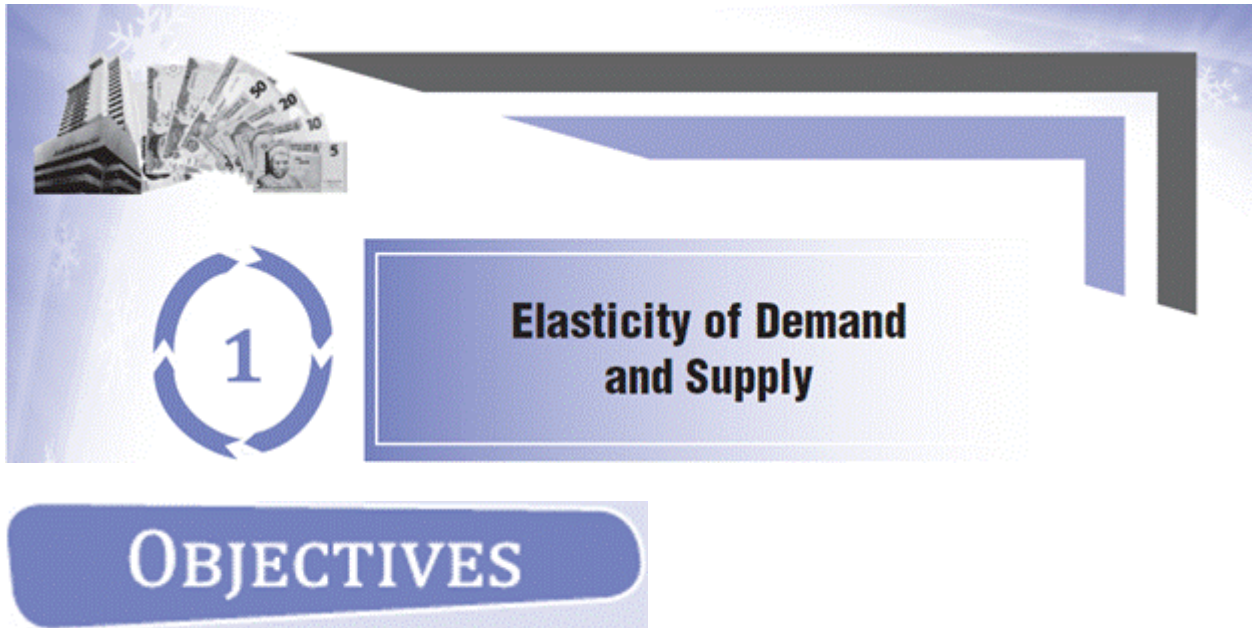# Elasticity of Demand and Supply

OBJECTIVES

At the end of this chapter, students should be able to:

- explain the meaning of elasticity;
- mention and explain the different types of elasticity;
- measure and determine the degrees of elasticity of demand and supply;
- determine the relationship between elasticity and revenue;define price control.

1.1 Introduction

In the explanation of demand and supply analysis, it was realized that the quantity demanded of a commodity and quantity supplied change as its price changes. In economics, it is important to know the degree of responsiveness or the extent of the expansion or contraction in quantity demanded or supplied when the price changes. The concept of elasticity is more easily understood if one thinks of the stretching of a rubber band between two hands. The extent to which the elastic band will stretch depends on the pressure applied on it by the hands. It also depends on the flexibility of the rubber.

In this chapter, the following shall be examined: meaning of elasticity; types of elasticity of demand and supply; factors affecting elasticity of demand and supply; relationship between elasticity; and revenue and price control.

1.2 Concept of Elasticity

Elasticity of demand refers to the degree of responsiveness of the quantity demanded of a commodity to a small change in price of that commodity. Demand is said to be elastic if a change in the price of a product or in prices of other commodities leads to more than proportional changes in the quantity demanded of that commodity.

1.3 Types of Elasticity of Demand

Elasticity of demand is of three types, namely, price elasticity, income elasticity and cross elasticity of demand.

(a) Income elasticity of demand: Income elasticity of demand is the degree of responsiveness of the demand of a commodity to a change in the consumers' income. Income elasticity of demand is negative for inferior goods since an increase in income will lead to a decreased demand for them.

(b) Price elasticity of demand: These measures the degree of responsiveness of the quantity demanded of a commodity to a small change (i.e., increase or decrease) in the price of that commodity. Price elasticity of demand is often called elasticity of demand.

(c) Cross elasticity of demand: This is the degree of responsiveness of the quantity of a commodity demanded to change in the prices of other commodities.

