

CHAPTER TWO

FUNDAMENTAL ECONOMIC CONCEPTS

2.1 Meaning of Demand

Demand is one of the crucial requirements for the existence of any business enterprise. A firm is interested in its own profit and/or sales, both of which depend partially upon the demand for its product. The decision which management makes with respect to production, advertising, cost allocation, pricing etc. call for an analysis of demand.

In Managerial Economics we are concerned with demand for a commodity faced by the firm. This depends upon the size of the total market or industry demand for the commodity, which in turn is the sum of the demands for the commodity of the individual consumers in the market. Thus, we begin by examining the theory of consumer demand in order to learn about the market demand on which the demand for the product faced by a particular firm depends.

Demand for a commodity refers to the quantity of the commodity which an individual household is willing to purchase per unit of time at a particular price. In other words, the amount of a good or service that consumers in a market are willing and able to purchase during a given period of time (example, a week, a month) is called **quantity demanded**.

Hence, demand for a commodity implies:

- (a) Desire to acquire it,
- (b) Willingness to pay for it, and
- (c) Ability to pay for it.

Demand has a specific meaning. Mere desire to buy a product is not demand. Mere desire and ability to pay for a car is not demand because he does not have the necessary will to pay for it. Similarly a poor man's desire and his willingness to pay for a car is not demand because he lacks the necessary purchasing power. One can also conceive of a person who possesses both the will and purchasing power to pay for a commodity, yet this is not demand for that commodity if he does not have desire to have that commodity.

2.1.1 Law of Demand

The assumption of profit-maximizing behavior assumes that owners and managers know the demand for the firm's good or service. The demand function asserts that there is a measurable relationship between the price that a company charges for its product and the number of units that buyers are willing and able

to purchase during a specified time period. Economists refer to this behavioral relationship as the *law of demand*, which is sometimes called the *first fundamental law of economics*.

Definition: The law of demand states the functional relationships between price and quantity demanded. According to this law, there is an inverse relationship between price and quantity demanded of a commodity, other things hold constant.

2.1.2 Determinants of Demand

Although price is the important determinant of demand, there are also various factors which determine demand. Some of these include:

1. **Price of a commodity:** as the law of demand describes, the relationship between the price of the commodity and the quantity demanded is inverse. I.e., as one increases the other decreases and vice versa.
2. **Price of related commodities:** the two goods are related either being substituted or complemented each other. The two goods are said to be substituted if they are independent in usage but substitute for each other. For such goods changes in the price of one affects the demand for other in the same direction. Example, tea and coffee, Pepsi and coca. However, the two goods are said to be complementary if they goes together in uses and complement of each other. For such goods changes in price of one affects the demand for other in the different direction. Example, tea and sugar, car and tyre, camera and film.
3. **Income of the consumer:** usually people want to spend more at higher income level than at lower income level. But for a detailed analysis of income-demand relationship the type of good taking into consideration will result different outcomes.
 - a. **Necessity or basic goods:** these are goods essentially consumed by the society such as food grains, vegetables and sugar etc. So the demand of such goods increases with the increase in income.
 - b. **Inferior goods:** goods which has been given less value by the society. The demand for such goods may initially increase with increase in income up to a certain limit. But it decreases when income increases beyond that limit.
 - c. **Normal goods:** normal goods are goods like clothing and furniture whose demand increases as income increase.
 - d. **Prestige or luxury goods:** these are goods demanded for luxury purposes usually by the rich. Demand for these goods a rise beyond a certain level of consumer's income. Example, Luxury cars and jewelers.

4. **Taste and preference of consumers:** it also has an effect on demand of a consumer due to the existence of different social, cultural, religious values which changes the taste and preference of consumers towards a given commodity.
5. **Expectation about future price of commodities and income of consumers:** there exist positive relationship between the expected price and demand, that is, as the expected price in the future time increases, the today's consumers' consumption (or demand) increases and vice versa. Also we will obtain the same result in the case of expected income of the consumer.

