UNIT I
DEMAND ANALYSIS

Meaning of Demand

Demand for commodity implies ;

Desire to acquire it

Willingness to pay for it

Ability to pay for it

Demand = Desire + Ability to Pay + Willingness to Pay

Demand for a particular commodity refers to the commodity which an individual consumer or household is willing to purchase per unit of time at a particular price.

Types of Demand

Individual and Market demand

The quantity of a commodity an individual is willing and able to purchase at a particular price, during a specific time period, given his/her money income, his/her taste, and prices of other commodities, such as substitutes and complements, is referred to as the **individual demand for the commodity.**

The total quantity which all the consumers of the commodity are willing and able to purchase at a given price per time unit, given their money incomes, their tastes, and prices of other commodities, is referred to as the **market demand for the commodity.**

Demand for firm’s and industry product

The quantity of a firm’s product that can be sold at a given price over time is known as the **demand for the firm’s product.**

The sum of demand for the products of all firms in the industry is referred to as the **market demand or industry demand for the product.**

Autonomous and Derived demand

An autonomous demand or direct demand for a commodity is one that arises on its own out of a natural desire to consume or possess a commodity. This type of demand is independent of the demand for other commodities.

The demand for a commodity which arises from the demand for other commodities, **called 'parent products' is called derived demand**. *Demand for land, fertilizers and* agricultural tools, is a derived demand because these commodities are demanded due to demand for food.

Demand for durable and non-durable goods

Durable goods are those goods for which the total utility or usefulness is not exhaustible in the short-run use. Such goods can be used repeatedly over a period of time.

The demand for non-durable goods depends largely on their current prices, consumers' income, and fashion. It is also subject to frequent changes.

Short-term and long-term demand

Short-term demand refers to the demand for goods over a short period.

The long-term demand refers to the demand which exists over a long period of time

Law of Demand

Law of demand expresses the relationship between the Quantity demanded and the Price of the commodity.

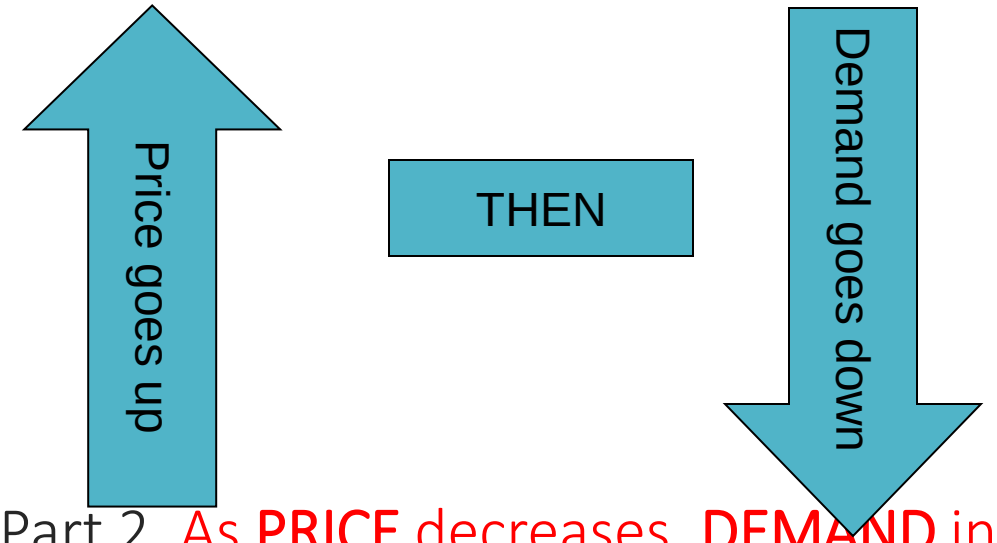
The law of demands states that, "Ceteris Paribus, (other things remaining constant) the lower the price of a commodity the larger the quantity demanded of it and vice versa."

In simple terms other things remain constant, if the price of the commodity increases, the demand will decrease and if the price of the commodity decreases, the demand will increase.

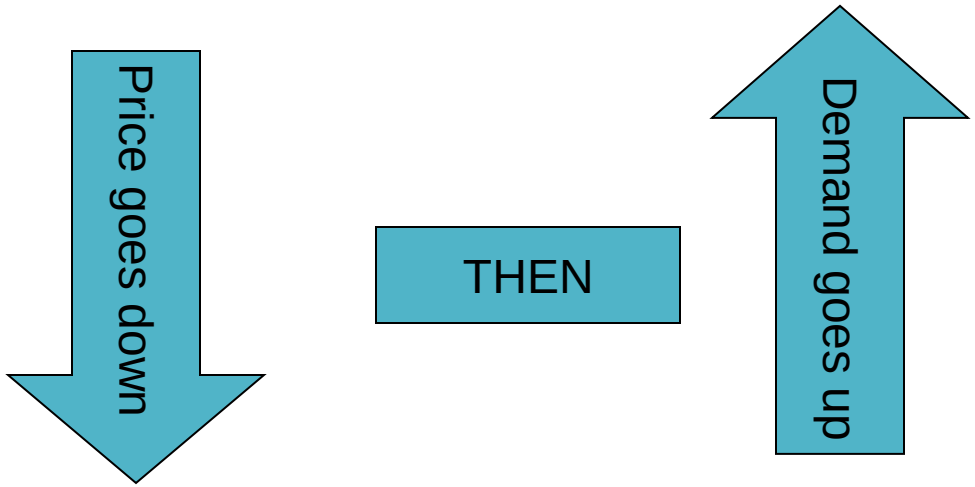
The quantity of a good that consumers are willing and able to buy per period relates inversely, or negatively, to the price, other things constant.

Law of Demand

Part 1. As **PRICE** increases, **DEMAND** decreases



Part 2. As **PRICE** decreases, **DEMAND** increases



Demand Analysis

Demand Schedule

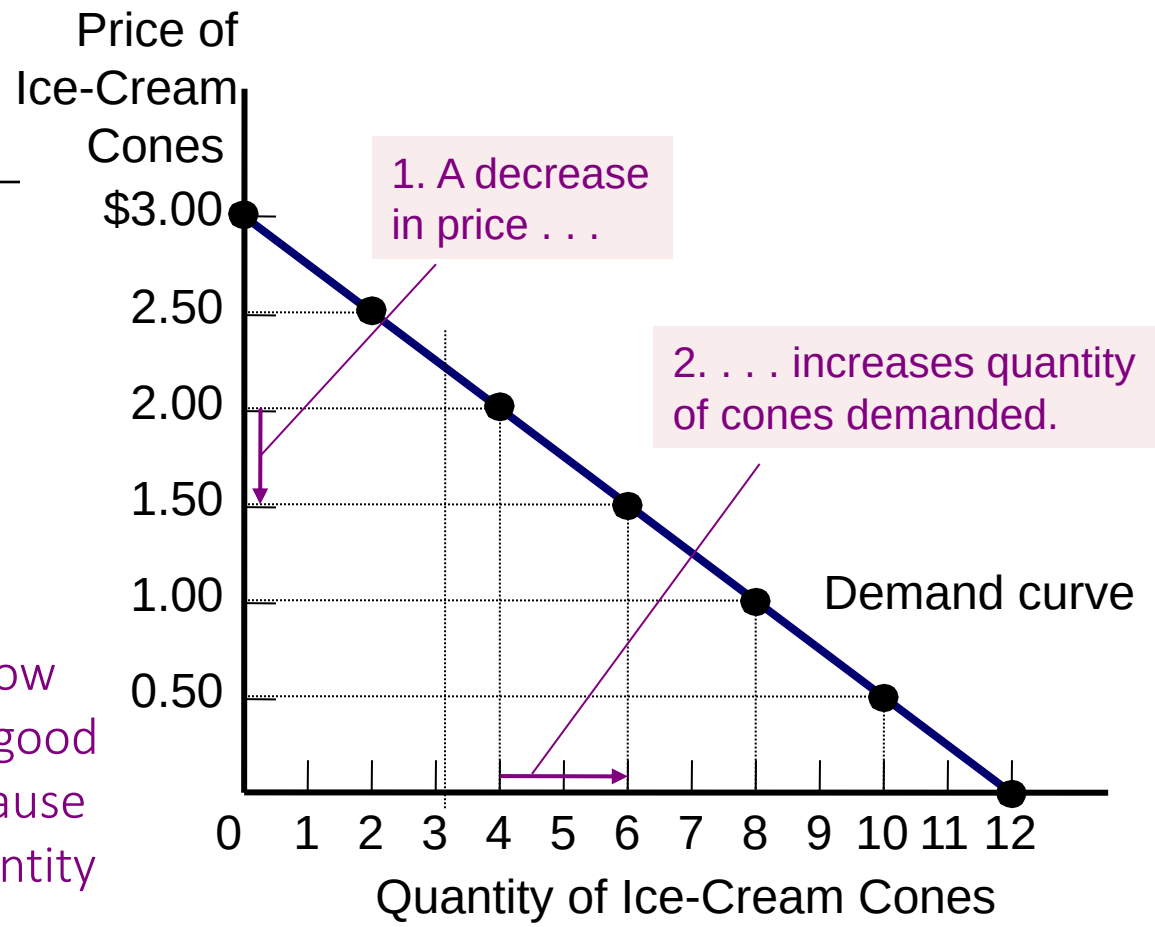
A demand schedule is a numerical tabulation that shows the quantity demanded of a commodity at different prices.

