commodity is deemed to be a ***complement*** of another when it complements the use of the other. For example, petrol is a complement to motor vehicles; butter and jam are complements to bread; milk and sugar are complement to tea and coffee and so on. Conceptually, two goods are complements for one another, if an increase in the price of one causes a decrease in the demand for another. By definition, *there is an inverse relationship between the demand for a good and the price of its complement.* For instance, an increase (or a decrease) in the price of petrol causes a decrease (or an increase) in the demand for car, other things remaining the same. The nature of relationship between the demand for a product and the price of its complement is given in Fig. 3.3 (b).

(ii) Consumers' income and Engel curves. Consumer's income is the basic determinant of the quantity demanded of a product. It is a common knowledge that the people with higher disposable income spend a larger amount on goods and services than those with lower income. Income-demand relationship is of a more varied nature than that between demand and its other determinants.

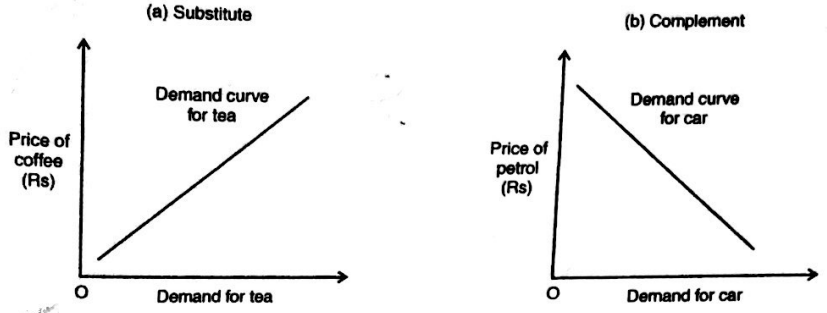

Fig. 3.3 Demand for Substitute and Complement

For the purpose of income-demand analysis, goods and services may be grouped under four broad categories, viz. (a) essential consumer goods; (b) inferior goods; (c) normal goods; and (d) prestige or luxury goods. The relationship between income and the different kinds of goods is presented through the **Engel Curves.***

(a) Essential consumer goods (ECG). The goods and services which fall in this category are essentially consumed by almost all persons of a society, e.g., food grains, clothes, vegetable oils, sugar, matches, cooking fuel and housing, etc. The quantity demanded of such goods increases with increase in consumer's income only upto a certain limit, other factors remaining the same. The relation between goods and services of this category and consumer's income is shown by curve *ECG* in Fig. 3.4. As the curve shows, consumer's demand for essential goods increases until his income rises to OY_2 and beyond this level of income, it does not.

(b) Inferior goods. Inferior and superior goods are generally known to both consumers and sellers. For instance, every consumer knows that *bajra* is inferior to wheat and rice; *bidi* (an indigenous cigarette) is inferior to cigarette, coarse textiles are inferior to refined ones, kerosene stove is inferior to gas-stove; travelling by bus is inferior to travelling by taxi, and so on. In economic terminology, however, *a commodity is deemed to be inferior if its demand decreases with the increase in consumers'* income. The relation between income and demand for an inferior good is shown by curve *IG* in Fig. 3.4 assuming that other determinants of demand remain the same. Demand for such goods may initially increase with increase in income (say upto Y_1) but it decreases when income increases beyond this level.

(c) Normal goods. In economic sense, normal goods are those which are demanded in increasing quantities as consumers' income rises. Clothing is the most important example of this category of goods. Household furniture, electricity, telephones, household gadgets, etc. are other examples of this category of goods. The nature of relation between income and demand for normal goods is shown by the curve *NG* in Fig. 3.4. As the curve shows, demand for such goods increases with increase in income of the consumer, but at different rates at different levels of income. Demand for normal goods initially increases rapidly with the increase in income and later, at a lower rate.

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* Engel Curve has been named after a German Statistician, Christian Lorenz Ernst Engel (1821–1986), who was one of the first to study systematically the relation between quantity demanded of a good and the consumer's income. According to Engel's law, proportion of expenditure on essential goods decr...

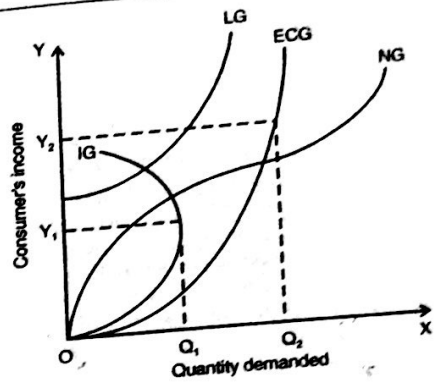

Fig. 3.4. Income-Demand Curves

It may be noted from Fig. 3.4 that upto a certain level of income (Y_1) the relation between income and demand for all types of goods is similar. The difference is of degree only. The relation between income and different kind of goods becomes distinctly different only beyond a certain level of income.