1.4 Degrees of Elasticity of Demand

(a) Inelastic demand: Here, elasticity is less than one, i.e., $e < 1$. A change in price leads to less than proportional change in the quantity demanded. For example, a 2% increase in price brings about a less than 2% decrease in the quantity demanded or a 2% decrease in price leads to a less than 2% increase in the quantity demanded.
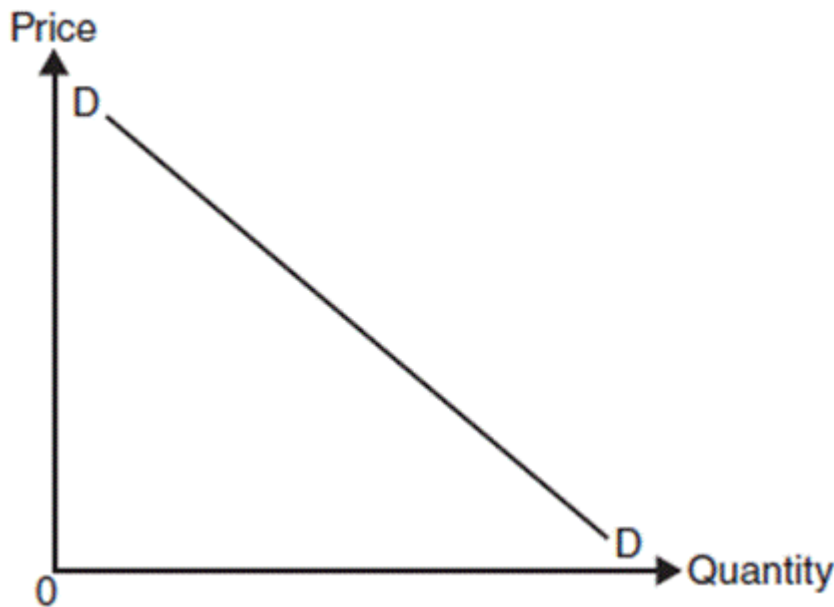

Fig. 1.1 Graphical Representation of Inelastic Demand

(b) Elastic demand: Demand is said to be elastic when a change in price leads to more than proportional change in the quantity demanded. This is a situation whereby elasticity of demand is greater than one. For example, if a 3% increase in price brings about more than 3% decrease in the quantity demanded or a 3% decrease in price leads to a more than 3% increase in the quantity demanded, elasticity is elastic.
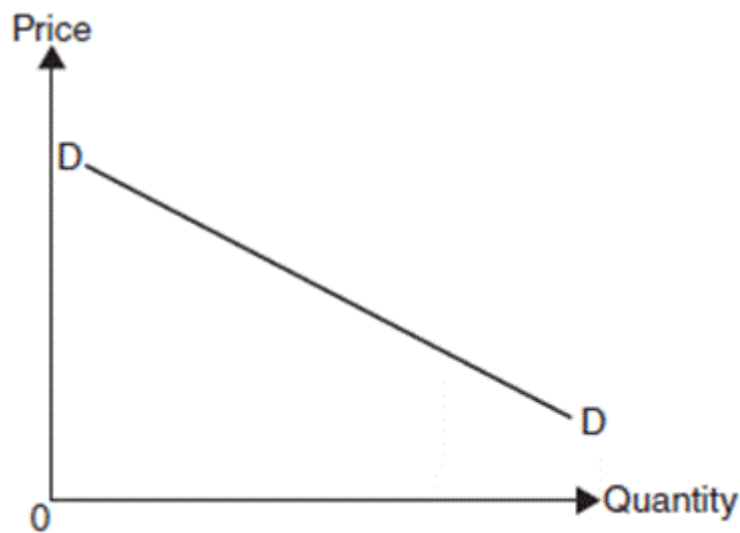
Price

Fig. 1.2 Graphical Representation of Elastic Demand

(c) Zero elastic or perfectly inelastic demand: This is a situation where the quantity demanded is constant irrespective of the increase or decrease in price, i.e., $e = 0$.
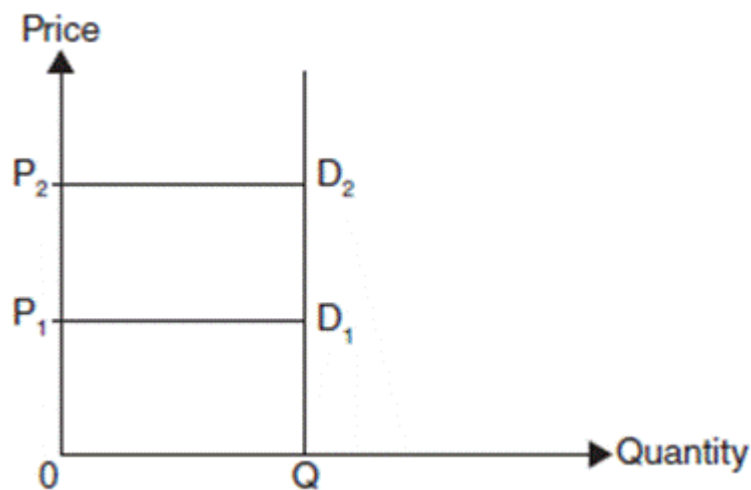

