CHAPTER TWO: DEMAND AND SUPPLY
2.1 THEORY OF THE DEMAND

- **Demand:** is willingness and ability to buy product at a particular price (Ceteris paribus)

- **Law of Demand:** State that there is an inverse relationship between price of a commodity and the quantity demanded.

- I.e., consumers will buy more of a commodity at lower price and vice versa

- **Quantity demanded** is the amount of a **good or service** buyers desires to purchase during some period at a certain price

Demand

- the higher (lower) the price (p_x ↑↓) of a product, the lower (higher) the quantity demanded (Q_x ↓↑); over a given period of time

- This inverse relationship between price and quantity demand is stated as *the **Law of Demand**.*

- The law of demand can be demonstrated using different instruments:
  - **Demand schedule**
 - **Demand Curve**
  - **Demand Function**

Demand

- **_Demand Schedule:_** is a tabular presentation of the relationship between **price** and **quantity** of a commodity that consumers are able and willing to buy at each specific price within the given period

- The following example shows a hypothetical buyer's demand schedule for corn

price per bushel(s)	5	4	3	2	1
qtty demanded per week ('00 bushel)	10	20	35	55	80

Demand

- **Demand Curve:** it is a graph that shows the inverse relationship between price and quantity demanded, and is plotted from the demand schedule

Price

Demand Curve

5

4

3

2

1

10   20   30   40   50
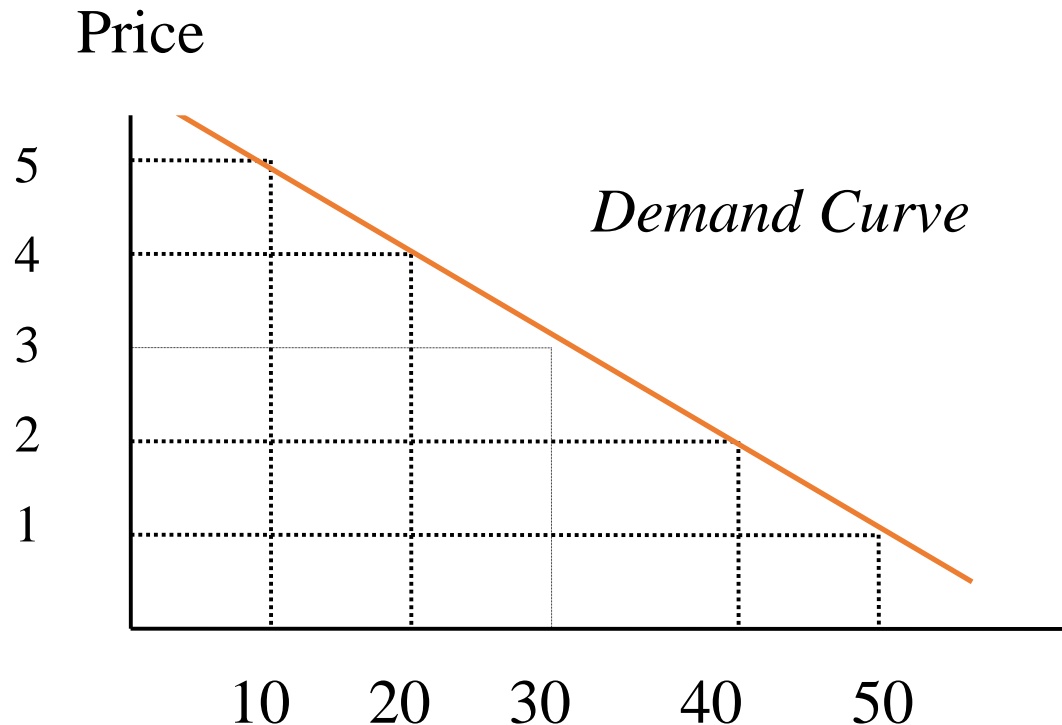
Demand

- **Demand Function**: is a mathematical equation that shows the relationship between price and quantity demanded of a commodity

$$Q_d = \alpha - \beta P$$

  - *Where* $'Q_d'$ is quantity demand, $'P'$ is price of the product, $'\alpha'$ is the reciprocal intercept, and $'\beta'$ is the reciprocal of the slope of the line

- *Numerical Example*

- Assume that your demand for orange decreases from **5 Kg** to **3 Kg** when the price of a Kilogram of orange rises from **Birr 8** to **Birr 12**. Derive your demand equation for orange

Demand

Solution

- Calculate the slope $'\boldsymbol{\beta}'$ ($\beta = {}^{\Delta Q_d}\!/_{\Delta P} \Rightarrow \frac{3kg-5kg}{12br-8br} = -\frac{2}{4} = -0.5$)

- $'\boldsymbol{\beta}'$ measures by how much $\boldsymbol{Q_d}$ changes as a result of a unit change in $\boldsymbol{P}$. The negative sign shows the inverse relationship between the two variables ($\boldsymbol{P}$ & $\boldsymbol{Q_d}$)

- Thus $\boldsymbol{Q_d} = \boldsymbol{\alpha} - \boldsymbol{0.5P}$

- Calculate "$\boldsymbol{\alpha}$", to find the value of "$\boldsymbol{\alpha}$", just substitute the values for $\boldsymbol{Q_d}$ and $\boldsymbol{P}$ from the coordinates

- Thus $\boldsymbol{5} = \boldsymbol{\alpha} - \boldsymbol{0.5(8)} = \boldsymbol{\alpha} - \boldsymbol{4} \Longrightarrow \boldsymbol{\alpha} = \boldsymbol{4 + 5 = 9}$

- Therefore your demand equation can be written as
$$\boldsymbol{Q_d} = \boldsymbol{9 - 0.5P}$$

Market Demand

- The above demand equation represents the demand of a single individual. But, in the orange market there could be more than one buyer who buy orange.

- In this case, you can derive a demand curve for each buyer like what we have done in the example

- The sum of the quantity demand by each individual for orange will give the total quantity demand in the market. We call this *Market Demand*

- *Market Demand:* is the demand of the individual consumers in a market added together horizontally for different prices and with in the given period of time

Market Demand

Numerical Illustration:

- Assume A, B and C are the only buyers of orange in the market; the following demand schedule represents there demand

Price /bushel ($)		5	4	3	2	1
Quantity Demanded/ week ('00 bushel)	A	10	20	30	40	50
	B	15	20	25	30	35
	C	20	25	30	35	38
	Total Market Demand	45	65	85	105	123

Market Demand

- Assume the following three equations represent the demand for individual A, B and C respectively, who are the only buyers of orange in the market.

$$Q_d^A = 40 - 2P; Q_d^B = 10 - 0.4P; Q_d^C = 20 - 2P$$

- Suppose now that the market price of a kilogram of orange is Birr 10
  - Calculate the Q_d of each individual
  - Calculate the market demand for orange Q_d^M
  - Market demand equation

- To calculate each individuals quantity demand, substitute current market price to there demand equation

Market Demand

a. $Q_d^A = 40 - 2(10) = 20kg$; $Q_d^B = 10 - 0.4(10) = 6kg$; and $Q_d^C = 20 - 2(10) = 0kg$

b. The market demand for orange is the sum of the quantity demand by A, B and C, thus

$$Q_d^M = 20kg + 6kg + 0kg = 26kg$$

- Market demand is simply the horizontal summation of individual demand equation,

$Q_d^M = Q_d^A + Q_d^B + Q_d^C$
$\quad = (40 - 2P) + (10 - 0.4P) + (20 - 2P) = 70 - 4.4P$