The demand schedule may be of 2 types :

- Individual demand Schedule
- Market demand Schedule.

Catherine's Demand Schedule and Demand Curve: Example

Price of Ice-cream cone	Q_D Cones demanded
$0.00	12
0.50	10
1.00	8
1.50	6
2.00	4
2.50	2
3.00	0



The demand curve illustrates how the quantity demanded of the good changes as its price varies. Because a lower price increases the quantity demanded, the demand curve slopes downward.

Demand (the Buyers)

Market vs. Individual Demand

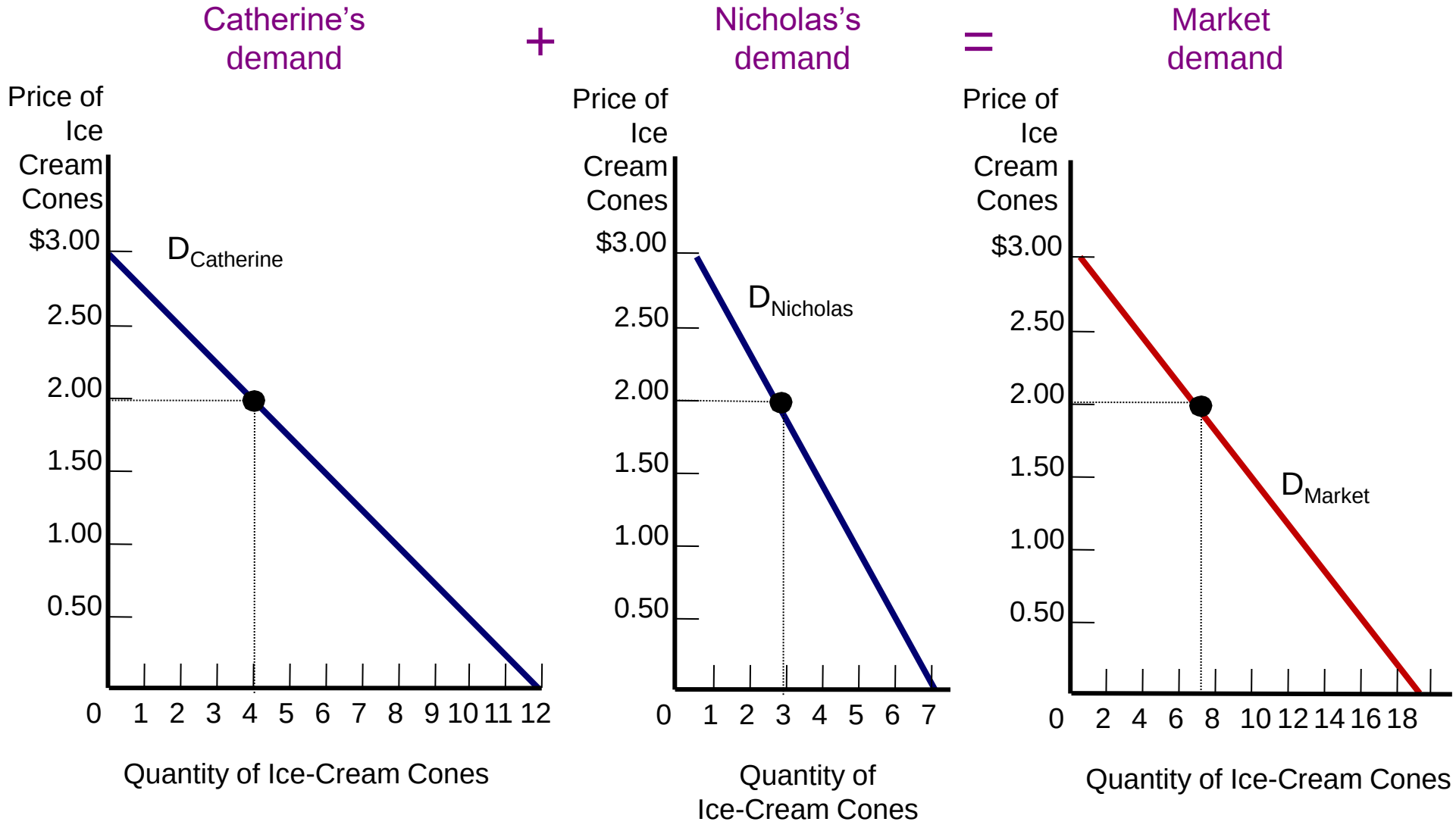
- Individual demand is a function of income, prices of related goods, expectations and tastes
- *Market demand is the sum of individual demands*
- Increases (decreases) in *aggregate* demand move the demand curve to the right (left)

Market Demand as the Sum of Individual Demands (Demand Schedule)

Price of ice-cream cone	Catherine		Nicholas		Market
$0.00	12	+	7	=	19
0.50	10		6		16
1.00	8		5		13
1.50	6		4		10
2.00	4		3		7
2.50	2		2		4
3.00	0		1		1

The quantity demanded in a market is the sum of the quantities demanded by all the buyers at each price: e.g., If price = $2.00, then Catherine demands 4 ice-cream cones, and Nicholas demands 3 ice-cream cones. The total quantity demanded in the market at this price is 7 cones.

Market Demand as the Sum of Individual Demands



Demand Analysis- Assumptions

- No change in taste and preference.
- Income of the consumer is constant.
- No change in customs, habit, quality of goods.
- No change in substitute products, related products and the price of the product.
- No complementary goods.

Demand Function

- A Mathematical relationship between quantity demanded of the commodity and its determinants is known as Demand Function.
- When this relationship relates to the demand by an individual consumer it is known as Individual demand function and while it relates to the market its known as market demand function.
- Individual Demand Function :

$Qdx = f (Px, Y, P1\ldots\ldots Pn\text{-}1, T, Ey. Ep)$

Market Demand Function

Qdx = f (Px, Y, P1……. Pn-1, T, A, Ey, Ep, P, D)

P = Population

D = Distribution of consumers.

Demand Analysis

Causes of downward sloping of Demand Curve

According to the law of demand there exists a opposite relationship between the PRICE and the QUANTITY DEMANDED, and that is why demand curve is downward sloping

Let the linear form of demand curve :

$$P = a + bq, \text{ where } a, q \text{ constant and } b < 0, \text{ i.e. } dp/dq = b < 0$$

(Assumption), so slope of the demand curve is negative.