2.1.3 Shift in Demand Vs Change in Quantity Demanded

Demand is represented by the entire demand curve while quantity demanded is represented by a single point on the demand curve. Thus, the shift in demand causes the entire curve to move and this is due to changes in the determinants of demand other than its own price. In contrast, the change in quantity demand referred the movement on the curve from one point to another point and caused by changes in its own price, other things held constant.

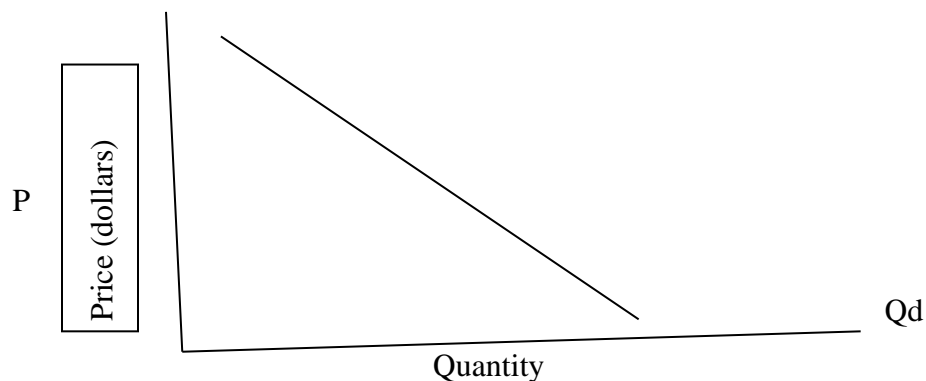


Figure 2.1 Quantity Demanded

2.1.4 Demand Schedule, Curve and Function

Under ceteris paribus assumption, the law of demand can be illustrated through the concept of demand schedule, curve and function.

Demand schedule: tabular representation of a series of price of a commodity and the corresponding quantity demanded.

Price	Quantity demanded
1	20
2	15
3	12
4	10
5	9

Demand curve: it is a graphical representation of law of demand and caused by changes in its own price, other things held constant.

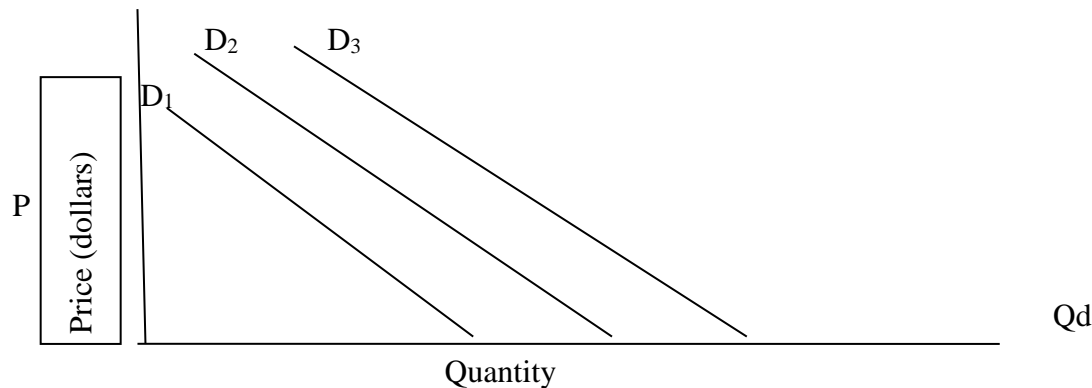


Figure 2.2 Shifts in Demand

Demand function: the mathematical representation of relationship between demand and its determinants given the factors such as price of commodity x (P_x), price of commodity y (P_y)- as a related commodity, income of the consumer (I) and taste and preference of the consumer (T), the quantity demanded of a commodity (Q_x) becomes a function of all the above stated determinants. $Q_x = f(P_x, P_y, I, T)$. In the case of law of demand, the function will be reduced to $Q_x = f(P_x)$.