- At $P = 10birr$, $Q_d^M = 70 - 4.4(10) = 26kg$

Market Demand

- Similarly market demand curve can be found by adding individuals demand horizontally at each price level

Quantity demanded for A	Quantity demanded for B	Market demanded for A and B
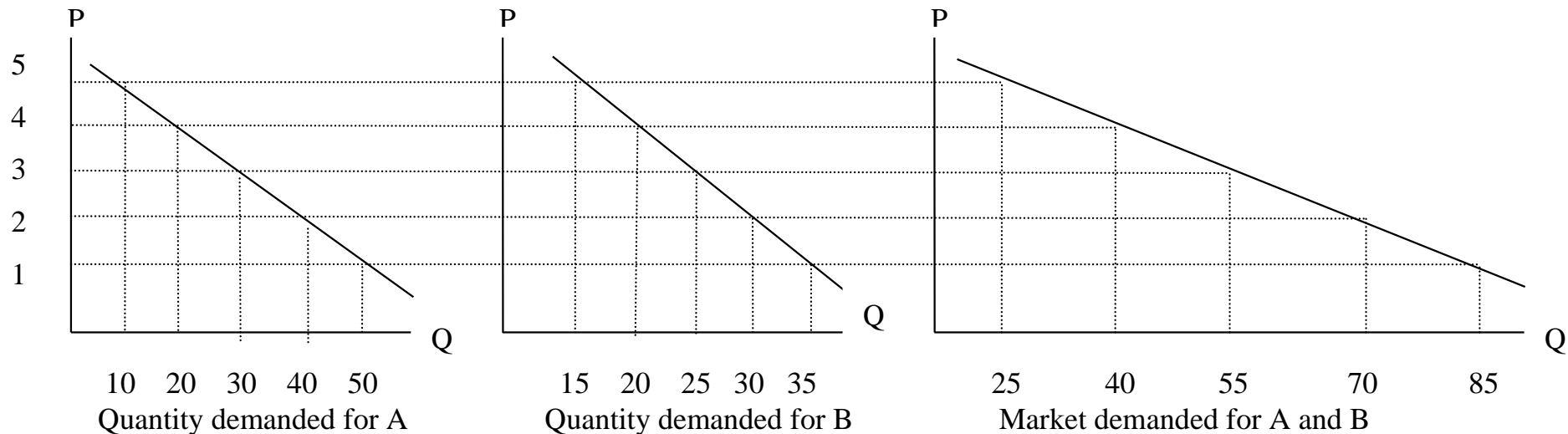
2.1.2 Determinants of Demand

- The demand curve shows what would happen to the quantity demanded if only the good's own price were to change.

- But good's own price is not the only determinant of demand; other factors can play an important role. They include:
  - The prices of related goods (Po)
  - Consumer income (I)
  - Consumer preferences (tastes) (T) ,
  - and so on.

Determinants of Demand

- There are other factors which would influence the demand for a commodity, even if the commodity price remains the same

- *Income:* an increase in income raises consumers' ability to purchase an item
  - If the quantity demanded of a good increase as in come increases, the good is said to be ***normal***,
  - if the quantity demanded of a good decreases as income increases the good is said to be ***inferior***

- The impact of change in income is to shift demand curve to the right or left keeping parallel to the original

Determinants of Demand

- ***The Prices of Related Goods:*** the change in the price of some goods may affect the demand of some other goods

  - If the p_y ↓ cause a Q_x ↓, then the goods($x\ and\ y$) is substitutes to each other,

  - If the p_y ↓ cause a Q_x ↑, then the goods($x\ and\ y$) is complements to each other

  - *Example of substitutes are ;* coca-cola and Pepsi ; *Examples of Complements are;* Sugar and Tea

- ***Tastes:*** favorable change in the testes of the good will cause an increase in demand; Unfavorable change in the testes of the good will cause a decrease in it

14

Determinants of Demand

- *Expectation*: when consumers expect higher price of goods and service in the future, current demand for goods and services will go up

- *The number of buyers*: when the numbers of buyers are large, the demand for goods becomes higher and the converse is also true

- *Season*: The demand for stationary would be high during academic periods, and falls during school vacation. Similarly demand for overcoats fall during hot and dry season and increases during rainy and cold seasons.

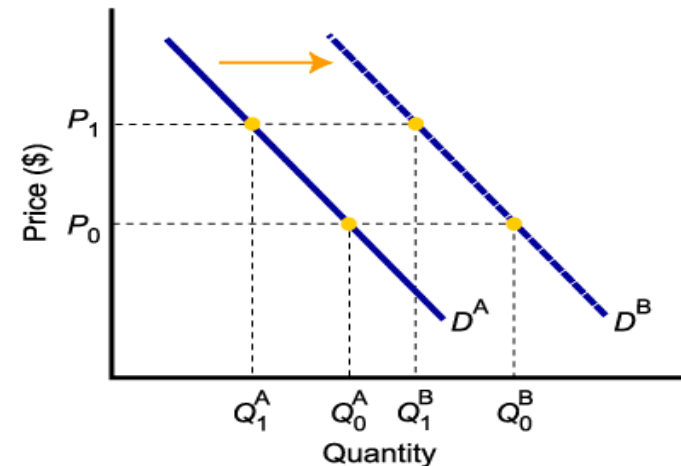# A change in Demand Vₛa change in Quantity Demanded

- *A change in demand* is a <u>shift</u> of the entire demand curve to the right (and increase in demand) or to the left (a decrease in demand).

- *A change in the quantity demanded* is a movement <u>along</u> the demand curve, from one price-quantity combination to another.

- *A change in demand* is a response to the change in demand caused by factors <u>other than price</u>, but

- *A change in quantity demanded* is a response for the <u>price of the commodity itself.</u>

# Graphically: *A Change in Demand Versus a Change in Quantity Demanded*

Change in price of a good or service leads to Change in *quantity demanded* (**Movement along the curve**).
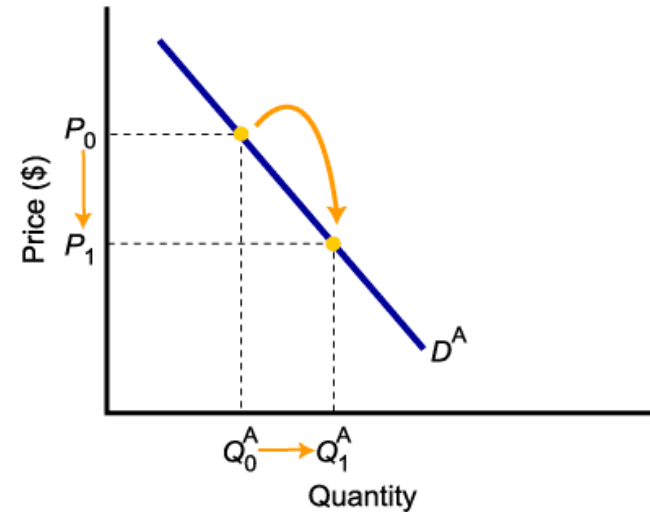
Change in income, preferences, or prices of other goods or services leads to Change in demand (**Shift of the curve**).