The various reasons for this downwards sloping of demand curves are as follows:

- Law of Diminishing Marginal Utility and Equi-Marginal utility.
- Price Effect.
- Income Effect.
- Substitution Effect.
- Different Uses (eg: Electricity)

Demand Analysis

Factors Determining Demand:

General Factors:

- Price of the product
- Taste and Preference
- Income
- Prices of the related goods

Additional Factors: (Luxury Goods & Durables)

- Consumer's Expectation of future price.
- Consumer's Expectation of future income.

Additional Factors:(Market Demand)

- Population
- Social, Economic & Demographic distribution of Consumer's.

Exceptions to Law of Demand

1) Giffen Goods:

Giffen goods are the inferior goods whose demand increases with the increase in its prices.

There are several inferior commodities, much cheaper than the superior substitutes often consumed by the poor households as an essential commodity.

Whenever the price of the Giffen goods increases its quantity demanded also increases because, with an increase in the price, and the income remaining the same, the poor people cut the consumption of superior substitute and buy more quantities of Giffen goods to meet their basic needs.

Eg: Barley, Bajra, Potatoes(this is classic example during Irish Famine- 1845-1849).

Exceptions to Law of Demand

2) Veblen Goods

Another exception to the law of demand is given by the economist Thorstein Veblen, who proposed the concept of **"Conspicuous Consumption."**

According to Veblen, there are a certain group of people who measure the utility of the commodity purely by its price, which means, they think that higher priced goods and services derive more utility than the lesser priced commodities.

Eg: Diamond, Platinum etc.

Contd..

3) Expectation of Price Change in Future:

When the consumer expects that the price of a commodity is likely to further increase in the future, then he will buy more of it despite its increased price in order to escape himself from the pinch of much higher price in the future.

On the other hand, if the consumer expects the price of the commodity to further fall in the future, then he will likely postpone his purchase despite less price of the commodity in order to avail the benefits of much lower prices in the future.

Contd..

4) Ignorance: Often people are misconceived as high-priced commodities are better than the low-priced commodities and rest their purchase decision on such a notion. They buy those commodities whose price are relatively higher than the substitutes.

5) Emergencies: During emergencies such as war, natural calamity- flood, drought, earthquake, etc., the law of demand becomes ineffective. In such situations, people often fear the shortage of the essentials and hence demand more goods and services even at higher prices

6) Change in fashion and Tastes & Preferences: The change in fashion trend and tastes and preferences of the consumers negates the effect of law of demand. The consumer tends to buy those commodities which are very much 'in' in the market even at higher prices.

Contd..

7) Bandwagon Effect: This is the most common type of exception to the law of demand wherein the consumer tries to purchase those commodities which are bought by his friends, relatives or neighbors. Here, the person tries to emulate the buying behavior and patterns of the group to which he belongs irrespective of the price of the commodity.

For example, if the majority of group members have smart phones then the consumer will also demand for the smartphone even if the prices are high.

Change in Demand and Shift in demand

Due to changes in price of the commodity

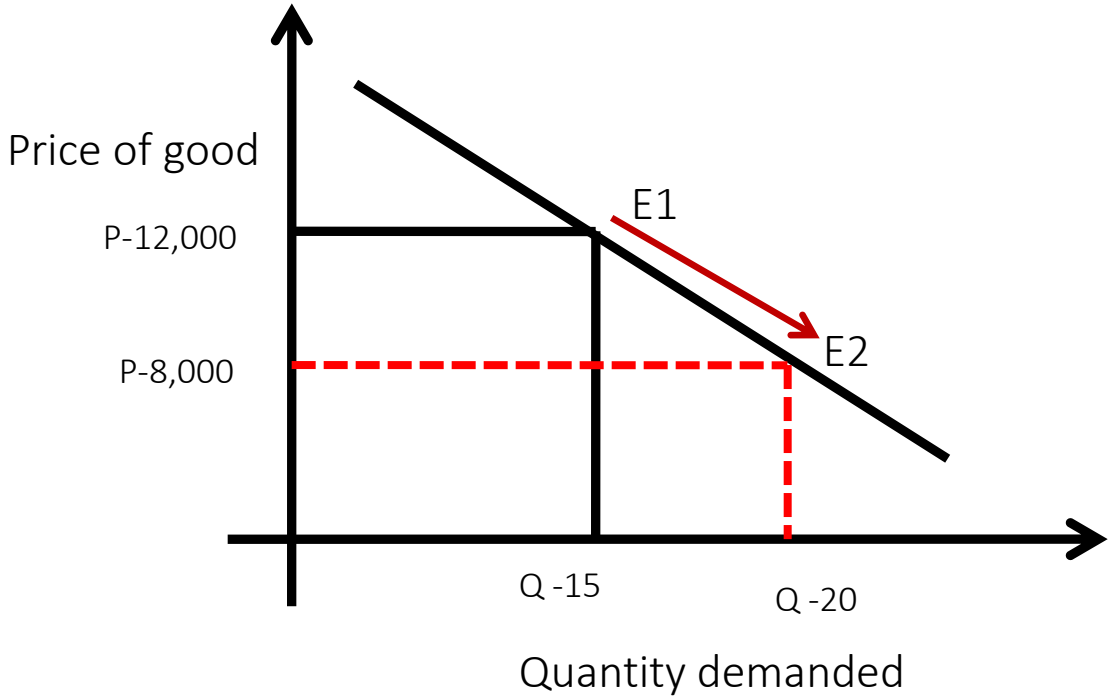
- ❑ Expansion
- ❑ Contraction

Due to changes in factors other than price/ Shift in Demand

- ❑ Increase
- ❑ Decrease

Expansion of Demand

Decrease in Price

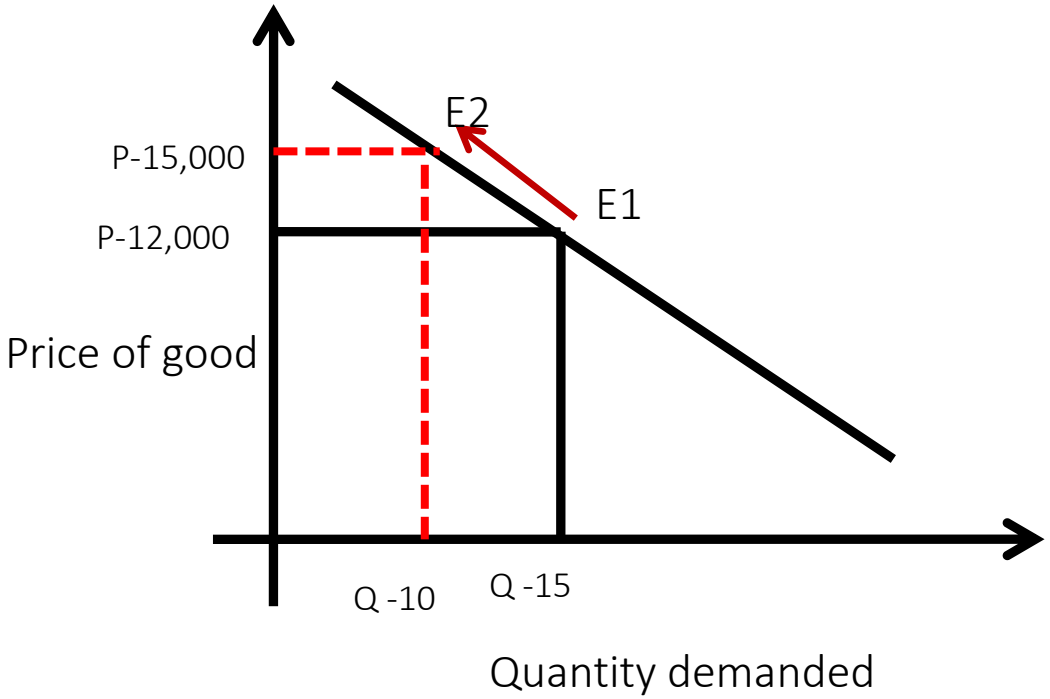


Price	Quantity
12,000	15 unit
8,000	20 unit

An **expansion of demand** denote E1 to E2
is **a** rise in the quantity demanded because ***the price has changed ,*** other factors remaining the same (**ceteris paribus**).