Relation: An increase in demand means that, at each price, more is demanded; a decrease in demand means that, at each price, less is demanded. Demand changes/shifts when one of the determinants of demand changes.

2.1.5 Demand Distinctions: Types of Demand

Demand may be defined as the quantity of goods or services desired by an individual, backed by the ability and willingness to pay.

Some of the types of Demand:

1. Direct and indirect demand: (or) Producers' goods and consumers' goods: demand for goods that are directly used for consumption by the ultimate consumer is known as direct demand (example: Demand for T shirts). On the other hand demand for goods that are used by producers for producing goods and services. (Example: Demand for cotton by a textile mill)

2. Derived demand and autonomous demand: when a produce derives its usage from the use of some primary product it is known as derived demand. (Example: demand for tyres derived from demand for car). Autonomous demand is the demand for a product that can be independently used.

(Example: demand for a washing machine)

3. Durable and nondurable goods demand: durable goods are those that can be used more than once, over a period of time (example: Microwave oven). Nondurable goods can be used only once. (Example: vegetables)

4. Joint demand and Composite demand: when two goods are demanded in conjunction with one another at the same time to satisfy a single want; it is called as joint or complementary demand. (Example: demand for petrol and car). A composite demand is one in which a good is wanted for several different uses. (Example: demand for iron rods for various purposes)

Exceptional demand curve:

The demand curve slopes from left to right upward if despite the increase in price of the commodity, people tend to buy more due to reasons like fear of shortages or it may be an absolutely essential good.

The law of demand does not apply in every case and situation. The circumstances when the law of demand becomes ineffective are known as **exceptions of the law**. Some of these important exceptions are as under.

1. Giffen Goods:

Some special varieties of inferior goods are termed as Giffen goods. Cheaper varieties millets like cheaper vegetables like potato etc come under this category. Sir Robert Giffen of Ireland first observed that people used to spend more of their income on inferior goods like potato and less of their income on meat. After purchasing potato the staple food, they did not have staple food potato surplus to buy meat. ***So the rise in price of potato compelled people to buy more potato and thus raised the demand for potato.*** This is against the law of demand. This is also known as Giffen paradox.

2. Conspicuous Consumption / Veblen Effect:

This exception to the law of demand is associated with the doctrine propounded by Thorsten Veblen. A few goods like *diamonds* etc are purchased by the **rich and wealthy** sections of society. The prices of these goods are so high that they are beyond the reach of the common man. ***The higher the price of the diamond, the higher its prestige value.*** So when price of these goods falls, the consumers think that the prestige value of these goods comes down. ***So quantity demanded of these goods falls with fall in their price.*** So the law of demand does not hold good here.

3. Conspicuous Necessities:

Certain things become the necessities of modern life. So we have to purchase them despite their high price. The demand for T.V. sets, automobiles and refrigerators etc. has not gone down in spite of the increase in their price. These things have become the symbol of status. So they are purchased despite their rising price.

4. Emergencies:

During emergencies like war, famine etc, households behave in an abnormal way. Households accentuate scarcities and induce further price rise by making increased purchases even at higher prices because of the apprehension that they may not be available.

5. Future Changes in Prices:

Households also act as speculators. When the prices are rising households tend to purchase large quantities of the commodity out of the apprehension that prices may still go up. **When prices are expected to fall further, they wait to buy goods** in future at still lower prices. So quantity demanded falls when prices are falling.

6. Change in Fashion:

A change in fashion and tastes affects the market for a commodity. When a digital camera replaces a normal manual camera, no amount of reduction in the price of the latter(Manual camera) is sufficient to clear the stocks. Digital cameras on the other hand, will have more customers even though its price may be going up. The law of demand becomes ineffective.

7. Demonstration Effect:

It refers to a tendency of low income groups to imitate the consumption pattern of high income groups. They will buy a commodity to imitate the consumption of their neighbors even if they do not have the purchasing power.