Fig. 1.3 Graphical Representation of Zero Elastic Demand

(d) Infinite elastic or perfectly elastic demand: Elasticity of demand here is equal to infinity, i.e., $e = Î±$. A change in price leads to an infinitely large change in the quantity demanded.
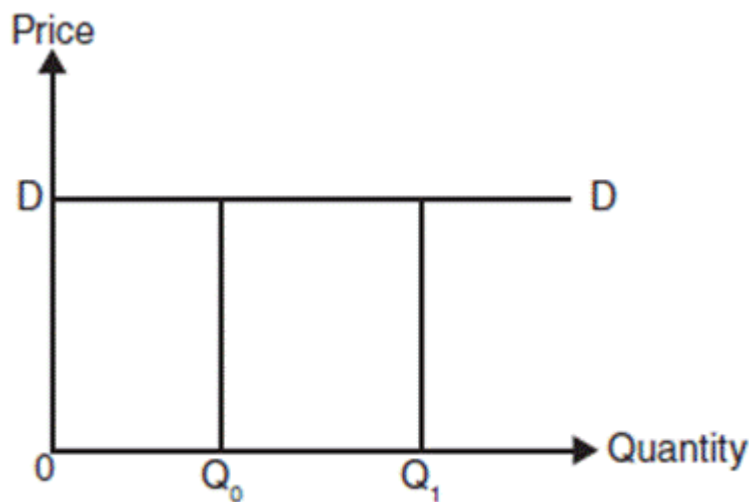
Price

Fig. 1.4 Graphical Representation of Infinite Elasticity of Demand

(e) Unitary or unity elasticity of demand: This refers to an elasticity of demand that is equal to one, i.e., $e = 1$. Here, the quantity demanded changes in the same proportion with the change in price. For example, a 2% increase in price brings about a 2% decrease in demand, while a 2% decrease in price brings about a 2% increase in demand.

Fig. 1.5 Graphical Representation of Unitary Elasticity of Demand

1.5 Measurement of Elasticity of Demand

Elasticity of demand can be measured or determined by calculating the elasticity of demand coefficient. This can be done using the following formulae:

   (a) Coefficient of price elasticity of demand

$$= \frac{\% \text{ change in quantity supplied}}{\% \text{ change in price}}$$

   (b) Coefficient of income elasticity of demand

$$= \frac{\% \text{ change in quantity demanded}}{\% \text{ change in income}}$$

(c) Coefficient of cross elasticity of demand

$$= \frac{\% \text{ change in quantity of commodity X demanded}}{\% \text{ change in price of commodity Y}}$$

If the coefficient is equal to zero, demand is perfectly inelastic; if it is less than one, demand is inelastic; if it is equal to one, demand is unitary and if it is greater than one, demand is elastic.

Example A

If the price of matches increased from N35.00 to N45.00 and the quantity bought per week decreased from 400 to 300 packets, determine the elasticity of demand for the matches.

Solution

Original quantity of matches demanded = 400 packets
New quantity demanded = 300 packets
Change in quantity demanded = 400 − 300 = 100 packets
% change in quantity demanded

$$= \frac{100}{400} \times \frac{100}{1} = \frac{100}{4} = 25\%$$

Original price of matches (per packet) = N35.00
New price of matches (per packet) = N45.00
Change in price of matches = N45.00 − N35.00 = N10.00
% change in price of matches (per packet)

$$= \frac{10}{35} \times \frac{100}{1} = 29\%$$

$$\therefore \frac{25\%}{29\%} = 1.14\%$$

This is elastic because it is greater than one, i.e., $e > 1$.

Example B

Mr Obi's income increased from N4,000.00 to N5,000.00. The quantity of rice he bought increased from 200 kg to 280 kg. Compute the income elasticity of demand for rice.

Solution

% change in Qd

$$= \frac{\text{new Qd} - \text{old Qd}}{\text{Old Qd}} \times \frac{100}{1}$$

$$= \frac{280 - 200}{200} \times \frac{100}{1}$$

$$= \frac{80}{200} \times \frac{100}{1} = 40\%$$

% change in income

$$= \frac{\text{New income} - \text{old income}}{\text{old income}} \times \frac{100}{1}$$

$$= \frac{5000 - 4000}{4000} \times \frac{100}{1}$$

Income elasticity of demand

$$= \frac{\% \, \Delta \, \text{Qd}}{\% \, \Delta \, 1} = \frac{40\%}{25\%} = 1.6\%$$

Example C

The price of *Omo* increased from N25 to N40 and the quantity demanded of *Klin* increased from 150 packets to 200 packets. Calculate the cross elasticity of demand.

Solution

% change in quantity demanded of *Klin*

$$= \frac{200 - 150}{150} \times 100$$

$$= 33.33\%$$

% change in price of *Omo*

$$= \frac{40 - 25}{25} \times 100$$

$$= \frac{15}{25} \times \frac{100}{1} = 60\%$$

∴Cross elasticity of demand

$$= \frac{\Delta \% \ Q_d \text{ of klin}}{\% \ \Delta \text{ price of Omo}} = \frac{33.33\%}{60\%} = 0.56$$

where Δ = change

Q_d = quantity demanded

1 = income

1.6 Determinants of Elasticity of Demand

The factors or determinants of elasticity of demand are as follows:

(a) Degree of necessity: In general terms, necessary goods like salt have inelastic demand. Consumers will not decrease the quantity bought to a large extent if price increases. The extent to which a commodity is regarded as being essential by consumers will determine the elasticity of demand for it.