Contraction of Demand

Increase in the price



Price	Quantity
12,000	15 unit
15,000	10 unit

A CONTRACTION of demand is the fall in the quantity demanded because *the price has changed ,* other factors remaining the same. (from E1 to E2)

Shift in Demand: Demand Curve Shifters

The demand curve shows how price affects quantity demanded, *other things being equal*.

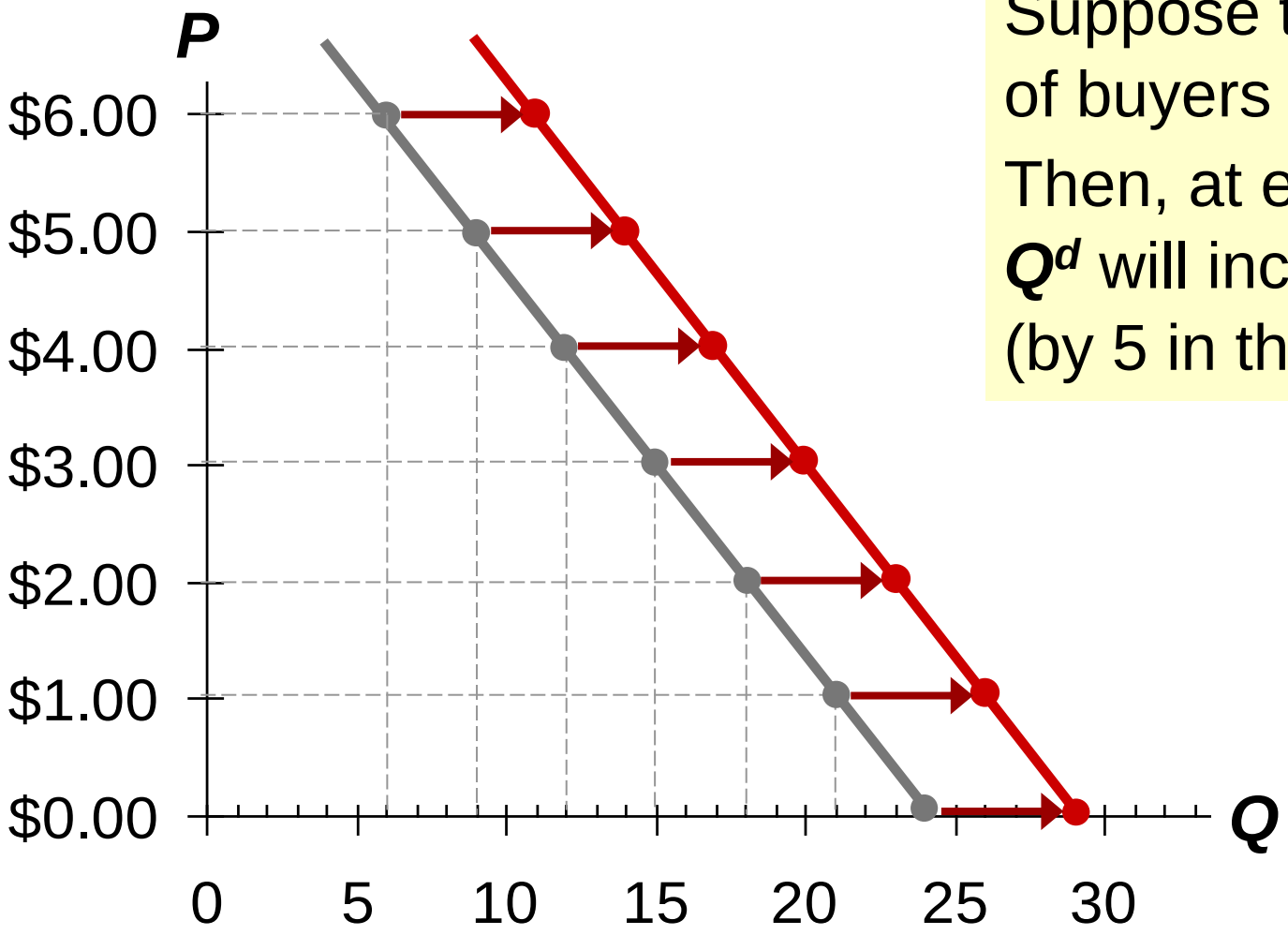
These “other things” are non-price determinants of demand (*i.e.,* things that determine buyers’ demand for a good, other than the good’s price).

Changes in them shift the ***D*** curve…

Demand Curve Shifters: Number of Buyers

Increase in number of buyers
increases quantity demanded at each price, shifts *D* curve to the right.

Demand Curve Shifters: Number of Buyers



Suppose the number of buyers increases.

Then, at each ***P***, Q^d will increase (by 5 in this example).

Demand Curve Shifters: Income

Demand for a **normal good** is positively related to income.

Increase in income causes
increase in quantity demanded at each price, shifts *D* curve to the right.

(Demand for an **inferior good** is negatively related to income. An increase in income shifts *D* curves for inferior goods to the left.)

Elasticity of Demand

Contents

Elasticity of Demand

Elasticity: a measure of the responsiveness of quantity demanded to one of its determinants.

Types of Elasticity of Demand:

1. Price Elasticity of Demand:

Price elasticity of demand measures how much the quantity demanded responds to a change in price.

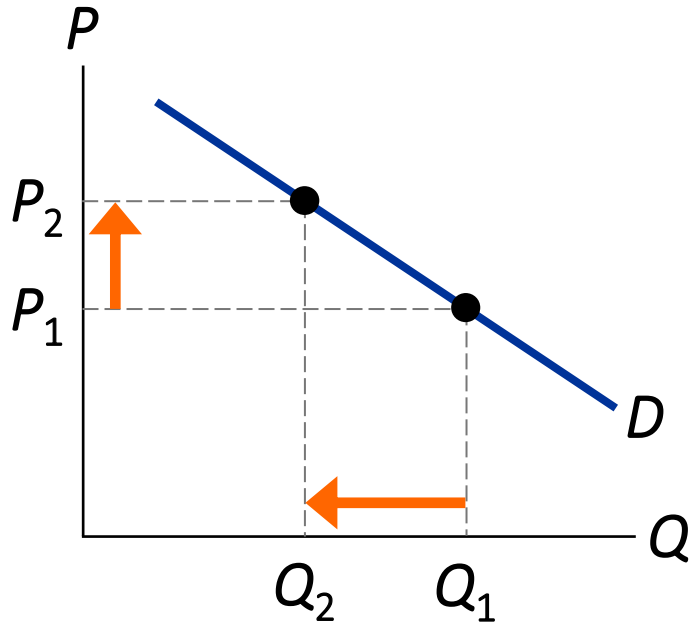
computed as the percentage change in quantity demanded divided by the percentage change in price

Price Elasticity of Demand

$$\text{Price elasticity of demand} = \frac{\text{Percentage change in } Q^d}{\text{Percentage change in } P}$$