8. Snob Effect:

Some buyers have a desire to own unusual or unique products to show that they **are different from others**. In this situation even when the price rises the demand for the commodity will be more.

9. Speculative Goods/ Outdated Goods/ Seasonal Goods:

Speculative goods such as shares do not follow the law of demand. Whenever the prices rise, the traders expect the prices to rise further so they buy more.

Goods that go out of use due to advancement in the underlying technology are called outdated goods. The demand for such goods does not rise even with fall in prices

Seasonal Goods: Goods which are not used during the off-season (seasonal goods) will also be subject to similar demand behavior.

10. Goods in Short Supply:

Goods that are available in limited quantity or whose future availability is uncertain also violate the law of demand.

2.2 Meaning of Supply

Supply refers to the producer's attitude towards a commodity to produce and sell a given commodity at a given price per time period. So it is the willingness and ability of a producer to produce and offer a commodity to the market. The amount of a good or service offered for sale in a market during a given period of time (example, a week, a month) is called quantity supplied, which we denote as Q_s .

2.2.1 Law of supply

The law of supply states that the price and quantity of a commodity are positively related. Implying that the supply of a commodity increases with increase in its price and it decreases in its price, *ceteris paribus*.

2.2.2 Determinants of Supply

- 1. Price of a commodity:** as the law of supply describes, the relationship between the price of the commodity and the quantity supplied is positively related.
- 2. Cost of inputs:** the cost of inputs has an indirect effect on the supply of a commodity. That is, when the cost of inputs used to produce a commodity increase/decreases the supply of the commodity decreases/increases respectively.
- 3. Technology and productivity:** the technology applied to the production process and the productivity has a direct effect on supply of a commodity by reducing the cost of production and increasing efficiency.
- 4. Price of alternative products:** the alternative products may be a substitute or complement. An increase in the price of the substitute product causes a reduction in supply of the commodity and vice versa, however, an increase in the price of a complementary product causes an increase in supply of the commodity. Thus, the substitute inversely affects supply where as the complement directly affects supply.
- 5. Number of firms in the industry:** the size of the industry affects the supply in the same direction. Increase/decrease in the number of producers causes the supply to increase/decrease. Moreover, a grant/subsidy to the producers affects the supply positively while the tax on producers affects supply negatively.

Note that: the conceptual explanations presented on the demand theory with regard to difference between demand and quantity demanded and the representation of relationship between demand and its determinant through schedule, curve and function would also have analogous conceptual explanations in the supply theory under the lessons of difference between supply and quantity supplied and supply schedule, curve and function.

2.3 Market Equilibrium

Demand and supply provide an analytical framework for the analysis of the behavior of buyers and sellers in markets. Demand shows how buyers respond to changes in price and other variables that determine quantities buyers are willing and able to purchase. Supply shows how sellers respond to changes in price and other variables that determine quantities offered for sale. The interaction of buyers and sellers in the marketplace leads **market equilibrium**. Market equilibrium is a situation in which, *at the prevailing price*, consumers can buy all of a good they wish and producers can sell all of the good they wish.

In other words, **market equilibrium** refers to *equilibrium of demand and supply* in which the *quantity demanded* of a commodity equals the *quantity supplied* of a commodity. Consequently, such equilibrium brings the *equilibrium price and quantity*. The equilibrium price is also known as a *market clearing price*, because at this price the market is clear in a sense that there is no unsold stock and no unsupplied demand, instead the supply equals the demand.