(d) Prestige or luxury goods. Prestige goods are those which are consumed mostly by the rich section of the society, e.g., precious stones, studded jewellery, costly cosmetics, luxury cars, airconditioners, costly decoration items (e.g., antiques), etc. Demand for such goods arises only beyond a certain level of consumer's income. The income-demand relationship of this category of goods is shown by the curve *LG* in Fig. 3.4.

(iii) Consumer's taste and preference. Consumer's taste and preferences play an important role in determining the demand for a product. Taste and preferences depend, generally, on the social customs, religious values attached to a commodity, habits of the people, the general life-style of the society and also the age and sex of the consumers. Change in these factors changes consumers' taste and preferences. When there is a change in consumers' liking, tastes and preferences for certain goods and services following the change in fashion, people switch their consumption pattern from cheaper and old fashioned goods over to costlier 'mod' goods, so long as price differentials commensurate with their preference. For example, preference for 'junk food' in the younger generation has increased as compared to normal home-made nutritious food. Consumers are prepared to pay higher prices for 'mod' goods even if their virtual utility is the same as that of old-fashioned goods. This fact reveals that tastes and preferences also influence demand for goods and services.

(iv) Expected utility at equilibrium. Most consumers have limited income to satisfy unlimited wants. They spend their income on various goods they consume in such a manner that the total satisfaction derived out of their limited income is maximum. A consumer maximises his total satisfaction or his total utility when marginal utility, per unit of expenditure, derived from each commodity is the same. For example, let us suppose that a consumer has to spend his limited income on bread (B), shirts (S), and cinema shows (C). Given their respective prices as P_b, P_s, P_c, he would spend his income on these items according to the law of equi-marginal utility* so that margin...

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* ... is discussed in detail in Chapter 6.

utility (MU) per unit of expenditure from each of these goods is the same, i.e.,

$$\frac{MU_b}{P_b} = \frac{MU_s}{P_s} = \frac{MU_c}{P_c}$$

where MU_b, MU_s and MU_c denote the MU of bread, shirts and cinema shows, respectively.

This is a necessary condition of consumer's equilibrium. Since MU schedule for each of these goods would be different, the consumer would buy different quantities of these goods with a view to equalising their MU per unit of expenditure. The equilibrium condition itself determines the quantity of each good (given their MU schedule) which a utility maximising consumer would like to buy. Although, in practice, a consumer may not be able to achieve the theoretical precision of his equilibrium, his pattern of expenditure and the quantity of each commodity that he would buy would approximate to the equilibrium condition stated above.

(v) Consumers' expectations. Consumers' expectations regarding the future course of economic events, particularly regarding changes in prices, income, and supply position of goods, play an important role in determining the demand for goods and services in the short run. If consumers expect a rise in the price of a commodity, they would buy more of it at its current price, with a view to avoiding the pinch of price-rise in future. On the contrary, if consumers expect prices of certain goods to fall, they postpone their purchases of such goods with a view to taking advantage of lower prices in future, mainly in case of non-essential goods. This behaviour of consumers reduces (or increases) the current demand for the goods whose prices are expected to decrease (or increase) in future. Similarly, an expected increase in income on account of the announcement of revision of pay-scales, dearness allowance, bonus, etc., induces increase in curent purchase, and *vice versa*.

(vi) Demonstration effect. When new commodities or new models of existing ones appear in the market, rich people buy them first. Some people buy new goods or new model of goods because they have genuine need for them while others buy because they want to exhibit their affluence. But once new commodities come in vogue, many households buy them, not because they have a genuine need for them but because others or neighbours have bought these goods. The purchase by the latter category of buyers are made out of such feelings as jealousy, competition, equality in the peer group, social inferiority and the desire to raise social status. Purchases made on account of these factors are the result of ***'Demonstration Effect'*** or the ***'Bandwagon Effect'***. These effects have a positive effect on the demand. On the contrary, when a commodity becomes the thing of common use, some people, mostly rich, decrease or give up the consumptions of such goods. This is known as **'Snob Effect'**. It has a negative effect on the demand for the related goods.

(vii) Consumer-credit facility. Availability of credit to the consumers from the sellers, banks, relations and friends or from any other source encourages the consumers to buy more than what they would buy in the absence of credit facility. That is why the consumers who can borrow more consume more than those who can borrow less or cannot borrow at all. Credit facility affects mostly the demand for consumer durables, particularly those which require bulk payment at the time of purchase.