Shifts of the Demand Curve

Price of Bread

Increase in demand

Decrease in demand

Demand curve, D^3

Demand curve, D^1

Demand curve, D^2

O

Qty of bread
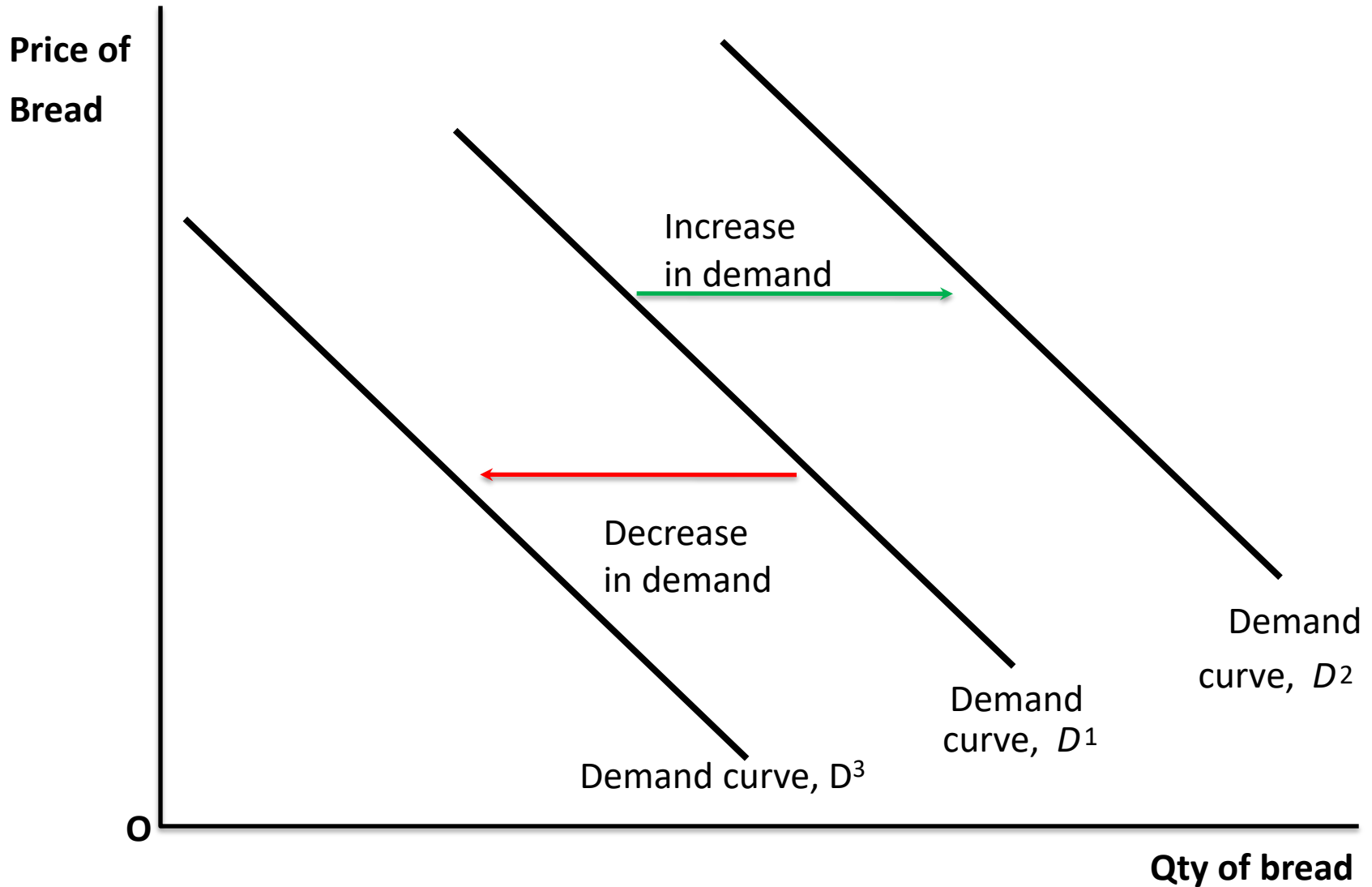
2.1.3 Elasticity of demand

- Consider the law of demand,
  - **when the price of a good goes up people will buy less of it and**
  - **if the price falls then people will buy more of it**
- Consumer responds to any change in the determinants of demand like,
  - Commodities own price
  - Prices of related goods
  - Consumers Income
  - Taste and preferences
  - And other factors

- The question however is that what is the magnitude of the responsiveness of consumers for these change?
- Economists have developed a tool that measure **responsiveness of consumers demand for the change in the determinants of demand**.
- This measurement is called Elasticity of demand
- We have as many elasticity of demand as the number of determinants of demand

The most common types of elasticity of demand are of the following:-

- Price elasticity of demand (own price elasticity of demand)

- Cross price elasticity of demand

- Income elasticity of demand

1. Own Price Elasticity of demand.
It is a measurement of responsiveness of quantity demanded to change in the commodities own price

- Price elasticity of demand is measured as a percentage change in quantity demanded resulting from a percentage change in price. It indicates how consumers react to changes in price.

- Depending on the magnitude of the change in price, we have two types of price elasticity of demand.
  - Point price elasticity of demand
  - Average or arc price elasticity of demand

- **Point elasticity of demand**:- is used to measure price elasticity of demand when the change in price is very small or at a point.

- the point price elasticity coefficient (Ep) can be determined as,

$$E_d = \frac{\%\ change\ in\ qunatity\ demand\ of\ X}{\%\ change\ in\ price\ of\ X}$$

$$E_d = \frac{\left(\dfrac{Q_2 - Q_1}{Q_1}\right) x100}{\left(\dfrac{P_2 - P_1}{P_1}\right) x100}$$

$$\varepsilon_p = \frac{\Delta Q}{\Delta P} \times \frac{P}{Q}$$

$$\frac{\Delta Q}{\Delta P}$$ = Represents slope of the demand curve

Suppose the demand function is $Q_d = a - bP$

$$\frac{\Delta Q}{\Delta P}$$ = -b

example:

Consider the following demand equation

$$Q_d = 15 - 0.5P$$

Calculate price elasticity of demand when P= 5

- **Arc Elasticity of Demand:** Arc Elasticity measurement is used when the change in price is relatively large.
- That is, it measures elasticity between to points.
- Arc elasticity measures an average elasticity of the segment AB

$$\varepsilon_p = \frac{\Delta Q}{\Delta P} X \frac{(P_1 + P_2)}{(Q_1 + Q_2)}$$

Example

If price of good X rises from birr 3 to birr 5 and its quantity demand falls from 240 units to 180 units. Calculate the arc price elasticity of demand.

- Elasticity of demand is usually a negative number because of the law of demand.
- The value of price elasticity of demand ranges from zero to infinite.
- In absolute terms, the values of price elasticity of demand ranges from $0 < Ed < \infty$.
- demand is elastic when (Ep > 1)
- Demand is inelastic when (Ep < 1)
- Demand is unitary elastic when (Ep = 1)
- Price elasticity of demand is perfectly elastic, when (Ep = ∞)
- Price elasticity of demand is perfectly inelastic, when (Ep= 0)

Determinants of the Price Elasticity of Demand

- There are about four factors which affect the degree of elasticity of demand function. These are:

i. The Availability of Substitutes

ii. Nature of the Commodity (Luxury Vs Necessity)

iii. The percentage that the commodity represents in the consumers Income commodity

iv. Time period available for adjustment.

ii. Income Elasticity of Demand

$$\varepsilon_{IX} = \frac{\text{percentage change in quantity demanded}}{\text{percentage change in income}}$$

$$\varepsilon_{IX} = \frac{\Delta Q_A}{\Delta I} \times \frac{I_1 + I_2}{Q_1 + Q_2}$$

- If it is point elasticity of demand

Ed=dQ/dI*I/Q

- The coefficient of income elasticity of demand can have both positive and negative values.
- When the value of income elasticity of demand is positive (EI > 1), the good is luxury.
- When the value of income elasticity of demand is positive (EI > 0), the good is normal/necessity .
- Where as negative value of income elasticity of demand (EI < 0) implies the good is inferior.