Table 2.1 Market Equilibrium

(1) Price	(2) S_0 Quantity supplied ($Q_s = 100 + 10P$)	(2) D_0 Quantity demanded ($Q_d = 1,300 - 20P$)	(4) Excess supply (+) or excess demand (-) ($Q_s - Q_d$)
\$65	750	0	+750
60	700	100	+600
50	600	300	+300
40	500	500	0
30	400	700	-300
20	300	900	-600
10	200	1,100	-900

To illustrate how market equilibrium is achieved, we can use the demand and supply concepts in the preceding sections. As the table 2.1 shows, equilibrium in the market occurs when price is \$40 and both

quantity demanded and quantity supplied are equal to 500 units. At every price above \$40, quantity supplied is greater than quantity demanded. **Excess supply** or a **surplus** exists when the quantity supplied exceeds the quantity demanded. At every price below \$40, quantity supplied is less than quantity demanded. A situation in which quantity demanded exceeds quantity supplied is called **excess demand** or a **shortage**. Excess demand and excess supply equal zero only in equilibrium. In equilibrium the market "clears" in the sense that buyers can purchase all they want and sellers can sell all they want at the equilibrium price. Because of this clearing of the market, equilibrium price is sometimes called the **market clearing price**.

Example 1: The demand equation is $Q_d = 1,300 - 20P$ and the supply equation is $Q_s = 100 + 10P$. Since equilibrium requires that $Q_d = Q_s$, in equilibrium,

$$1,300 - 20P = 100 + 10P$$

Solving this equation for equilibrium price,

$$1,200 = 30P$$

$$\underline{\underline{P = \$40}}$$

Figure 2.3 Market Equilibrium

At the market clearing price of \$40,

$$Q_d = 1,300 - (20 * 40) = \underline{\underline{500}}$$

$$Q_s = 100 + (10 * 40) = \underline{\underline{500}}$$

As expected, these mathematically derived results are identical to those presented in Table 2.1.

According to Table 2.1, when price is \$50, there is a surplus of 300 units. Using the demand and supply equations, when $P = 50$,

$$Q_d = 1,300 - (20 * 50) = \underline{\underline{300}}$$

$$Q_s = 100 + (10 * 50) = \underline{\underline{600}}$$

Therefore, when price is \$50,

$Q_s - Q_d = 600 - 300 = \underline{\underline{300}}$, which is the result shown in column 4.

To express the equilibrium solution graphically, Figure 2.3 shows the demand curve D_0 and the supply S_0 associated with the schedules in Table 2.1. Clearly, \$40 and 500 units are the equilibrium price and quantity. Only at a price of \$40 does quantity demanded equal quantity supplied.

Market forces will drive price toward \$40. If price is \$50, producers want to supply 600 units while consumers only demand 300 units. An excess supply of 300 units develops. Producers must lower price in order to keep from accumulating unwanted inventories. At any price above \$40, excess supply results, and producers will lower price.

If the price is \$20, consumers are willing and able to purchase 900 units, while producers offer only 300 units for sale. An excess demand of 600 units results. Since their demands are not satisfied, consumers bid the price up. Any price below \$40 leads to an excess demand, and the shortage induces consumers to bid up the price. Given no outside influences that prevent price from being bid up or down, an equilibrium price and quantity are attained. This equilibrium price is the price that clears the market; both excess demand and excess supply are zero in equilibrium.

Example 2: Given the demand and supply functions, the equilibrium price and quantity can be computed algebraically using the concept of market equilibrium. Suppose the demand and supply functions for a commodity x be given as $Q_d = 150 - 5P_x$ and $Q_s = 10P_x$ respectively. Thus, the equilibrium P and Q will be computed as: For market equilibrium

$$DD = SS$$

$$150 - 5P_x = 10P_x$$

$$150 = 15P_x$$

$$P_x = 10$$

$$Q = 10P_x$$

$$Q = 10 \times 10$$

$$Q = 100$$

Therefore, the equilibrium price and quantity are **10** and **100** respectively.

2.4 Elasticity

Elasticity is the responsiveness of a consumer/producer to the change in the quantity demanded/quantity supplied of a commodity.