(viii) Population of the country. The total domestic demand for a product depends also on the size of population. Given the price, per capita income, taste and preferences etc., the larger the population, the larger the demand for a product of common use. With an increase (or decrease) in the size of population, employment percentage remaining the same, demand for the product increases (or decreases). The relation between market demand for a product (normal) and the size of population is similar to the income–demand relationship.

(ix) Distribution of national income. The distribution pattern of national income also affects the demand for a commodity. If national income is evenly distributed, market demand for ***normal goods*** will be the largest. If national income is unevenly distributed, i.e., if majority of population belongs to the lower income groups, market demand for essential goods will be the largest whereas the same for other kinds of goods will be relatively low.

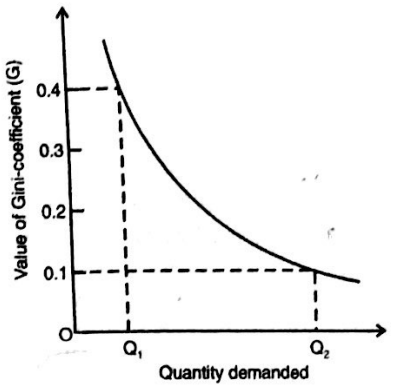

Fig. 3.5 Gini-coefficient and Demand

The relationship beteween market demand for a normal good and national income distribution is illustrated in Fig. 3.5. In the figure, vertical axis measures the Gini efficient[1] (a measure of national income distribution—G) and the horizontal axis measures the quantity demanded of a normal good. As Fig. 3.5 shows, at high value of $G = 0.4$, quantity demand of a normal good is small equal to Q_1. As G decreases from 0.4 to 0.1 (i.e., income distribution becomes more and more even) quantity of a normal goods demanded increases from Q_1 towards Q_2.

3.2.9 Demand Function

In mathematical language, a function is a symbolic statement of relationship between a dependent and independent variables. Demand function states the relationship between demand for a product (the dependent variable) and its determinants (the independent variables). Let us consider the most common form of a demand function, i.e., the short-run demand function, which consists of quantity demand (Q) and price (P). Assume that the quantity demanded of a commodity (D_x) depends only on its price, other factors remaining constant. The demand function will then read as 'demand for a commodity (D_x) depends on its price (P_x)'. The same statement may be written in its functional form as

$$D_x = f(P_x) \qquad (3.1)$$

where D_x is demand for commodity X, the dependent variable, and P_x is price of X, the independent variable.

1. Gini-coefficient is a standard measure of national income distribution through Phillips curve. Gini-coefficient (G) having numerical value equal to zero indicates equal distribution of national income. $G > O$ indicates inequality. The higher the value of G, the greater the inequality in the distribution of national income.

The function (3.1), however, does not give the quantitative relationship between D_x and P_x. When quantitative relationship between D_x and P_x is known, the demand function may be expressed in the form of an equation as

$$D_x = a - bP_x \tag{3.2}$$

where a and b are constants—a is intercept and b quantifies the relationship between D_x and P_x.

The form of equation depends on the empirical demand-price relationship. The two most common forms of demand-price relationship are ***linear*** and ***non-linear***. Accordingly, the demand function may take a linear or a non-linear form.

(i) Linear demand function. A demand function is said to be linear when the slope of the demand curve remains constant throughout its length. The simplest form of a linear demand function is given by equation (3.2). In equation (3.2), the alphabet a denotes total demand at zero price and $b = \Delta D/\Delta P$, also a constant, denotes slope of the demand curve.

Given the demand function (3.2), if values of a and b are known, total demand (D_x) for any given price (P_x) can easily be obtained. For example, let us assume that $a = 100$ and $b = 5$. Now the demand function (3.2) can be written as

$$D_x = 100 - 5P_x \tag{3.3}$$

Given the Eq. (3.3), the value of D_x can be easily obtained for any value of P_x. For example, if $P_x = 4$,

$$D_x = 100 - 5 \times 4$$
$$= 80;$$

and if

$$P_x = 10,$$
$$D_x = 100 - 5 \times 10$$
$$= 50.$$

Thus, a demand schedule can be prepared assigning different values to P_x. When this demand schedule is plotted, it produces a linear demand curve as shown in Fig. 3.6.