iii. Cross Price Elasticity of Demand

- Demand for a good is also affected by the change in the price of related goods.
- Consumers respond for the change in the price of related goods by either cutting their consumption or by increasing their consumption.
- Cross price elasticity measures responsiveness of demand for the change in the relative price of related goods.
- Cross price elasticity of demand between commodity XY, measures responsiveness quantity demanded of Commodity X for a unit change in price of commodity X

- It is a percentage change in quantity demanded of commodity X divided by the percentage change in price of Y
- This can be shown as

$$\varepsilon_{XY} = \frac{\text{percentage change in quantity demanded good X}}{\text{percentage change in price of good Y}}$$

$$\varepsilon_{XY} = \frac{\Delta Q_X}{\Delta P_Y} \times \frac{P_{1Y} + P_{2y}}{Q_{1X} + Q_{2X}}$$

- The cross price elasticity can have both positive and negative value,
- Such value determine the nature of the relationship between the two goods.
- The cross-price elasticity of demand is zero if the two goods are not related at all.
- When cross price elasticity of demand is positive, the two goods are substitute.
- When to goods are complementary the cross price elasticity between goods will have negative value.
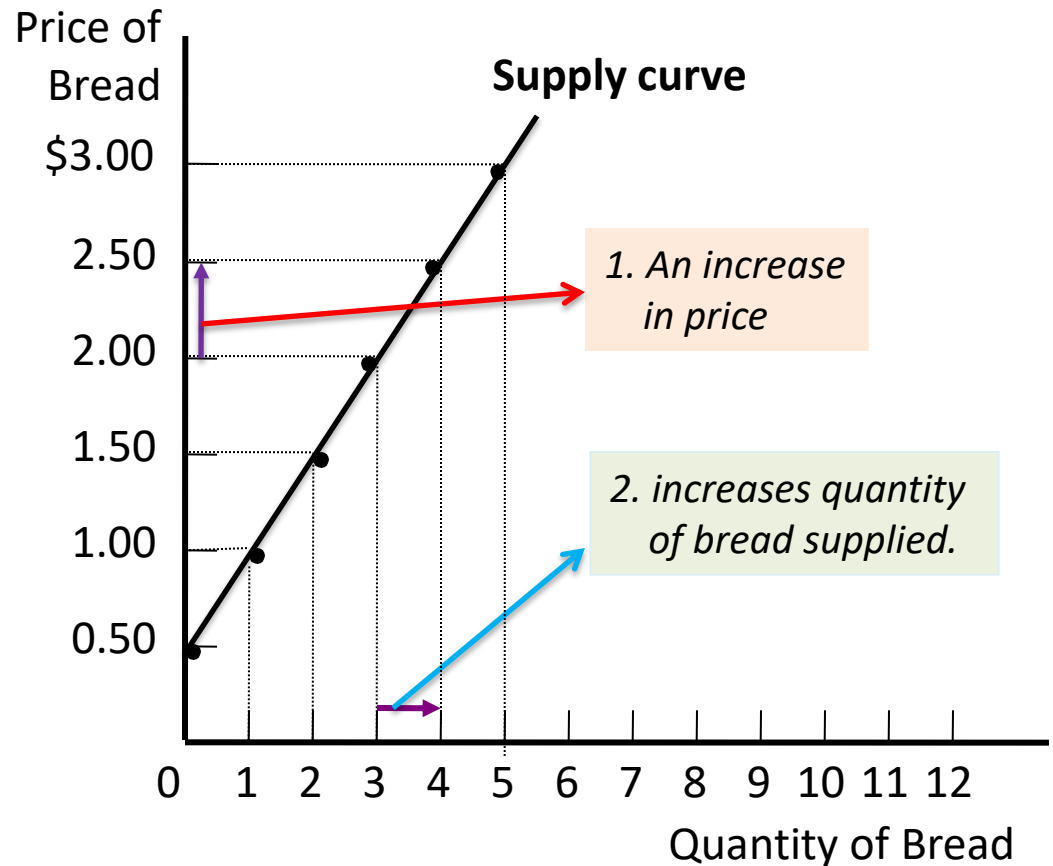
II. THEORY OF SUPPLY

- **Supply** indicates the various quantities of a product that sellers (producers) are **willing and able to provide** at each of a series of possible prices in a given period of time, other things remain unchanged;

- *Supply* is a full description of how the quantity supplied of a commodity responds to changes in its price *(*After all, we use SS as short spell of supply);*

- A *supply schedule* is a table showing how much of a given product a firm would be willing to sell at different prices in a given period of time.

Supply… cont'd

- The *supply curve* is a graph illustrating how much of a given product a firm would be willing to sell at different prices in a given period of time;

- Supply curve can also be expressed in the form of mathematical equation, which is called supply function.

Mr.X's supply schedule and supply curve

Price of Bread	Quantity of Bread supplied
$0.00	0 cones
0.50	0
1.00	1
1.50	2
2.00	3
2.50	4
3.00	5

Price of Bread

Supply curve

$3.00

2.50

2.00

1.50

1.00

0.50

1. An increase in price

2. increases quantity of bread supplied.

0 1 2 3 4 5 6 7 8 9 10 11 12

Quantity of Bread

Hypothetical SS schedule: Quantity of SS increase as Price rises

Law of Supply

- The *law **of supply*** states that, as **price of the good rises**, **the quantity supplied of a good rises** as long as all other factors that affect suppliers' decisions are unchanged.

Individual Supply and Market Supply

- The supply of a good or service can be defined for an individual firm, or for a group of firms that make up a market or an industry;

- *Market supply* is the sum of all the quantities of a good or service supplied per period by all the firms selling in the market for that good or service;

- *Market supply* is the horizontal summation of individual firms' supply curves.

Market supply

Price	Quantity supplied/week			Market supply/week
	Seller A	*Seller B*	*Seller C*	
6	9	7	8	24
5	7.5	6	6	19.5
4	6	5	5	16
3	4.5	4	4.5	13
2	3	3	3	9
1	1.5	2	2.5	6

Market supply graphically:

Seller A

Seller B

Seller C

Market supply

Determinants of Supply

The supply of a product is determined/influenced by:

- Price of the product;

- Input prices(cost of inputs);

- Technology;

- Sellers expectation of price of the product;

- Number of sellers (short run);