(b) Habit or the strength of one's taste for a commodity: When one forms a habit of consuming a particular commodity, increase in price will not affect the demand for such commodity. The demand for such commodity is usually inelastic, e.g., alcohol, cigarettes, etc.

(c) Close substitute of a commodity: A slight increase in the price of a commodity with close substitutes will make consumers to switch over to the close substitutes and vice versa, e.g., Milo and Bournvita.

(d) Consumers' income: The larger the income of a consumer, the more inelastic his demand for a particular commodity. A consumer with a high income will complain less about any price increase, while a consumer with lower income will quickly adjust to the price changes.

(e) Number of uses a commodity has: The more a commodity can be put into so many uses, the more elastic the demand and vice versa, e.g., flour for bread, chin-chin, bun, cake, etc.

1.7 Importance of the Concept of Elasticity of Demand

The concept is important in many aspects, which include the following:

(a) It is important to producers or sellers: It helps him in deciding whether to increase or decrease the prices of his commodities. If the demand for a commodity is elastic, the producer or seller can maximize his profits by reducing prices a little.

This is because his total revenue can be increased by doing so. It will therefore pay him to reduce prices a little than to increase them. If he increases prices, he will lose both revenue and profits.

If demand for the product is inelastic, the producer or seller can maximize his profits by increasing prices of his commodity. His total revenue will increase because the increase in price does not lead to a substantial decrease in demand. He therefore stands to gain, if he increases the price a little.

(b) It is important to the government: It helps the government in fixing tax policies. They can increase taxes on commodities that have inelastic demand to increase their revenue but if they increase taxes on commodities

with elastic demand, it will lead to fall in quantity demanded of such commodities thereby reducing their revenue.

(c) It is important to the monopolist: It helps him to increase prices of commodities with inelastic demand so as to maximize his profits. However, if he increases price of elastic commodities, the demand will fall.

1.8 Elasticity of Supply

Elasticity of supply is the degree of responsiveness of supply in response to little changes in prices of goods and services. It shows how the quantity of goods supplied changes as a result of changes in prices of goods. Supply reacts favourably and unfavourably to price changes.

The quantity of goods supplied increases at slight increase in prices of goods, while it decreases at little decrease in prices of goods.

1.9 Types of Elasticity of Supply

Elasticity of supply is of two types:

(a) Price elasticity of supply: It measures the responsiveness of quantity of goods supplied to price changes. It measures the extent to which the quantity supplied changes as a result of changes in the price of the commodity.

(b) Cost elasticity of supply: It measures the responsiveness of quantity of goods supplied to changes in the cost of production.

1.10 Degree of Elasticity of Supply

(a) Inelastic supply: Supply is inelastic when a small change in price brings about less than proportional change in the quantity of a commodity supplied. For example, if a 2% increase in price brings about a less than 2% increase in the quantity supplied or a 2% decrease in price leads to a less than 2% decrease in the quantity supplied, elasticity is less than one, i.e., $e < 1$, as shown in the graph below.
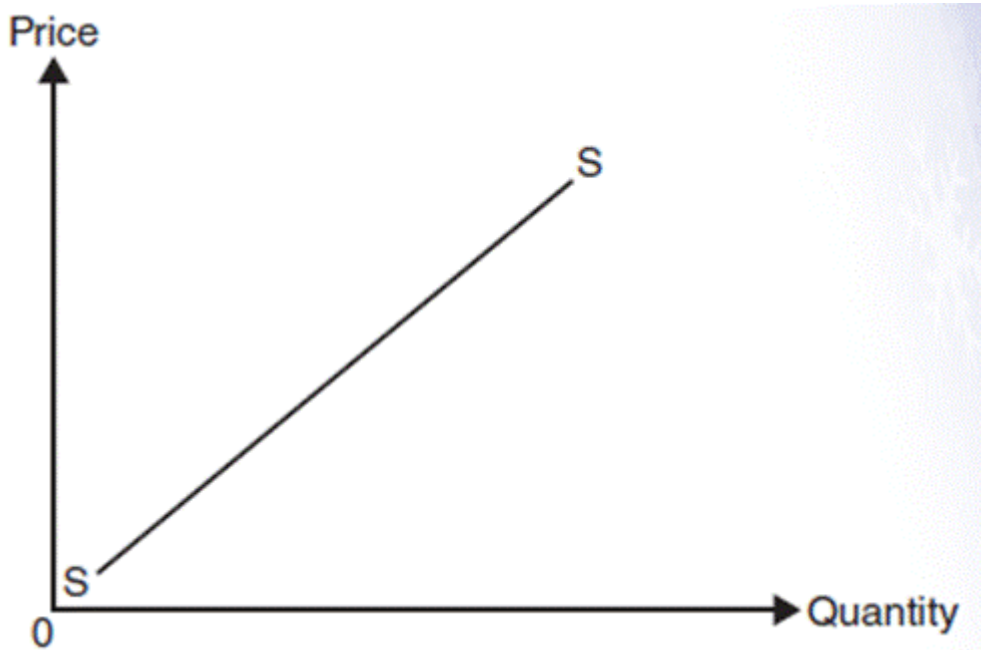
Fig. 1.6 Graphical Representation of Inelastic Supply