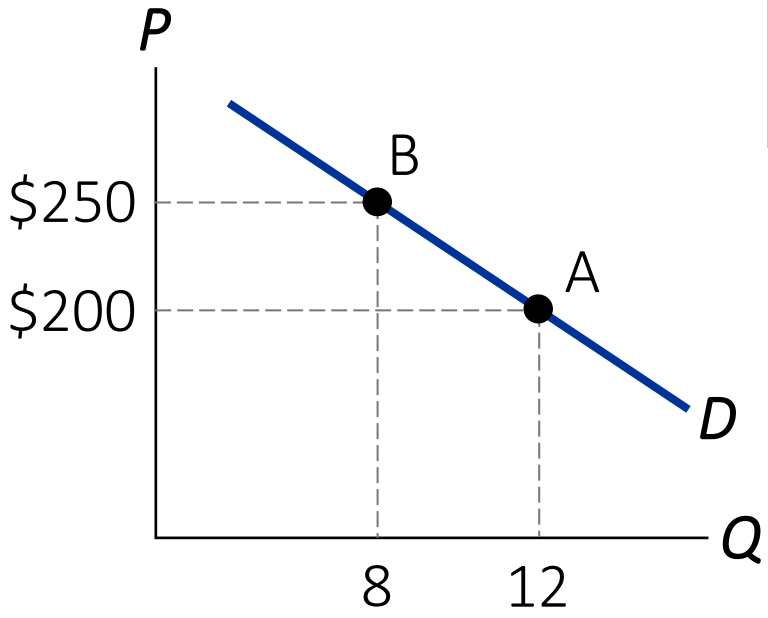
Along a *D* curve, *P* and *Q* move in opposite directions, which would make price elasticity negative.

We will drop the minus sign and report
all price elasticities
as positive numbers.



Calculating Percentage Changes

Demand for your websites



Standard method of computing the percentage (%) change:

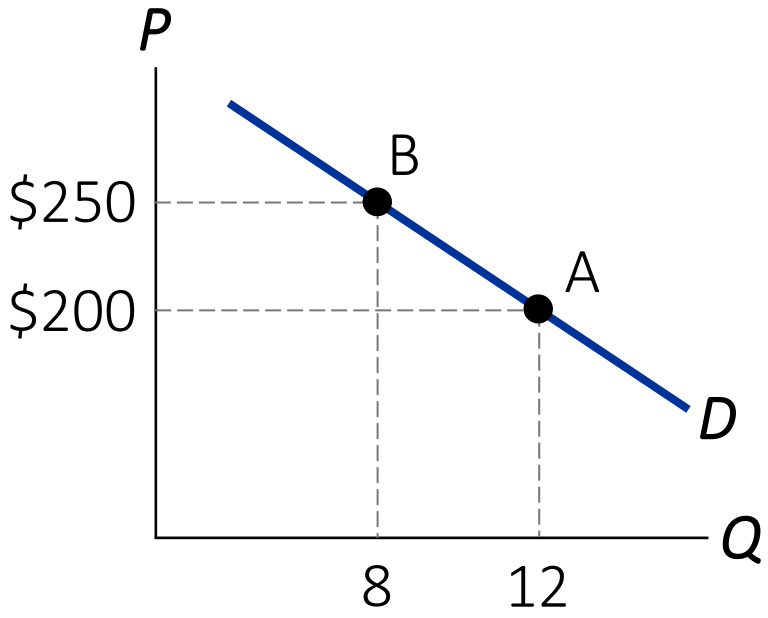
$$\frac{\text{end value} - \text{start value}}{\text{start value}} \times 100\%$$

Going from A to B, the % change in ***P*** equals

($250–$200)/$200 = 25%

Calculating Percentage Changes

Demand for your websites



Problem:

The standard method gives different answers depending on where you start.

From A to B,

P rises 25%, ***Q*** falls 33%,

elasticity = 33/25 = 1.33

From B to A,

P falls 20%, ***Q*** rises 50%,

elasticity = 50/20 = 2.50

Calculating Percentage Changes

So, we instead use the **midpoint method**:

$$\frac{\text{end value} - \text{start value}}{\text{midpoint}} \times 100\%$$

- The midpoint is the number halfway between the start & end values, also the average of those values.
- It doesn't matter which value you use as the "start" and which as the "end" – you get the same answer either way!