2.4.1 Price Elasticity of Demand

It is the responsiveness or sensitiveness of a consumer to the price change and price elasticity of demand,

$$\varepsilon_d, \text{ is given by } \varepsilon_d = \frac{\text{percentage change in quantity demanded}}{\text{percentage change in price}} = \frac{\Delta x / x \cdot 100}{\Delta p / p \cdot 100}$$

where x, p are quantity and price respectively. It can be also written as:

$$\varepsilon_d = \frac{\Delta x / x}{\Delta p / p} = \frac{\Delta x}{x} \cdot \frac{p}{\Delta p} = \frac{\Delta x}{\Delta p} \cdot \frac{p}{x} = - \frac{\Delta x}{\Delta p} \cdot \frac{p}{x}$$

ε_d is the coefficient of elasticity of demand that lie between 0 and ∞ . Thus, depending up on the proportional change in quantity demanded (Q_x) and price (p), there are various types of elasticities.

- i. **Perfectly elastic demand** ($\varepsilon_d > \infty$): change in price leads the quantity demanded to be very high so that the consumer is highly responsible.
- ii. **Elastic demand** ($1 < \varepsilon_d < \infty$): proportional change in quantity demanded greater than that of price so that the consumer is more responsible.
- iii. **Unitary elastic demand** ($\varepsilon_d = 1$): proportionate change in quantity demanded and price are equal so that the consumer responds by the same magnitude of the price change.
- iv. **Inelastic demand** ($0 < \varepsilon_d < 1$): proportionate change in quantity demanded is less than that of the price so that the consumer is less responsive.
- v. **Perfectly inelastic demand** ($\varepsilon_d = 0$): it refers to whatever the price change there is no change in quantity demanded so that the consumer is not responsive for the price change.

The arc price elasticity of demand calculates price elasticity between two prices and indicates the effect on the demand.

$$\varepsilon_d = \frac{Q_2 - Q_1}{P_2 - P_1} \cdot \frac{P_2 + P_1}{Q_2 + Q_1}$$

Example 1: Consider the following demand schedule.

Price P (\$ /unit)	Quantity sold, QD
20	12
19	14
18	16
17	18
16	20

Table 3.1 Demand schedule

Calculate the price elasticity between an original price \$20 (12 units are demanded) and a new price of \$19.

Given:

$$P_1 = 20, \quad Q_1 = 12$$

$$P_2 = 19, \quad Q_2 = 14$$

$$\varepsilon_d = \frac{Q_2 - Q_1}{P_2 - P_1} \cdot \frac{P_2 + P_1}{Q_2 + Q_1} = \frac{14 - 12}{19 - 20} \cdot \frac{19 + 20}{14 + 12} = \frac{2}{-1} \cdot \frac{39}{26} = \frac{78}{-26} = \underline{\underline{-3}}$$

Interpretation: A price elasticity of demand coefficient of -3 means that a 1 percent decrease in price can be expected to result in a 3 percent increase in quantity demanded, other things remain constant.

Example 2: Suppose that the price and quantity demanded for a good are \$5 and 20 units, respectively. Suppose further that the price of the product increases to \$20 and the quantity demanded falls to 5 units. Calculate the price elasticity of demand.

Solution: Since we are given two price–quantity combinations, the price elasticity of demand may be calculated using the midpoint formula.

Given:

$$P_1 = 5, \quad Q_1 = 20$$

$$P_2 = 20, \quad Q_2 = 5$$

$$\varepsilon_d = \frac{Q_2 - Q_1}{P_2 - P_1} \cdot \frac{P_2 + P_1}{Q_2 + Q_1} = \frac{5 - 20}{20 - 5} \cdot \frac{20 + 5}{5 + 20} = \frac{-15}{15} \cdot \frac{25}{25} = \underline{\underline{-1}}.$$

2.4.2 Income Elasticity of Demand

Income is among the variables that strongly affect demand. Income elasticity of demand measures the responsiveness of a change in quantity demanded of some commodity to a change in income.

$$E_Y = \frac{\% \Delta Q_D}{\% \Delta Y}$$

Where, E_Y = Income elasticity

ΔQ_D = Change in quantity demand,

ΔY = Change in income

Arc income elasticity is used when relatively large changes in income are being considered and defined as:

$$E_Y = \frac{Q_2 - Q_1}{Y_2 - Y_1} \cdot \frac{Y_2 + Y_1}{Q_2 + Q_1}$$

Example 1: What is the income elasticity of automobiles as per capital income increases from \$10,000 to \$11,000? The demand for automobiles as a function of income per capital is given by the equation; $Q = 50,000 + 5(y)$.