(b) Elastic supply: Supply is elastic when it responds more than proportional to price changes. For example, a 2% increase in price brings about a more than 2% increase in the quantity of goods or services offered for sale or a 2% decrease in price leads to a more than 2% decrease in the quantity supplied. Elasticity is greater than one, i.e., $e > 1$.
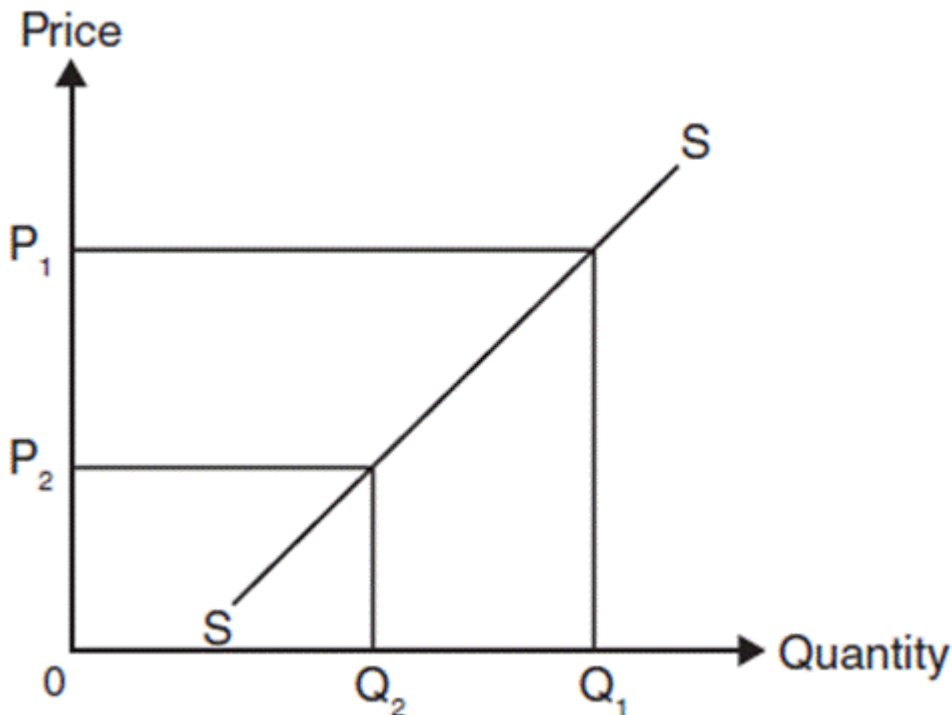

Fig. 1.7 Graphical Representation of Elastic Supply

There are also extreme cases like the following:
(c) Perfectly elastic supply or infinity elastic supply: Here, a little increase in the price of a commodity would result in the supply of the entire

available commodity; on the other hand, a little decrease in the price of a commodity would make the producers or sellers not offer any of the commodities for sale.

Fig. 1.8 Graphical Representation of Perfectly Elastic Supply

(d) Zero elastic supply ($e < 1$): This indicates that changes in price do not bring about change in the quantity of goods supplied. The quantity supplied remains the same irrespective of price changes.

Fig. 1.9 Graphical Representation of Zero Elastic Supply

(e) Unitary elasticity of supply: Here, the percentage change in quantity supplied is equal to a percentage change in price. The elasticity of supply is equal to one, i.e., $e = 1$.

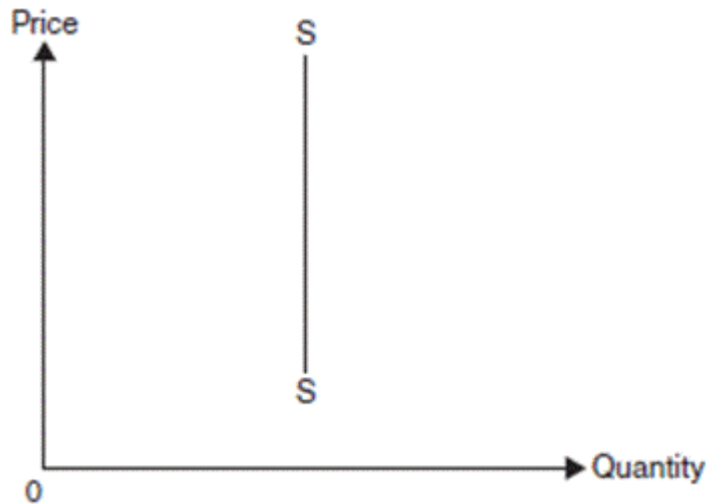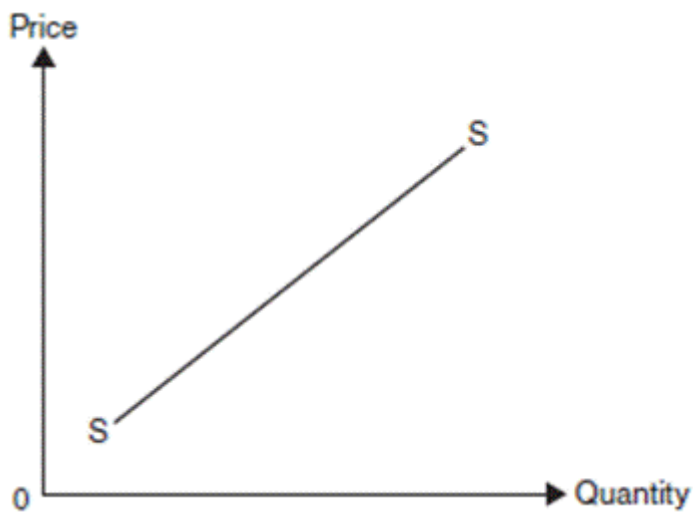**Fig. 1.10** Graphical Representation of Unitary Elasticity of Supply