Calculating Percentage Changes

Using the midpoint method, the % change in ***P*** equals

$$\frac{\$250 - \$200}{\$225} \times 100\% = 22.2\%$$

- The % change in ***Q*** equals

$$\frac{12 - 8}{10} \times 100\% = 40.0\%$$

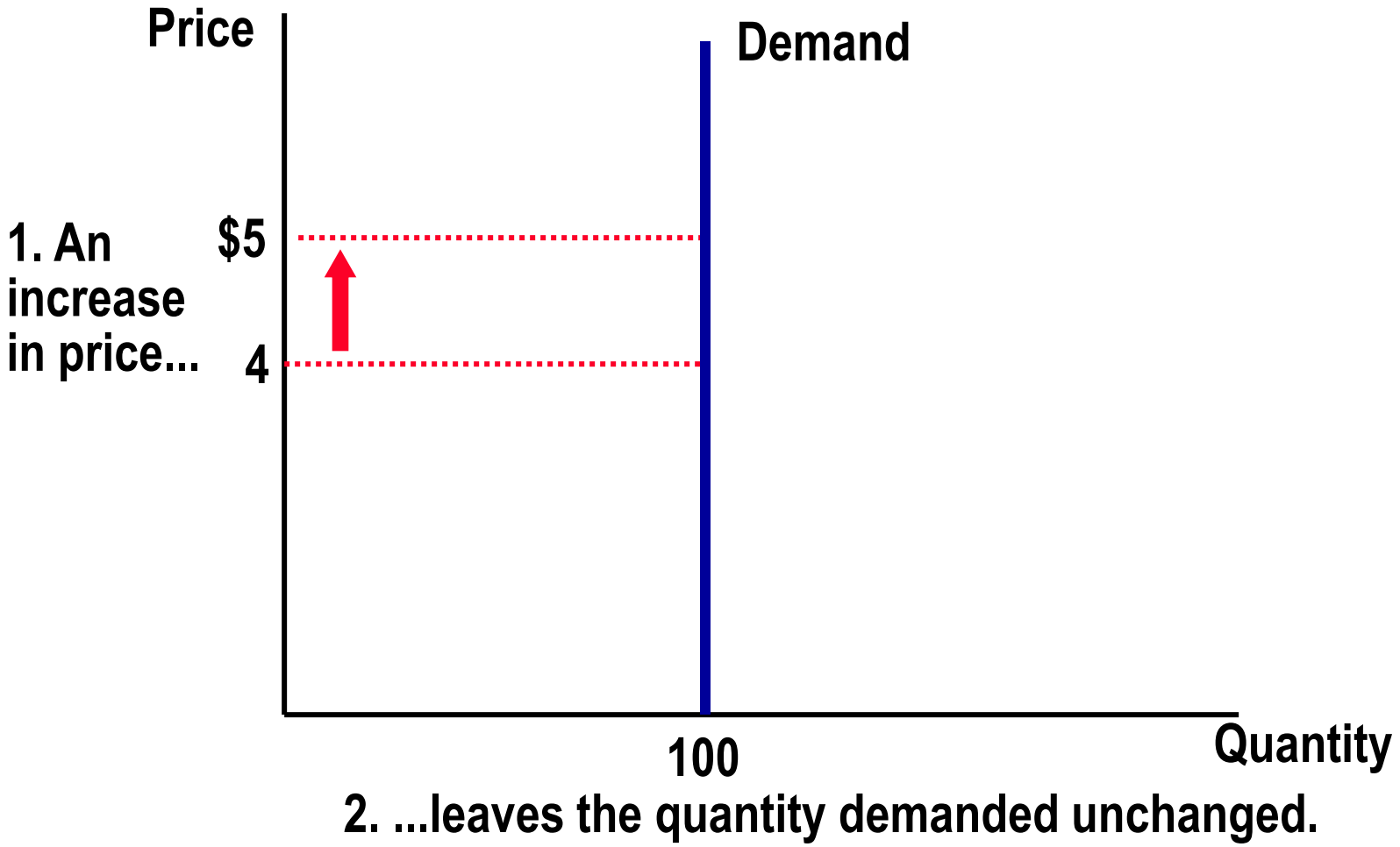
- The price elasticity of demand equals

$$40/22.2 = 1.8$$

Types of Price Elasticity of Demand

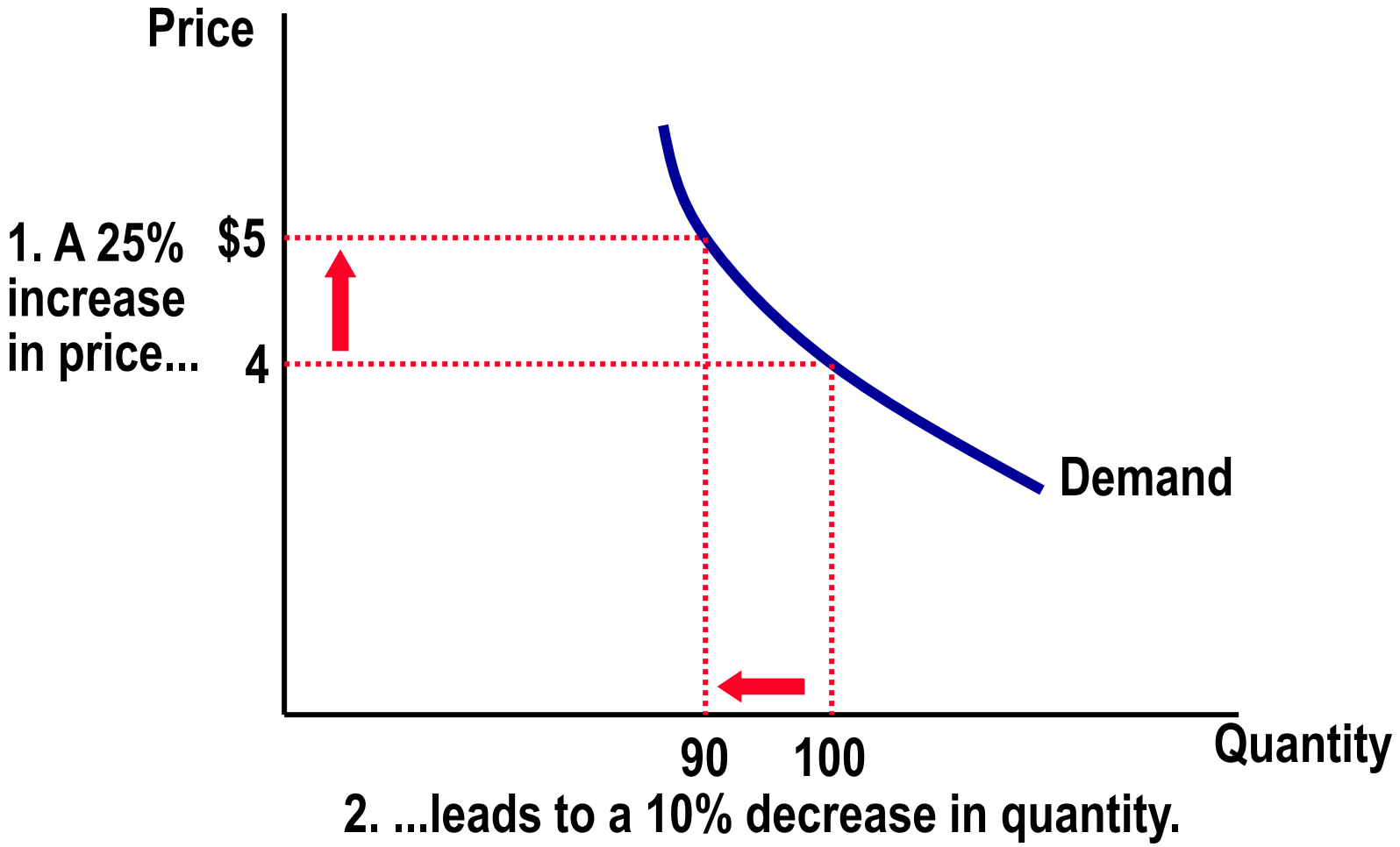
1. Perfectly Inelastic Demand
2. Inelastic Demand
3. Unitary elastic Demand
4. Elastic Demand
5. Perfectly Elastic Demand