Solution: First find Q_1 and Q_2 by substituting $Y_1 = \$10,000$ and $Y_2 = 11,000$ in the demand equation respectively.

$$\begin{aligned} Q_1 &= 50,000 + 5(10,000) \\ &= 50,000 + 50,000 \end{aligned}$$

$$Q_1 = 100,000 \text{ cars}$$

$$Q_2 = 50,000 + 5(11,000)$$

$$= 50,000 + 55,000$$

$$Q_2 = 105,000 \text{ cars}$$

$$\text{Thus, } E_Y = \frac{105,000 - 100,000}{11,000 - 10,000} \cdot \frac{11,000 + 10,000}{105,000 + 100,000} = \underline{\underline{0.512}}.$$

The result can be interpreted as over the income range \$10,000 to \$11,000 each 1 percent increase in income causes about 0.51 increases in quantity demanded.

2.4.3 Cross Elasticity of Demand

Another variable that often affects the demand for a product is the price of a related product (Substitute or Complementary). Cross elasticity denoted as E_X and it is a measure of the responsiveness of change in the quantity demanded (Q_{DA}) of product A to price changes for product B (P_B).

$$E_X = \frac{\% \Delta Q_{DA}}{\% \Delta P_B}, \text{ ceteris paribus}$$

Where, $\% \Delta Q_{DA}$ = change in quantity demanded of product A

$\% \Delta P_B$ = change in price of product B

As we did previously arc cross elasticity uses to compute cross elasticity between two price levels. It is calculated as follows:

$$E_X = \frac{Q_{A2} - Q_{A1}}{P_{B2} - P_{B1}} \cdot \frac{P_{B2} + P_{B1}}{Q_{A2} + Q_{A1}}$$

Where, Q_{A2} = quantity demanded of A after a price change in B

Q_{A1} = original quantity demanded of A

P_{B2} = new price for product B

P_{B1} = original price for product B

Example 1: Suppose at a local grocery store the price of butter increase from \$1 to \$1.50 per pound. As a result, the quantity demanded of margarine Q_A increases from 500 pounds to 600 pounds per a month. Compute the arc cross elasticity of demand.

Solution: Substituting the relevant data into the above equation,

$$E_x = \frac{600 - 500}{\$1.50 - \$1.00} \cdot \frac{\$1.50 + 1.00}{600 + 500}$$

$$E_x = 0.45.$$

The result can be interpreted as follows a 1 percent increase in the price of butter will lead to a 0.45 percent increase in the quantity demanded of margarine, which is, of course, a butter *substitute*, *ceteris paribus*.

2.4.4 Price Elasticity of Supply

Price elasticity of supply, ε_s , is the responsiveness of a producer to the price change and it is given by

$$\varepsilon_s = \frac{\text{percentage change in quantity supplied}}{\text{percentage change in price}} = \frac{\Delta x / x \cdot 100}{\Delta p / p \cdot 100}$$

Like the price elasticity of demand, the price elasticity of supply can also be classified in five types of price elasticity which will be explained in brief as follows:

- i. Perfectly elastic supply: $\varepsilon_s > \infty$
- ii. Elastic supply: $1 < \varepsilon_s < \infty$
- iii. Unitary elastic supply: $\varepsilon_s = 1$
- iv. Inelastic supply: $0 < \varepsilon_s < 1$
- v. Perfectly inelastic supply: $\varepsilon_s = 0$

Exercise: Suppose that the price of salt rises from 15 cents to 17 cents a pound. The quantity demanded decrease from 25 pounds to 20 pound per month and the quantity supplied increases from 525 pounds to 600 pounds per month

- A. Calculate the price elasticity of demand for salt
- B. Is the demand for salt price elastic or price inelastic?
- C. Calculate the price elasticity of supply for salt
- D. Is the supply for salt price elastic or price inelastic?