- Taxes and subsidies; and

- Weather
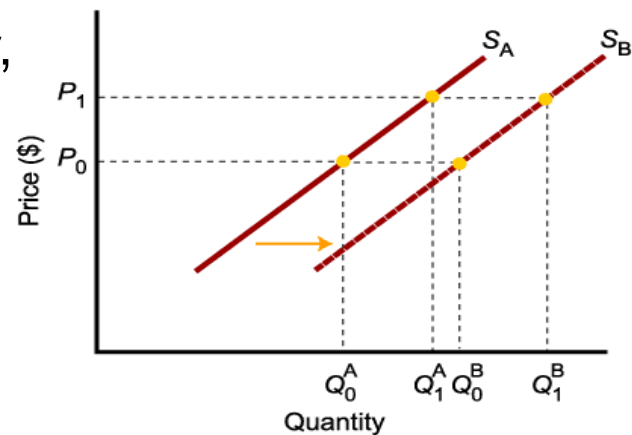
Change in quantity supplied and change in supply
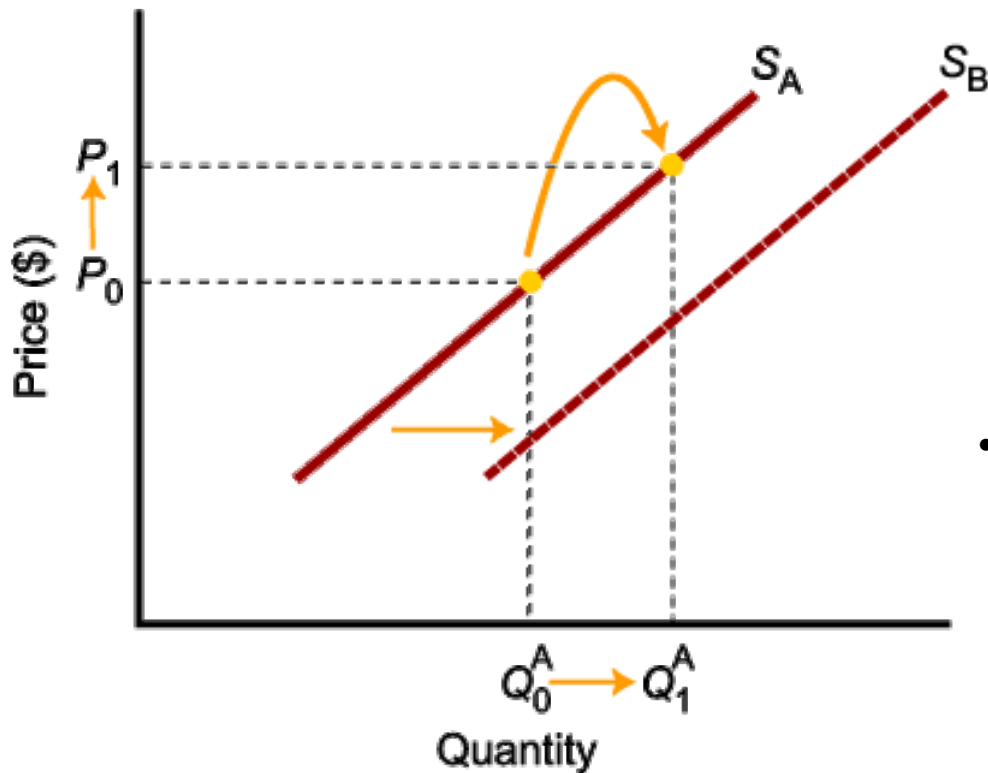
- A higher price causes **higher quantity supplied**, and a **move along** the SS curve.

- A change in determinants of SS other than price causes an **increase in SS**, or a **shift** of the entire supply curve, from S_A to S_B.

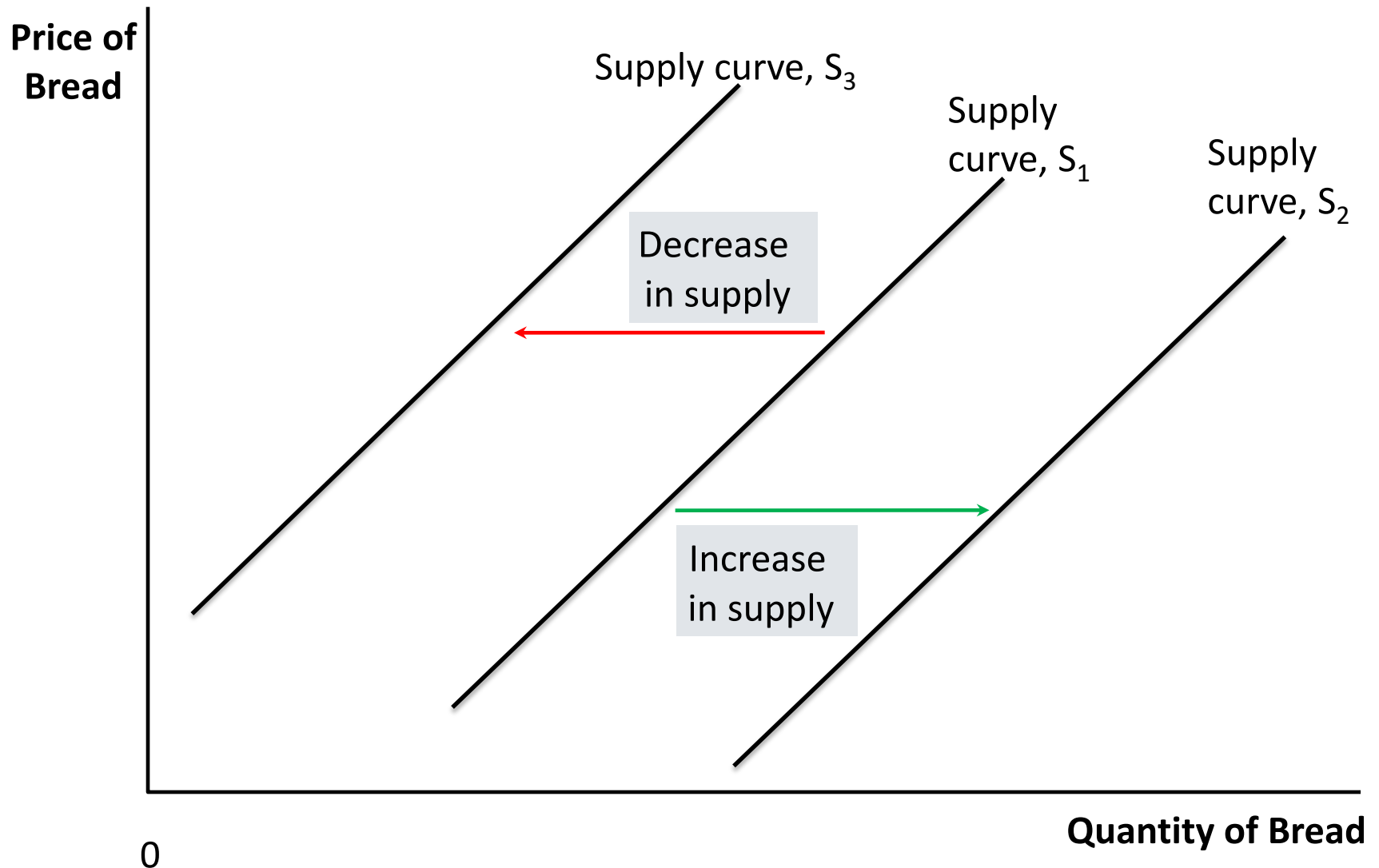# Shift of supply Versus movement along a supply curve

Change in price of a good or service leads to Change in *quantity supplied* (**Movement along the curve**).
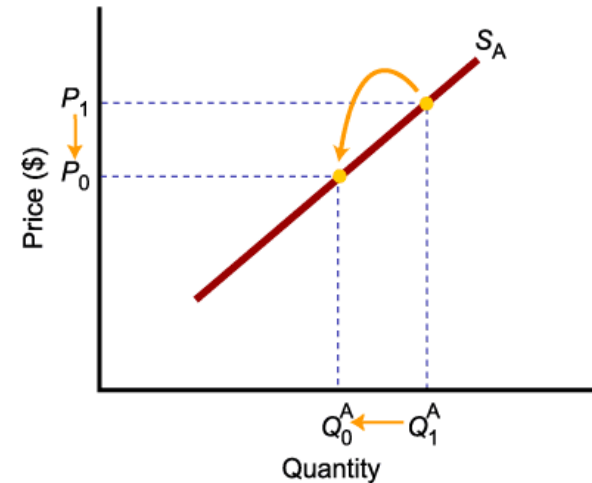
Change in costs, input prices, technology, or prices of related goods and services leads to Change in supply (**Shift of curve**).