Perfectly Inelastic Demand
- Elasticity equals 0



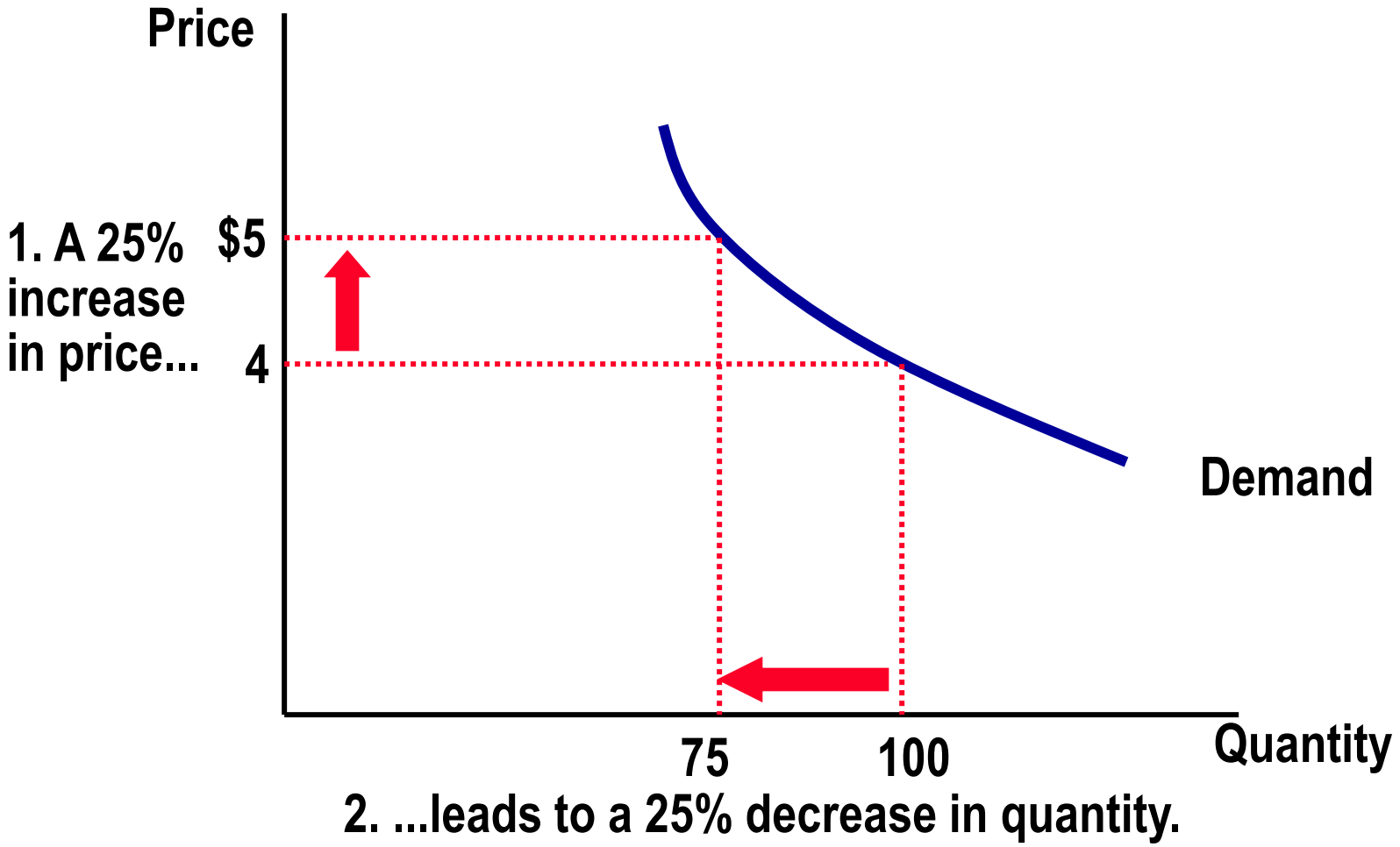
Inelastic Demand

- Elasticity is less than 1



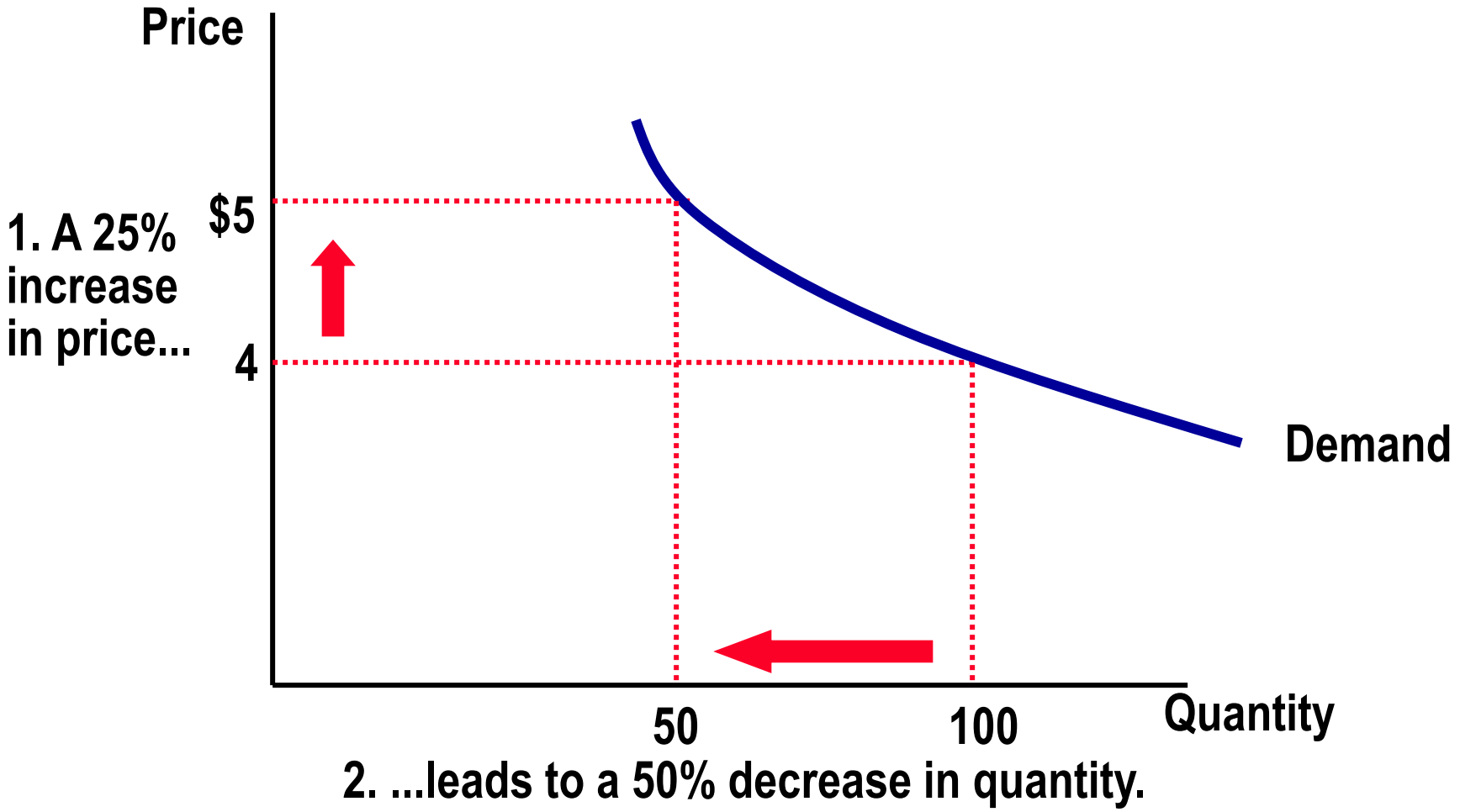
Unitary Elastic Demand

- Elasticity equals 1

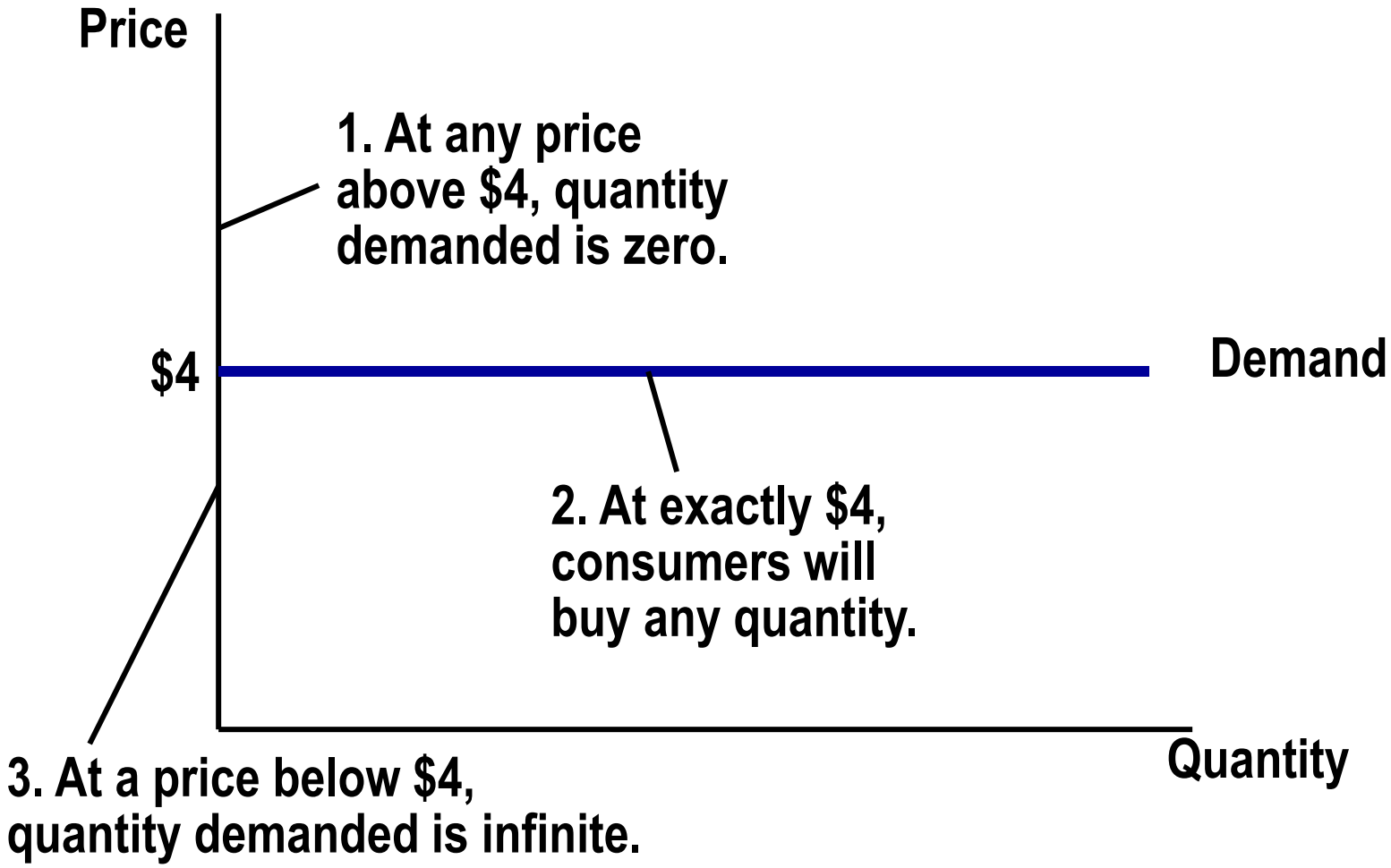


Elastic Demand

- Elasticity is greater than 1



Perfectly Elastic Demand
- Elasticity equals infinity



Determinants of Price Elasticity of Demand

- *Necessities versus Luxuries*
- *Availability of Close Substitutes*
- *Definition of the Market*
- *Time Horizon*