1.11 Measurement of Elasticity of Supply

This determines the degree of elasticity of supply for a commodity. If the coefficient is equals to zero, supply is said to be perfectly inelastic; if it is less than one, supply is inelastic; if it is equal to one, supply is unitary and if it is greater than one, supply is elastic.

Coefficient of price elasticity is measured using the following formula:

$$Es = \frac{\%\text{change in quantity supplied}}{\%\text{change in price}}$$

Example A

If the price of sugar increases from N100.00 per packet to N150.00 and the quantity sold increases from 200 to 250 packets. Determine the elasticity of supply.

Change in quantity supplied
= 250 â^' 200 = 50

% change in quantity supplied

$$= \frac{50}{200} \times 100 = 25\%$$

Change in price = N150.00 â^' N100.00 = N50.00

% change in price

$$= \frac{50}{100} \times 100 = 50\%$$

$$Es = \frac{25}{50} = 0.5\%$$

This is less than one, i.e., $e < 1$.

Example B

If the cost of production of milk per tin increased by N50.00 from N200.00 and the quantity sold increased from 200 to 280 tins per week. Determine the cost elasticity of supply.

Solution

Change in quantity supplied

= 280 − 200 = 80

% change in quantity supplied

$$= \frac{80}{200} \times 100 = 40\%$$

Change in cost of production

= N250 − N200 = N50

% change in cost of production

$$= \frac{50}{200} \times 100 = 25\%$$

Cost elasticity of supply

$$= \frac{40}{25} = 1.6\%$$

Supply is cost elastic because it is greater than one.

1.12 Factors that Affect Elasticity of Supply

(a) Nature of the product: Durable goods like tin tomatoes because of their nature are inelastic in their supply, and on the other hand, the perishable ones like fresh tomatoes are elastic in their supply.

(b) Cost of production: Low cost of production results in elastic supply; this is because the low cost of production will lead to increased profit and the producers will respond by increasing supply and vice versa.

(c) Cost of storage: If the cost of storing goods is high, the producers may decide to take all their produce at a particular time to the market at the same time to avoid high cost of storage. Supply will be elastic and vice versa.

(d) Availability of storage facilities: Availability of storage facilities maintains inelastic supply after production or harvest, while non-availability will lead to elastic supply.

1.13 Relationship between Elasticity and Revenue

(a) Elastic demand: When demand for a commodity is elastic, an increase in its price will lead to a decrease in total revenue. An increase in price will make the quantity demanded fall more than proportionately relative to the price increase.

This can be illustrated with the following table:

Table 1.1 Effect of Elastic Demand on Revenue (Increase in Price)

Price	Quantity Demanded	Total Revenue
₦20	80	₦8.00
₦30	20	₦3.00

In the table, the coefficient of elasticity of demand is 1.5; an increase in price from N20 to N30 which led to a more than proportional decrease in quantity demanded from 80 kg to 20 kg. On the other hand, a decrease in price will lead to an increase in total revenue. A decrease in price makes quantity demanded to increase more than proportionately.

Table 1.2 Effect of Elastic Demand on Revenue (Decrease in Price)

Price	Quantity Demanded	Total Revenue
₦80	160	₦64.00
₦40	400	₦80.00

A decrease in price from N80 to N40 per unit made quantity demanded to increase more than proportionately from 160 units to 400 units. Consequently, revenue increased from N64.00 to N80.00.
The effects of price changes on revenue if demand is elastic can be represented graphically as follows:
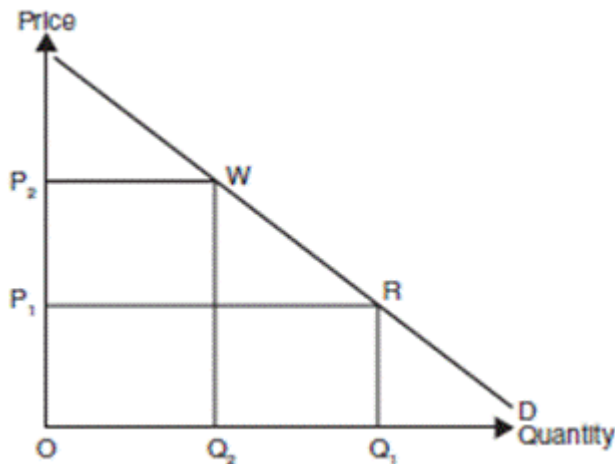

Fig. 1.11 Effect of Elastic Demand on Total Revenue
Total revenue is represented by the rectangles P_1RQ_1O and P_2WQ_2O. When price increased from OP_1 to OP_2, total revenue fell from P_1RQ_1O to P_2WQ_2O. Summarily, a commodity with an elastic demand pays the producer or seller if price is decreased a little to increase revenue.