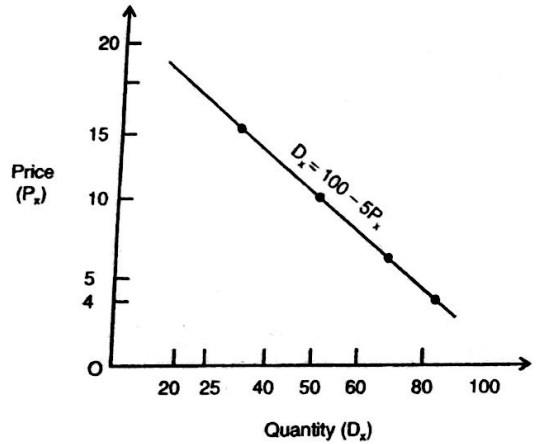

Fig. 3.6 Linear Demand Function

From the demand function, one can easily derive a corresponding ***price function***. For example, given the demand function (3.2), the price function may be written as

$$P_x = \frac{a - D_x}{b} \tag{3.4}$$

or

$$P_x = \frac{a}{b} - \frac{1}{b}D_x$$

Denoting a/b by a' and $1/b$ by b', Eq. (3.4.) may be written as

$$P_x = a' - b'D_x$$

Given the demand function (3.3), price function can be derived as follows.

If $$D_x = 100 - 5P_x,$$

then $$P_x = 20 - 0.20\,D_x$$

(ii) Non-linear demand function. A demand function is said to be non linear or curvilinear when the slope of a demand curve ($\Delta P/\Delta Q$) changes all along the demand curve. Non-linear demand function yields a demand curve instead of a ***demand line***, as shown in Fig. 3.7. A non-linear demand function, generally, takes the form of a power function as

$$D_x = aP_x^{-b} \tag{3.5}$$

or of a rectangular hyperbola of the form

$$D_x = \frac{a}{P_x + c} - b \quad \text{where } a, b, c > 0. \tag{3.6}$$

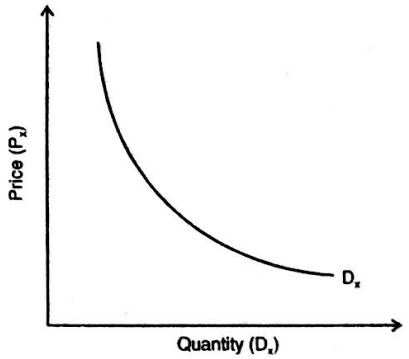

Fig. 3.7 Nonlinear Demand Function

Note that the exponent ($-b$) of the price variable in a non-linear demand function (3.5) is the coefficient of price elasticity of demand, which is constant.

(iii) Dynamic demand function. The demand function with price as a single independent variable, as described above, may be termed as ***short-term demand function***. A short-run demand function assumes all other factors than price to be given. In the long-run, however, the market demand for a product depends on the composite impact of all the determinants operating simultaneously. Therefore, in a ***long-run*** or ***dynamic demand function***, all the relevant determinants of demand for a product are included in the demand function. For instance, if individual demand (D_x) for a commodity X, depends

on its price (P_x), consumer's income (Y), consumer's wealth (W), price of its substitute (P_y), price of complementary goods (P_c), consumer's taste (T), and advertisement expenditure (A), it can be expressed as

$$D_x = f(P_x, Y, W, P_y, P_c, T, A) \tag{3.7}$$

If relationship between D_x and the independent variables P_x, Y, W, P_y, P_c and A is of linear form, the estimable form of the demand function is expressed as

$$D_x = a - bP_x + cY + wW + dP_y + jA \tag{3.8}$$

where a is a constant term and b, c, w, d and j are the coefficient of relation between D_x and the respective independent variables.

In a *market demand function* for a product, other independent vaiables, viz., size of population (N) and a measure of income distribution, i.e., Gini-coefficient (G), may also be included.

3.2.10 Shift in Demand Curve

When demand curve changes its position retaining its shape (though not necessarily), the change is known as *shift in demand curve*. Let us suppose that the demand curve, D_2 in Fig. 3.8 is the original demand curve for commodity X. As shown in the figure, at price OP_2, demand equals OQ_2 units of X, other factors remaining constant. But if any of the other factors (e.g., consumers' income or price of the substitutes) changes, it will change consumer's ability and willingness to buy commodity X. For example, if consumer's disposable income decreases due to increase in income tax, he may be able to buy only OQ_1 units of X instead of OQ_2 at price OP_2. As a result, demand curve D_2 shifts downward D_1. This is true for the whole range of price of X, that is, consumers would be able to buy less at all other prices. This will cause a ***downward shift*** in demand curve from D_2 to D_1. Similarly, increase in disposable income of the consumer, say, due to reduction in taxes, may cause an ***upward shift*** from D_2 to D_3. The consumer shifts to point E_3 on demand curve D_3 and can buy OQ_3 of commodity X. Such changes in the location of demand curves are known as shifts in demand curve.