2.5 The Marginal Analysis

Marginal analysis is an analytical technique used for solving optimization problem and arrives at optimal decision. Although there are various maximization or minimization decision to solve the optimization problems, all optimization problems can be solved using analytical technique called *marginal analysis*. The marginal analysis involves changing the value/s of the variables that determine the objective function (i.e., choice variables) by a small amount to see if the objective function can be further increased (in the case of maximization problems) or further decreased (in the case of minimization problems). The manager continues to make incremental adjustment on the choice variables until no further improvements are possible.

The change on a choice variable also refers to an activity that decision makers might wish to undertake will generate both benefits and costs. Consequently, the decision makers will want to obtain a maximum possible net benefit from the activity where the net benefit (NB) associated with a specific amount or level of activity (A) is the difference between the total benefit (TB) and total cost (TC) of the activity. $NB = TB - TC$. This net benefit helps to maximize the objective function.

Regarding the marginal analysis the marginal benefit (MB) and the marginal cost (MC) helps to analyze the optimization problem. MB is a change in total benefit caused by an incremental change in the level of an activity and MC is a change in total cost caused by an incremental change in the level of activity. MB and MC can be expressed mathematically as:

$$MB = \frac{\text{change in total benefit}}{\text{change in activity}} = \frac{\Delta TB}{\Delta A} \quad MC = \frac{\text{change in total cost}}{\text{change in activity}} = \frac{\Delta TC}{\Delta A}$$

Principle: If, at a given level of activity, a small increase or decrease in activity causes net benefit to increase, then this level of the activity is not optimal. The activity must then be increased (if marginal benefit exceeds marginal cost, $MB > MC$) or decreased (if marginal cost exceeds marginal benefit, $MB < MC$) to reach the highest net benefit. The optimal level of the activity- the level that maximizes net benefit- is obtained when no further increases in net benefit are possible for any changes in the activity, which occurs at the activity level for which marginal benefit equals marginal cost: $MB = MC$.

2.6 The Time Value of Money

People generally earn money because they want to spend it. If they save it, rather than spend it in the period in which it was earned, it is usually because they want it to spend in the future. However, for most people present consumption is more desirable than future consumption if only because the future is so uncertain. "Live and be merry, for tomorrow we may die," is a rationale used over the ages to justify the urge to buy now rather than deferring gratification to the future. For this reason, most of us would rather have a dollar today than a dollar a year from today, and must be given something extra to get us to defer gratification.

Looking at the transaction from the borrower's perspective, there are consumers and businesses (not to mention the deficit-ridden government) who really need that dollar today and who are willing to promise to pay back more than that dollar in the future. Businesses can invest borrowed funds in capital to create profits which are (hopefully) more than sufficient to repay the borrowed funds (principal) plus *interest*. Consumers and governments borrow for various reasons but are expected to have income in the future sufficient to repay principal and interest. Simply put, the basic concept of time value of money is that money has time value. That is, a bird at hand worth two in the forest.

Discounting principle: Discounting principle states that when a decision affects costs and revenue at future dates, it is necessary to discount those costs and revenues to present values before a valid comparison of alternatives is possible. This is because money has time value, that is Birr 1 to be received in the future does not worth Birr 1 today. Therefore, it is necessary to have techniques for measuring the value today (i.e., the present value) of money to be received or paid at different points in future.

Example: What is the present value of Birr 1 to be received in 4 years if the interest rate is 0.10?

Solution: $P = \frac{A}{(1+i)^n} = \frac{1}{(1+0.10)^4} = \frac{1}{1.4641} = \underline{\underline{\text{Birr 0.683}}}$