(b) Inelastic demand: An increase in the price of a commodity with inelastic demand will lead to an increase in total revenue. An increase in price leads to a less than proportional fall in quantity bought.
Table 1.3 Effect of Inelastic Demand on Total Revenue

Price	Quantity Demanded	Total Revenue
₦20	50 units	₦1000.00
₦30	40 units	₦1200.00

An increase in price from N20 to N30 made demand fall less than proportionately from 50 units to 40 units. Total revenue increased from N1000 to N1200.

Table 1.4 Effect of Inelastic Demand on Revenue if Price Decreases

Price	Quantity Demanded	Total Revenue
₦20	50 units	₦1000.00
₦30	40 units	₦1200.00

A decrease in price led to a less than proportional increase in quantity bought from 50 units to 60 units. Total revenue fell from N1500 to N1200, which can graphically be represented as follows:
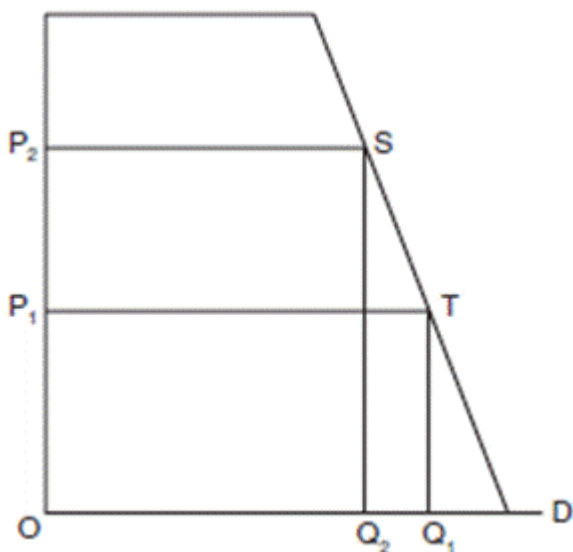

Fig. 1.12 Graphical Representation of the Effect of Inelastic Demand on Total Revenue

1.14 Effects of Inelastic Demand on Total Revenue

Total revenue is represented by rectangles P_1TQ_1O and P_2SQ_2O showing that a producer can maximize his profits by increasing price since by doing so total revenue will increase.

(c) Unitary elastic demand: When demand is unitary elastic, a change in price will not bring any change in total revenue.

Total revenue remains the same whether there is increase in price or not.

Table 1.5 Effects of Unitary Elasticity on Total Revenue

Price	Quantity Demanded	Total Revenue
N6.00	40	N240.00
N12.00	20	N240.00

An increase in price from N6.00 to N12.00 led to a fall in the quantity bought from 40 to 20 units and total revenue remained the same. If the price decreases from N12.00 to N6.00, the quantity bought will increase but total revenue will remain the same.
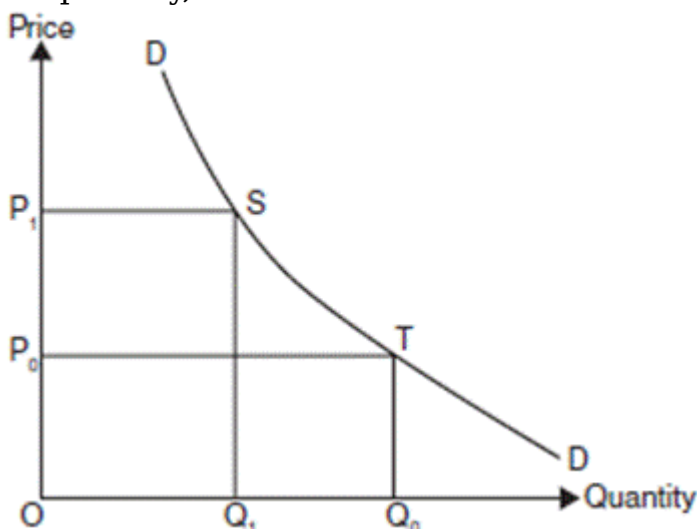
Graphically, it looks as follows:

Fig. 1.13 Graphical Representation of the Effect of Unitary Elasticity on Total Revenue

P_0TQ_0O and P_1SQ_1O represent total revenue. The areas of the two rectangles are equal showing that an increase or decrease in price results in the same total revenue. The seller here need not alter his price since the revenue will be the same irrespective of how much he influences the price.

Minimum and Maximum Price Legislation

The government regulates the price system by the use of price legislation. They may do this through their agencies, regulatory bodies or pass a law, e.g., Organization of Petroleum Exporting Countries (OPEC) that regulates prices of petroleum.