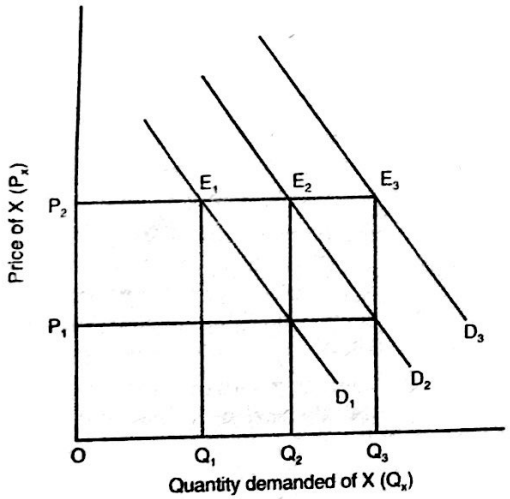

Fig. 3.8 Shift in Demand Curve

Reasons for shift in demand curve. Shifts in a demand curve may take place owing to the change in one or more of the determinants of demand. Consider, for example, the decrease in demand for commodity X by Q_1Q_2 in Fig. 3.8. This fall in demand may have been caused by any of the following reasons:

(i) fall in the consumer's income so that consumer can buy only OQ_1 of X at price OP_2 — it is called ***income effect;***

(ii) fall in the price of X's substitute so that the consumers find it gainful to substitute Q_1Q_2 of X for its substitute—it is ***substitution effect;***

(iii) advertisement made by the producer of the substitute, changes consumer's taste or preference against commodity X so much that they replace Q_1Q_2 of it with its substitute—again a ***substitution effect;***

(iv) increase in the price of complements of X so that consumers can afford only OQ_1 of X; and

(v) also for such reasons as commodity X is going out of fashion; its quality has deteriorated; consumers' technology has so changed that only OQ_1 of X can be used, and change in season if commodity X has only seasonal use.

3.3 THE SUPPLY SIDE OF THE MARKET

In a market economy, while buyers of a product constitute the demand side of the market, sellers of that product make the supply side of the market. In this section, we turn to discuss the law of supply.

Market Supply

Supply means the quantity of a commodity which its producers or sellers offer for sell at a given price, per unit of time. Market Supply, like market demand, is the sum of supplies of a commodity made by all individual firms.

3.3.1 The Law of Supply

The supply of a commodity depends on its price and cost of its production. In other words, supply is the function of price and production cost.[1] The law of supply is, however, expressed generally in terms of price-quantity relationship. The ***law of supply*** can be stated as follows: ***The supply of a product increases with the increase in its price and decreases with decrease in its price, other things remaining constant.*** It implies that the supply of a commodity and its price are positively related. This relationship holds under the assumption that "other things remain the same" "Other things" include technology, price of related goods (substitute and complements), and weather and climatic conditions in case of agricultural products.

3.3.2 The Supply Schedule

A supply schedule is a tabular presentation of the law of supply. A supply schedule is a table showing different prices of a commodity and the corresponding quantity that suppliers are willing to offer for sale. Table 3.2 presents a hypothetical supply schedule of shirts, i.e., number of shirts supplied per month at different prices.

1. Cost of production determines, in fact, the minimum price of a commodity.

Table 3.2 Supply Schedule of Shirts

Price (in Rs)	Supply (Shirts in '000)
100	10
200	35
300	50
400	60
600	75
800	80

3.3.3 The Supply Curve

A supply curve is a graphical presentation of the supply schedule. The supply curve SS' given in Fig. 3.9 has been obtained by plotting the data in Table 3.2. The points S, P, Q, R, T and S' show the price-quantity combinations on the supply curve SS'. The supply curve, SS', depicts ***the law of supply***. The upward slope of the supply curve indicates the rise in the supply of shirts with the rise in its price and fall in the supply with fall in prices. For example, at price Rs 200, only 35 thousand shirts are supplied per month. When price rises to Rs 400, supply increases to 60 thousand shirts.

As shown in Fig. 3.9, ***a supply curve has a positive slope***. The positive slope or upward movement of the supply curve is caused by seller's desire to make larger profit and, more importantly, by the rise in cost of production. The rise in cost of production results from the law of diminishing returns. In fact, supply curve is derived from the marginal cost curve. The derivation of supply curve from the marginal cost curve is discussed and illustrated ahead in Chapter 15.