Shifts in the Supply Curve: What causes them?

Price of Bread

Supply curve, S_3

Supply curve, S_1

Supply curve, S_2

Decrease in supply

Increase in supply

0

Quantity of Bread

2.2.3 Elasticity of supply

- It is the degree of responsiveness of the supply to change in price. It may be defined as the percentage change in quantity supplied divided by the percentage change in price. As the case

- with price elasticity of demand, we can measure the price elasticity of supply using point and arc elasticity methods. However, a simple and most commonly used method is point method.

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

$$\varepsilon_p = \frac{\Delta Q}{\Delta P} \times \frac{P}{Q}$$

Like elasticity of demand, price elasticity of supply can be

➢ elastic, **Ep > 1** - when a small change on price leads to great change in supply.
➢ inelastic, **Ep <1** - when great change in price induces only a slight change in supply
➢ unitary elastic **Ep = 1**,

- ➢ perfectly elastic - $E_p = \infty$. represented by a horizontal straight line.
- ➢ perfectly inelastic- $E_p = 0$ represented by a vertical line.
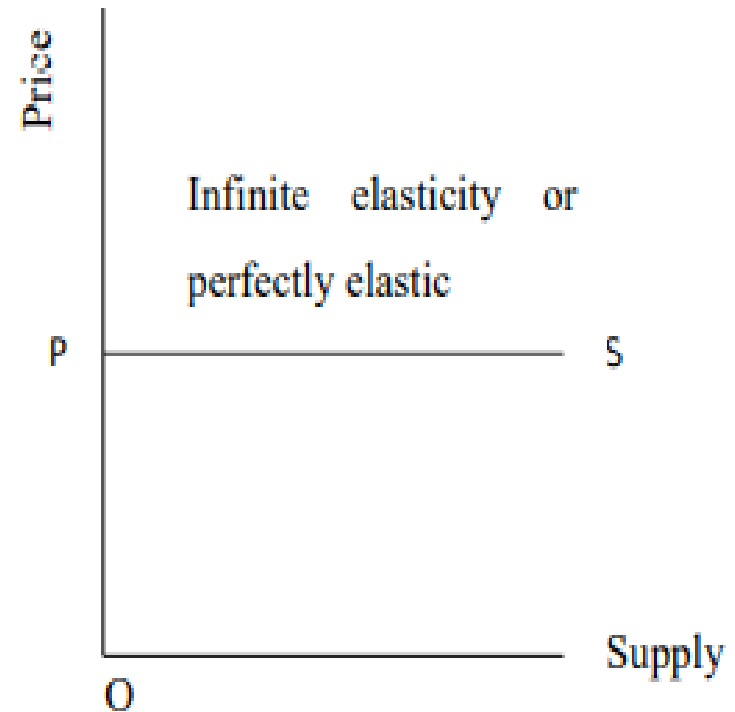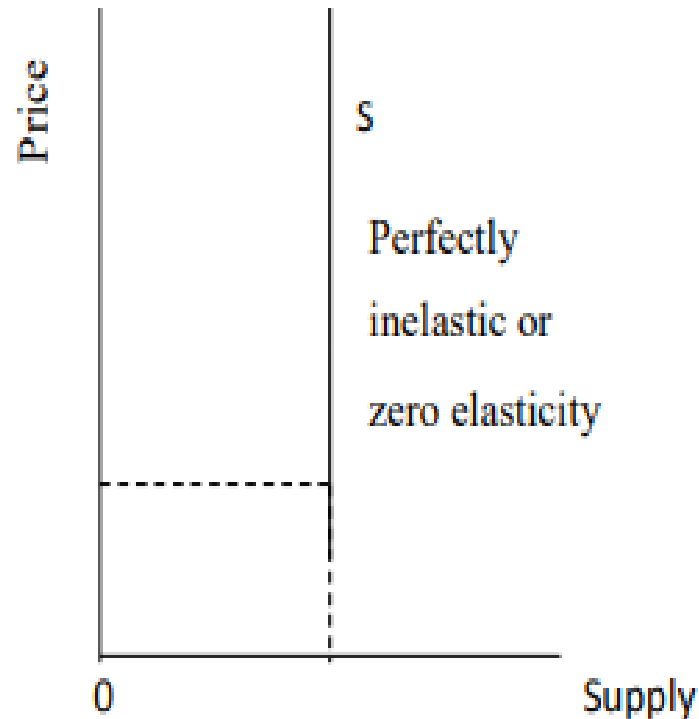
III.   MARKET EQUILIBRIUM

- An *equilibrium* is the condition that exists when quantity supplied and quantity demanded are equal. We assume that the price will automatically reach a level at which the quantity demanded equals the quantity supplied

- At equilibrium, there is no tendency for the market price to change.

- Given market demand: Qd= 100-2P, and market supply: = Qs = 2P-20

- a) Calculate the market equilibrium price and quantity b) Determine, whether there is surplus or shortage at P= 25 and P= 35.

- Calculate the market equilibrium price and quantity b) Determine, whether there is surplus or shortage at P= 25 and P= 35.

Solution:

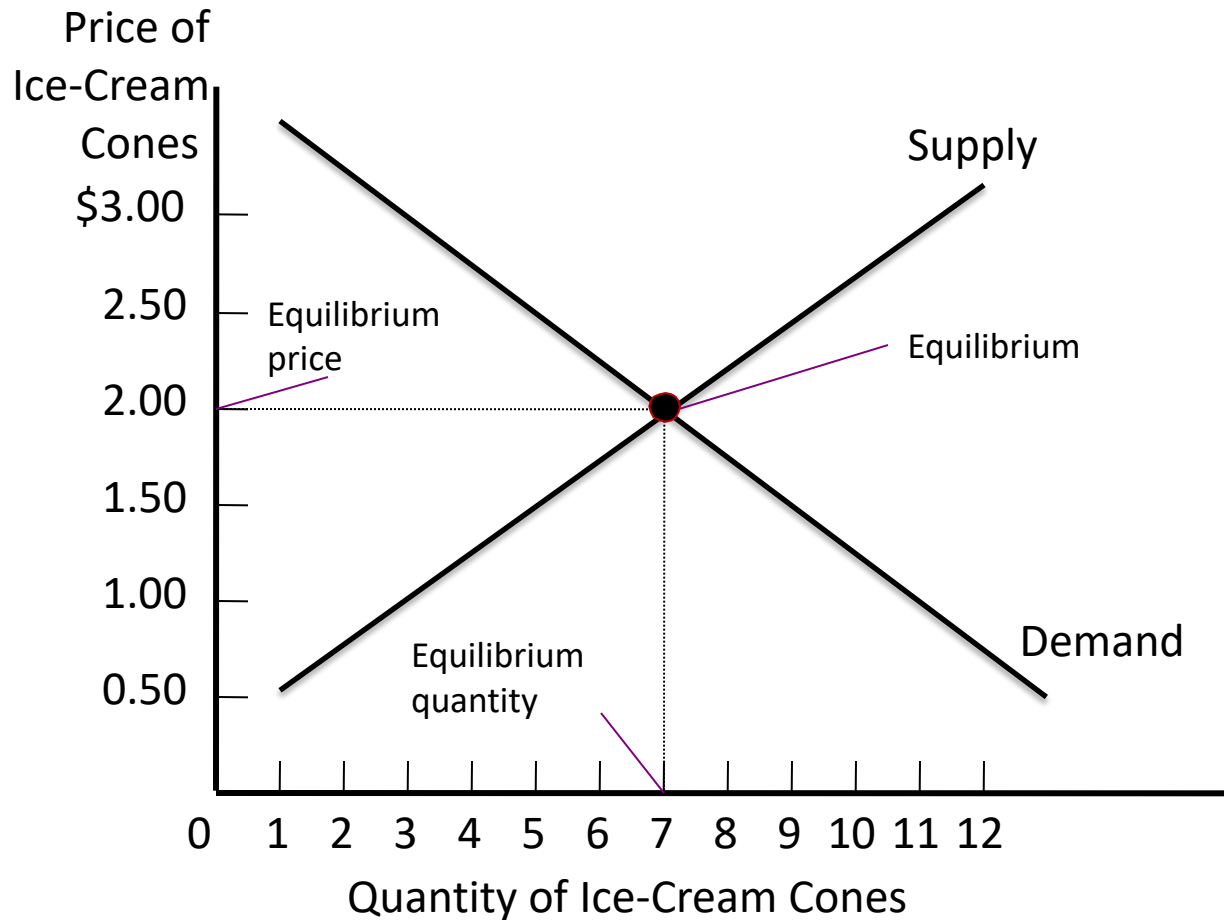a) At equilibrium, $Q_d = Q_s$

$$100 - 2P = 2P - 20$$

$$4P = 120$$

$$\overline{P} = 30, \text{ and } \overline{Q} = 40$$

b) $Q_d(\text{at } P = 25) = 100-2(25) = 50$ and $Q_s(\text{at } P = 25) = 2(25) -20 = 30$

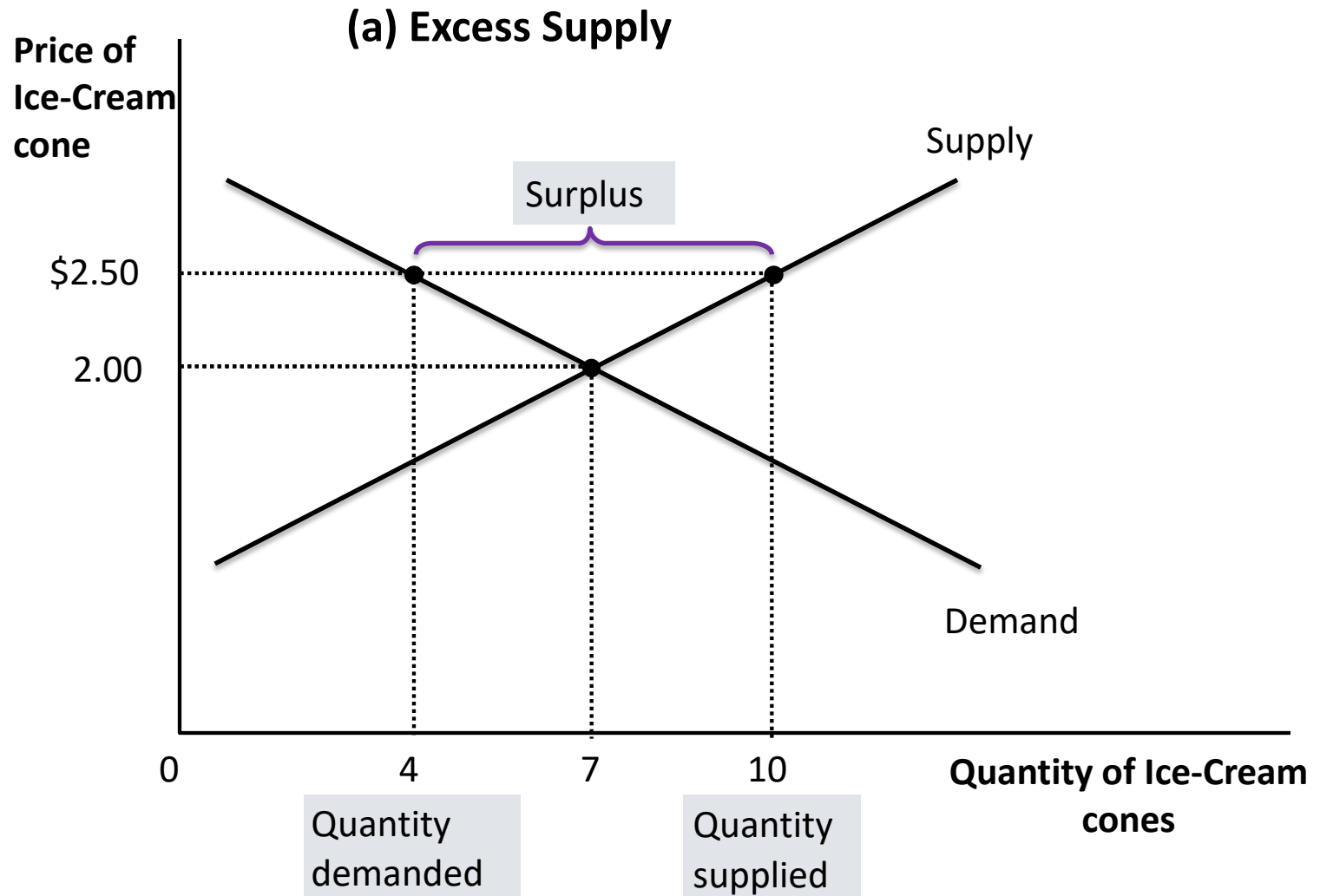Therefore, there is a shortage of: $50 - 30 = \underline{\mathbf{20}}$ **units**

$Q_d(\text{ at } P=35) = 100-2(35) = 30$ and Q_s (at $p = 35) = 2(35)-20 = 50$, a surplus of **20 units**