(a) Maximum price control: This means that the price is fixed by the regulatory bodies of the government at which goods and services are sold. It can be fixed for both raw materials and finished products. They are fixed in order to protect buyers from exploitative attitude of sellers, for example, the Government in Nigeria fixing fuel pump price at N65.00 per litre. This means that any person selling above this price is doing an illegal business.

(b) Minimum price control: Minimum prices are fixed to protect producers. This means the government fixes minimum prices at which commodities are to be sold. Marketing board and commodity boards play a major role in this regard in Nigeria. Before each crop season, they fix minimum prices at which agricultural produce would be bought from

farmers.

The government sometimes passes laws that regulate wages, for example, the Minimum Wage Act 2010 in Nigeria fixed the minimum wage at N18,000.00 for civic and public servants.

Summary

- Elasticity of demand is the degree of responsiveness of quantity demanded of a commodity in response to a small change in price of the commodity.
  Types of elasticity of demand
  (a) Price elasticity
  (b) Income elasticity
  (c) Cross elasticity

- **Degree of elasticity demand**
  (a) Elastic demand
  (b) Inelastic demand
  (c) Zero elastic or perfectly inelastic demand
  (d) Infinity elastic or perfectly elastic demand
  (e) Unitary or unity elasticity of demand

- **Types of elasticity of supply**
  - **(a)** Price elasticity
  - **(b)** Cost elasticity
  Degree of elasticity of supply
  (a) Elastic supply
  (b) Inelastic supply
  (c) Infinity elastic supply or perfectly elastic supply
  (d) Zero elastic supply
  (e) Unitary elastic supply

Price Control: the fixing of maximum or minimum prices of certain selected goods by government

Class Activity

The teacher should lead the students to draw the different graphs of elasticities of demand and supply.

Revision Questions
Objective Questions

1. Which of the following is not an advantage of price control?
(a) Control of inflation
(b) Despoliation of price mechanism
(c) Prevention of exploitation
(d) Control of producersâ€™ profit
(e) Helping low-income earners
2. Price control can be defined as the fixing by government of maximum or

minimum prices of:

(a) luxury goods

(b) interior goods

(c) imported capital goods

(d) all of the above

3. When the demand for a commodity is inelastic, total revenue will fall if:

(a) price is increased

(b) price is reduced

(c) price remains constant

(d) the commodity is a luxury

4. The coefficient of price elasticity of demand is zero when demand is:

(a) fairly elastic

(b) perfectly inelastic

(c) fairly inelastic

(d) unitary inelastic

(e) perfectly elastic

5. Income elasticity of demand is the measurement of the responsiveness of:

(a) price to changes in income

(b) quantity demanded to changes in income

(c) changes in expenditure to changes in income

(d) changes in expenditure to changes in price of the commodity

Essay Questions

1. (a) Define price elasticity.

(b) If, at N800 per tuber, twenty tubers were demanded and when the price fell to N600 per tuber, thirty tubers were demanded, what is the elasticity of demand? **(SSCE 1992)**

2. What are the factors that determine the price elasticity of demand for a commodity? **(SSCE 1993)**

3. (a) Define cross elasticity of demand.

(b) The table below shows the response of quantity demanded to changes in price for three pairs of commodities. Use the table to answer the questions that follow.

Commodity	Changes in Price		Commodity	Changes in Quantity Demanded	
	Original Price (₦)	New Price (₦)		Original Quantity (kg)	New Quantity (kg)
Bread	15	20	Yam	150	200
Beef	25	40	Fish	1,000	3,000
Butter	100	50	Margarine	250	400

Calculate the cross elasticities of demand for the following:

(i) Bread and yam

(ii) Beef and fish

(iii) Butter and margarine **(SSCE 1998)**

4. (a) What is income elasticity of demand?

(b) The table below shows the various incomes and demands for different commodities.

	Income (₦)	Quantity Demanded (kg)
A	20,000	120
B	36,000	96
C	40,000	160
D	44,000	200
E	45,000	240
F	47,000	252

Calculate the income elasticity between the following:
(i) A and B
(ii) C and D
(iii) E and F
(c) What kind of good is between the following:
(i) A and B
(ii) C and D **(SSCE 2000)**
5. (a) What is meant by price elasticity of demand?
(b) The following figures are extracted from a schedule of demand:
(i) Calculate the elasticity of demand when price rises from N10.00 to N11.00.
(ii) State whether the demand in (i) above is elastic or inelastic.
(iii) Calculate the elasticity of demand when price falls from N10.00 to N9.00.

Glossary
Elasticity of demand: The degree of responsiveness of quantity demanded of a commodity to a small change in price of that commodity.
Income elasticity: The degree of responsiveness of the demand of a commodity to a change in the consumers' income.
Price elasticity of demand: The degree of responsiveness of quantity demanded of a commodity to a small change in the price of that commodity.
Cross elasticity of demand: The degree of responsiveness of quantity demanded of a commodity to change in the prices of other commodities.
Elasticity of supply: The degree of responsiveness of supply to a little change in the prices of goods and services.