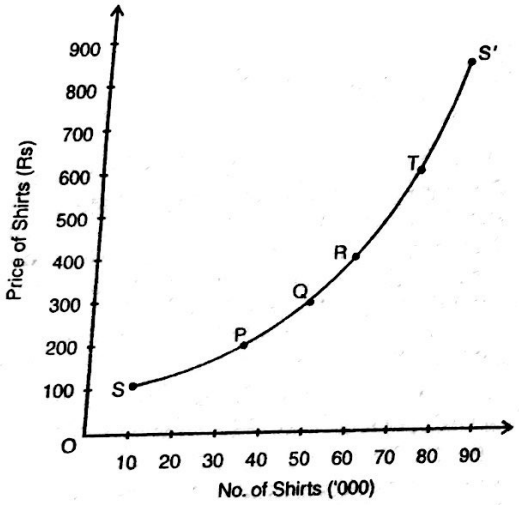

Fig. 3.9 Supply Curve of Shirts

3.3.4 Shift in the Supply Curve

We have shown above that a change in the price of a commodity causes a change in its quantity supplied along a given supply curve. Although price of a commodity is the most important determinant of its supply, it is not the only determinant. Many other factors influence the supply of a commodity. Given the supply curve of a commodity, when there is change in its other determinants, the supply curve shifts rightward or leftward depending on the effect of such changes. Let us now explain how other determinants of supply cause shift in the supply curve.

(i) Change in input prices. When input prices decrease, the use of inputs increases. As a result, product supply increases and the supply curve SS shifts to the right to SS'', as shown in Fig. 3.10. Similarly, when input prices increase, product supply curve shifts leftward from SS to SS'.

(ii) Technological progress. Technological changes that reduce cost of production or increase efficiency cause increase in product supply. For instance, introduction of high yielding variety of paddy and new techniques of cultivation increased per acre yield of rice in India in the 1970s. Such changes make the supply curve shift to the right.

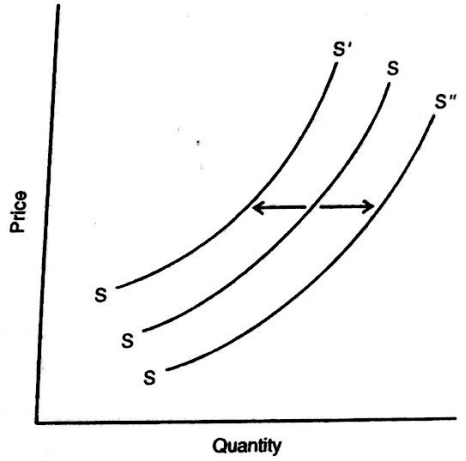

Fig. 3.10 Shift in the Supply Curve

(iii) Price of product substitutes. In production of many commodities, it is possible to produce some other goods which require a similar technology. For example, a refrigerator company can also produce ACs; Tatas famous for truck production can also produce cars; Maruti Udyog can produce trucks, and so on. Fall in the price of one of the product substitutes may lead to the rise in the supply of other due to capacity utilization for profit maximisation.

(iv) Nature and size of the industry. The supply of a commodity depends also on whether an industry is monopolized or competitive. Under monopoly, supply is fixed. When a monopolized industry is made competitive, the total supply increases. Besides, if size of an industry increases due to new firms joining the industry, the total supply increases and supply curve shifts rightward.

(v) Government policy. When government imposes restrictions on production, e.g., import quota on inputs, rationing of or quota imposed on input supply, etc., production tends to fall. Such restrictions make supply curve to shift leftward.

(vi) Non-economic factors. The factors like labour strikes and lock-outs, war, drought, flood, communal riots, epidemics, etc. also affect adversely the supply of commodities.

3.3.5 Supply Function

The ***supply function*** is a mathematical statement which states the relationship between the quantity supplied of a commodity (as a dependent variable) and its determinants (as independent variables). Supply function is based on the law of supply. The law of supply states only the nature of relationship between the price and the quantity supplied. A supply function quantifies this relationship. A supply function may be written as

$$Q_x = 10\,P_x \qquad (3.9)$$

(where Q_x denotes the quantity supplied of commodity X and P_x denotes its price).

Given the supply function, a supply schedule can be obtained by substituting numerical values for P_x. For example, if $P_x = 2$, $Q_x = 20$ and if $P_x = 5$, $Q_x = 50$. By plotting the supply schedule, a supply curve can be obtained. (For procedure, refer to the section on demand function).

3.4 THE MARKET EQUILIBRIUM: EQUILIBRIUM OF DEMAND AND SUPPLY

Determination of Price in a Free Market

In sections 3.2 and 3.4, we have explained the laws of demand and supply and how demand and supply behave in response to the change in price and other determinants. In this section, we explain how demand and supply strike a balance, how market attains **equilibrium**, and how **equilibrium price** is determined in a free market. A **free market** is one in which market forces of demand and supply are free to take their own course and there is no outside control on price, demand and supply.

The Concept of Market Equilibrium

In physical sense, the term equilibrium means the "state of rest". In general sense, it means balance in opposite forces. In the context of market analysis, ***equilibrium refers to a state of market in which quantity demanded of a commodity equals the quantity supplied of the commodity***. The equality of demand and supply produces an ***equilibrium price***. The **equilibrium price** is the price at which quantity demanded of a commodity equals its quantity supplied. That is, at equilibrium price, demand and supply are in equilibrium. Equilibrium price is also called ***market-clearing price***. Market is cleared in the sense that there is no unsold stock and no unsupplied demand.