Mkt Equilibrium ... cont'd

Markets Not in Equilibrium

(a) Excess Supply

Mkts not in Equilibrium … cont'd
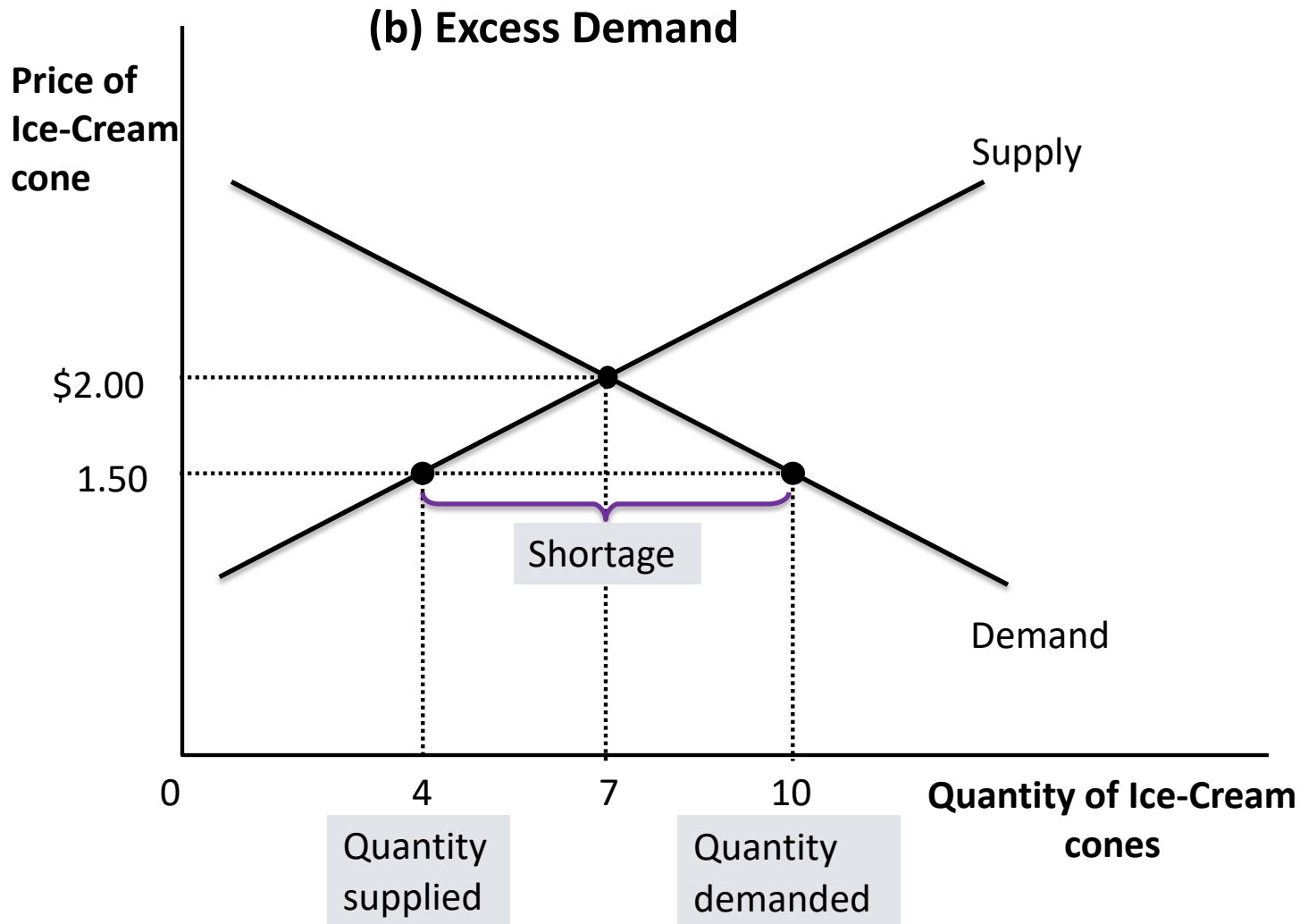
- *Surplus*

  – When price exceeds equilibrium price, then quantity supplied is greater than quantity demanded:

    - There is excess supply or a surplus;

    - Suppliers will lower the price to increase sales, thereby moving toward equilibrium;

    - *Excess supply*, or surplus, is the condition that exists when quantity supplied exceeds quantity demanded at the current price.

Mkts not in Equilibrium … cont'd

(b) Excess Demand

Price of Ice-Cream cone

Supply

$2.00

1.50

Shortage

Demand

0   4   7   10

Quantity supplied
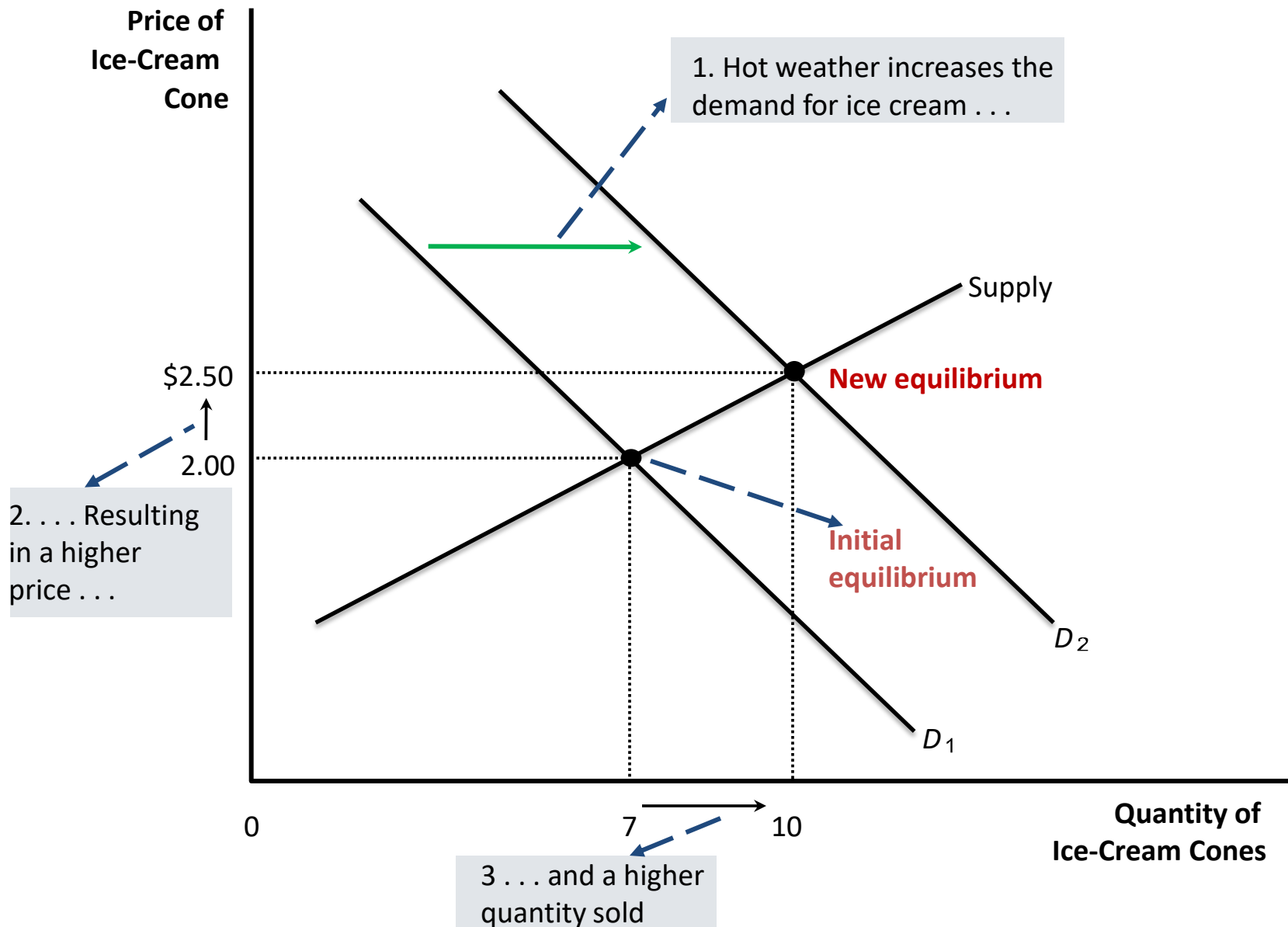
Quantity demanded

Quantity of Ice-Cream cones

Mkts not in Equilibrium … cont'd

- ***Shortage***

    – When price is less than equilibrium price, then quantity demanded exceeds the quantity supplied:

    - There is excess demand or a shortage;

    - Suppliers will raise the price due to too many buyers chasing too few goods, thereby moving toward equilibrium;

    - ***Excess demand***, or shortage, is the condition that exists when quantity demanded exceeds quantity supplied at the current price.

How an increase in demand affects the equilibrium

Price of Ice-Cream Cone

1. Hot weather increases the demand for ice cream . . .

Supply

$2.50 — New equilibrium

2.00

2. . . . Resulting in a higher price . . .

Initial equilibrium

D_2

D_1

0

7   10

Quantity of Ice-Cream Cones

3 . . . and a higher quantity sold

How an increase in demand affects the equilibrium

Price of Ice-Cream Cone

S_2

S_1

1. An increase in the price of sugar reduces the supply of ice-cream. . .

New equilibrium

$2.50

2.00

Initial equilibrium

2. . . . resulting in a higher price of ice cream . . .

Demand

0   4   7

3. . . . and a lower quantity sold.

Quantity of Ice-Cream Cones