Determination of Market Price

Equilibrium price of a commodity in a free market is determined by the market forces of demand and supply. In order to analyse how equilibrium price is determined, we need to integrate the demand and supply curves. For this purpose, let us use the example of shirts. Let us suppose that the market demand and supply schedules for shirts are given as shown in Table 3.3.

As the table shows, there is only one price of shirts (Rs 300) at which the market is in equilibrium: quantity demanded equals the quantity supplied at 40 thousand shirts. At all other prices, the shirt market is in ***disequilibrium***—the state of imbalance between supply and demand. When market is in the state of disequilibrium, either demand exceeds supply or supply exceeds demand. As the table shows, at all prices below Rs 300, demand exceeds supply showing *shortage* of shirts in the market. Likewise, at all prices above Rs 300, supply exceeds demand showing *excess supply*.

Table 3.3 Monthly Demand and Supply Schedules for Shirts

Price per Shirt (Rs)	Demand ('000 shirts)	Supply ('000 shirts)	Market Position	Effect on Price
100	80	10	Shortage	Rise
200	55	28	Shortage	Rise
300	40	40	Equilibrium	Stable
400	28	50	Surplus	Fall
500	20	55	Surplus	Fall
600	15	60	Surplu	Fall

In a free market, disequilibrium itself creates the condition for equilibrium. When there is excess supply, it forces downward adjustments in the price and quantity supplied. When there is excess demand, it forces upward adjustments in the price and quantity demanded. The process of downward and upward adjustments in price and quantity continues till the price reaches Rs 300 and quantities supplied and demanded balance at 40 thousand shirts. This process is automatic. Let us now look into the process of price and quantity adjustments called 'market mechanism'.

Market mechanism: How market brings about balance

Market mechanism is a process of interaction between the market forces of demand and supply to determine equilibrium price. To understand how it works, let the price of shirts be initially set at Rs 100. At this price, the quantity demanded exceeds the quantity supplied by 70 thousand shirts. The shortage will force buyers to bid higher price to buy the desired number of shirts. This gives sellers an opportunity to raise the price. Increase in price enhances the profit margin. This induces firms to produce and sell more in order to maximize their profits. This trend continues till price rises to Rs 300. As Table 3.3 shows, at price Rs 300, the buyers are willing to buy 40 thousand shirts. This is exactly the number of shirts that sellers would like to sell at this price. At this price, there is neither shortage nor excess supply of shirts in the market. Therefore, Rs 300 is the equilibrium price. The market is, therefore, in equilibrium.

Similarly, at all prices above Rs 300, supply exceeds demand showing excess supply of shirts in the market. The excess supply forces the competing sellers to cut down the price. Some firms find low price unprofitable and go out of market and some cutdown their production. Therefore, supply of shirts goes down. On the other hand, fall in price invites more customers. This process continues until price of shirts falls to Rs 300. At this price, demand and supply are in balance and market is in equilibrium. Therefore, price at Rs 300 per shirt is equilibrium price.

Graphical Illustration of Price Determination

The determination of equilibrium price is illustrated graphically in Fig. 3.11. The demand curve DD' and the supply curve SS' have been obtained by plotting the demand and supply schedules, respectively, (given in Table 3.3) on the price and quantity axes.

As Fig. 3.11 shows, demand and supply curves intersect at point E determining the **equilibrium price** at Rs 300. At this price, the quantity demanded (40 thousand shirts) equals the quantity supplied. Thus, the equilibrium price is Rs 300 and equilibrium quantity is 40 thousand shirts. The quilibrium condition is not fulfilled at any other point on the demand and supply curves. Therefore, if price is set at any price other than Rs 300, there would be either excess supply or shortage of shirts in the market.

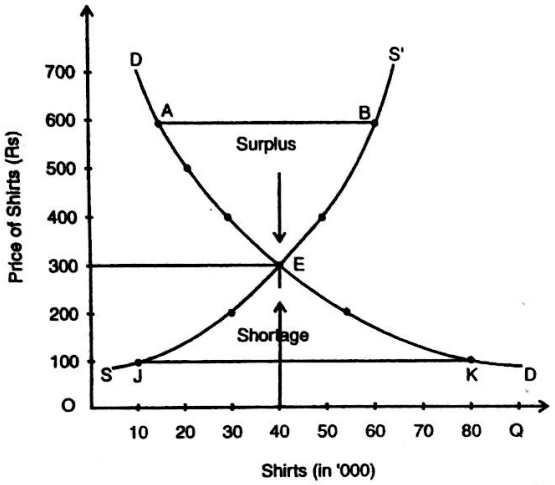

Fig. 3.11 Equilibrium of Demand and Supply: Price Determination

Let us now see how market works to bring about balance in demand for and supply of shirts. Let the price be initially set at Rs 600. At this price, suppliers bring in a supply of 60 thousand shirts whereas buyers are willing to buy only 15 thousand shirts. The supply, obviously, far exceeds the demand. As Fig. 3.11 shows, the excess supply equals, $AB = 60 - 15 = 45$ thousand shirts. The suppliers would, therefore, lower down the price gradually in order to get rid of the unsold stock and cut down the supply simultaneously. Besides, when price falls, demand for shirts increases too. In this process, the supply-demand gap is reduced. This process continues until price reaches Rs 300 at point E, the point of equilibrium where demand and supply equal at 40 thousand shirts. At this price, the market is in equilibrium and there is no inherent force at work which can disturb the market equilibrium.

Likewise, if price is initially set at Rs 100, the buyers would be willing to buy 80 thousand shirts whereas suppliers would be willing to supply only 10 thousand shirts. Thus, there would be a shortage of 70 thousand shirts as shown by the distance JK in Fig. 3.11. The shortage will force the buyers to bid a higher price. This will lead to increase in price which will encourage the suppliers to increase their supply. This process of adjustment will continue as long as demand exceeds supply. When price rises to Rs 300, the market reaches its equilibrium.

Price Determination: A Numerical Example

In the previous section, we have illustrated how equilibrium of demand and supply is determined at the point of intersection of the demand and supply curves. If demand and supply functions are known, the equilibrium quantity and equilibrium price can also be determined numerically.

Let **demand function** for a commodity X be given as

$$Q_d = 150 - 5P_x$$

and **supply function** as

$$Q_s = 10P_x$$

We know that at equilibrium, quantity supplied equals quantity demanded, i.e., $Q_s = Q_d$.

By substituting supply and demand functions, we get

$$10P_x = 150 - 5P_x$$

$$P_x = 10$$

At equilibrium price $P_x = 10$, the quantity supplied and demanded are in equilibrium.

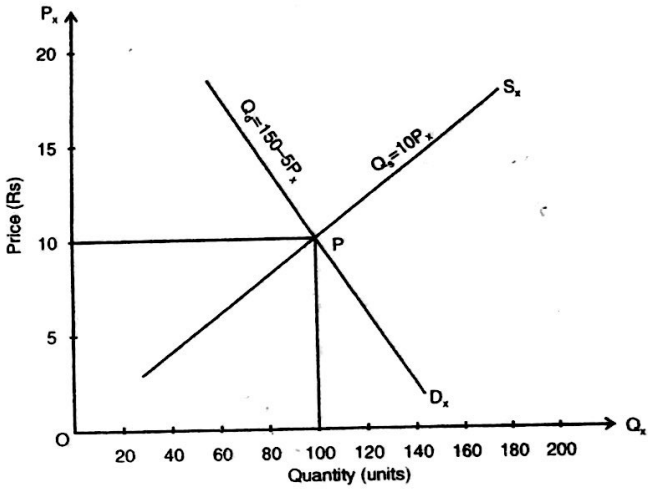

Fig. 3.12 Determination of Equilibrium Price and Quantity

The algebraic determination of equilibrium price and quantity is illustrated graphically in Fig. 3.12. The demand curve DD' has been drawn by using the demand function $Q_d = 150 - 5P_x$ and the supply curve SS' by using the supply function $Q_s = 10P_x$. As the figure shows, demand and supply curves intersect at point P. A perpendicular drawn from point P to the quantity axis determines the equilibrium quantity at 100 units and a line drawn from point P to the price axis determines the equilibrium price at Rs 10. At this price, the quantity demanded equals the quantity supplied and hence the shirt market is in equilibrium.

3.5 SHIFT IN DEMAND AND SUPPLY CURVES AND MARKET EQUILIBRIUM

3.5.1 Shift in Demand Curve

Whenever there is a shift in the demand and/or supply curve, there is also a shift in the equilibrium point. The effect of shift in the demand curve on the equilibrium is shown in Figure 3.13. Suppose that the initial demand curve is given by the curve DD' and supply curve by SS'. The demand and supply curves intersect each other at point P. The equilibrium price is determined at PQ and equilibrium quantity at OQ. Let the demand curve now shift from its position DD' to DD'', supply curve remaining the same. The demand curve DD'' intersects the supply curve SS' at point M. Thus, shift in the demand curve causes a shift in the equilibrium from point P to point M. At the equilibrium, quantity demand and supplied increases from OQ to ON and price increases from PQ to MN. Note that, the supply curve remaining the same, a rightward shift in the demand curve results in a higher