Determinants of Price Elasticity of Demand

Demand tends to be more inelastic

- *If the good is a necessity.*
- *If the time period is shorter.*
- *The smaller the number of close substitutes.*

Determinants of Price Elasticity of Demand

Demand tends to be more elastic :

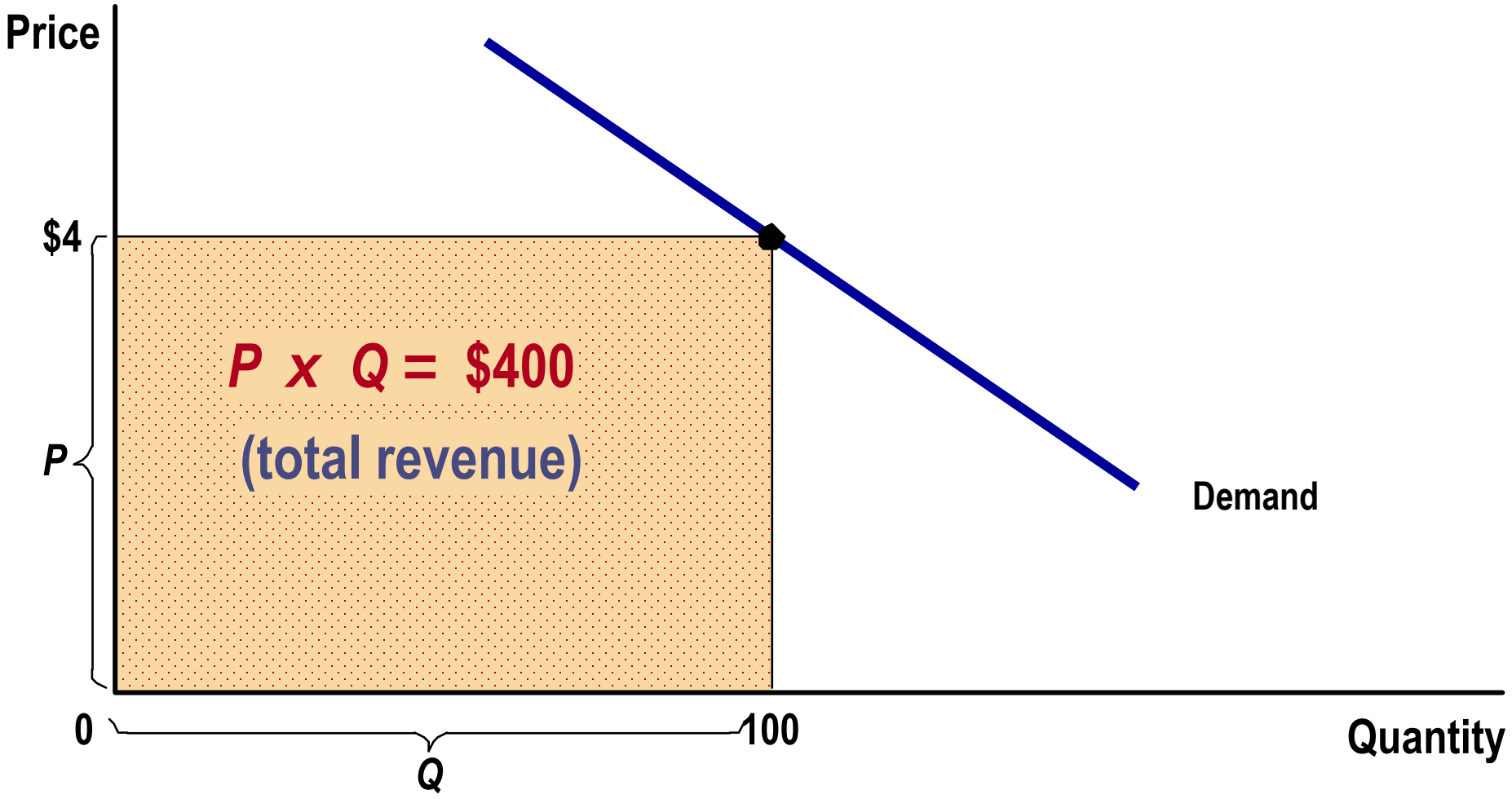
- if the good is a luxury.
- the longer the time period.
- the larger the number of close substitutes.

Elasticity and Total Revenue

- Total revenue is the amount paid by buyers and received by sellers of a good.
- Computed as the price of the good times the quantity sold.

$$TR = P \times Q$$

Elasticity and Total Revenue



Price Elasticity and Total Revenue

Continuing our scenario, if you raise your price from $200 to $250, would your revenue rise or fall?

$$\text{Revenue} = P \times Q$$

A price increase has two effects on revenue:

- Higher *P* means more revenue on each unit you sell.
- But you sell fewer units (lower *Q*), due to Law of Demand.

Which of these two effects is bigger?
It depends on the price elasticity of demand.

Price Elasticity and Total Revenue

$$\text{Price elasticity of demand} = \frac{\text{Percentage change in } Q}{\text{Percentage change in } P}$$

$$\text{Revenue} = P \times Q$$

If demand is elastic, then

$$\text{price elast. of demand} > 1$$

$$\%\text{ change in } Q > \%\text{ change in } P$$

The fall in revenue from lower Q is greater than the increase in revenue from higher P, so revenue falls.

Income Elasticity of Demand

- Income elasticity of demand measures how much the quantity demanded of a good responds to a change in consumers' income.
- It is computed as the percentage change in the quantity demanded divided by the percentage change in income.

Computing Income Elasticity

$$\text{Income Elasticity of Demand} = \frac{\text{Percentage Change in Quantity Demanded}}{\text{Percentage Change in Income}}$$

Income Elasticity - Types of Goods

- *Normal Goods*
  - Income Elasticity is positive.
- *Inferior Goods*
  - Income Elasticity is negative.
- Higher income *raises* the quantity demanded for normal goods but *lowers* the quantity demanded for inferior goods.

Cross Price Elasticity of Demand

The **cross-price elasticity of demand** measures the response of demand for one good to changes in the price of another good.

$$\text{Cross-price elasticity of demand} = \frac{\%\text{ change in } Q^d \text{ for good 1}}{\%\text{ change in price of good 2}}$$

- For substitutes, cross-price elasticity > 0
  E.g., an increase in price of tea causes an increase in demand for coffee.
- For complements, cross-price elasticity < 0
  E.g., an increase in price of computers causes decrease in demand for software.

Promotional Elasticity of Demand (Advertisement Elasticity)

The advertisement elasticity of demand measures the responsiveness of the quantity demanded through the changes in the advertisement expenditure. (assuming other factors unchanged).

It can be calculated through the following formula

$$\text{Promotional elasticity of demand} = \frac{\%\ \text{change in } Q^d}{\%\ \text{change in advertisement expenditure}}$$

Demand Forecasting

“Prediction is very difficult,
especially if it's about the future.”
(Niels Bohr)

What is forecasting?

Forecasting is a tool used for predicting future demand based on past demand information.

- Is essentially a judgement of future probabilities of the future demand.
- Is an attempt to predict the future demand based on past data under conditions of uncertainty.
- Prediction or estimation of a future situation, under given conditions

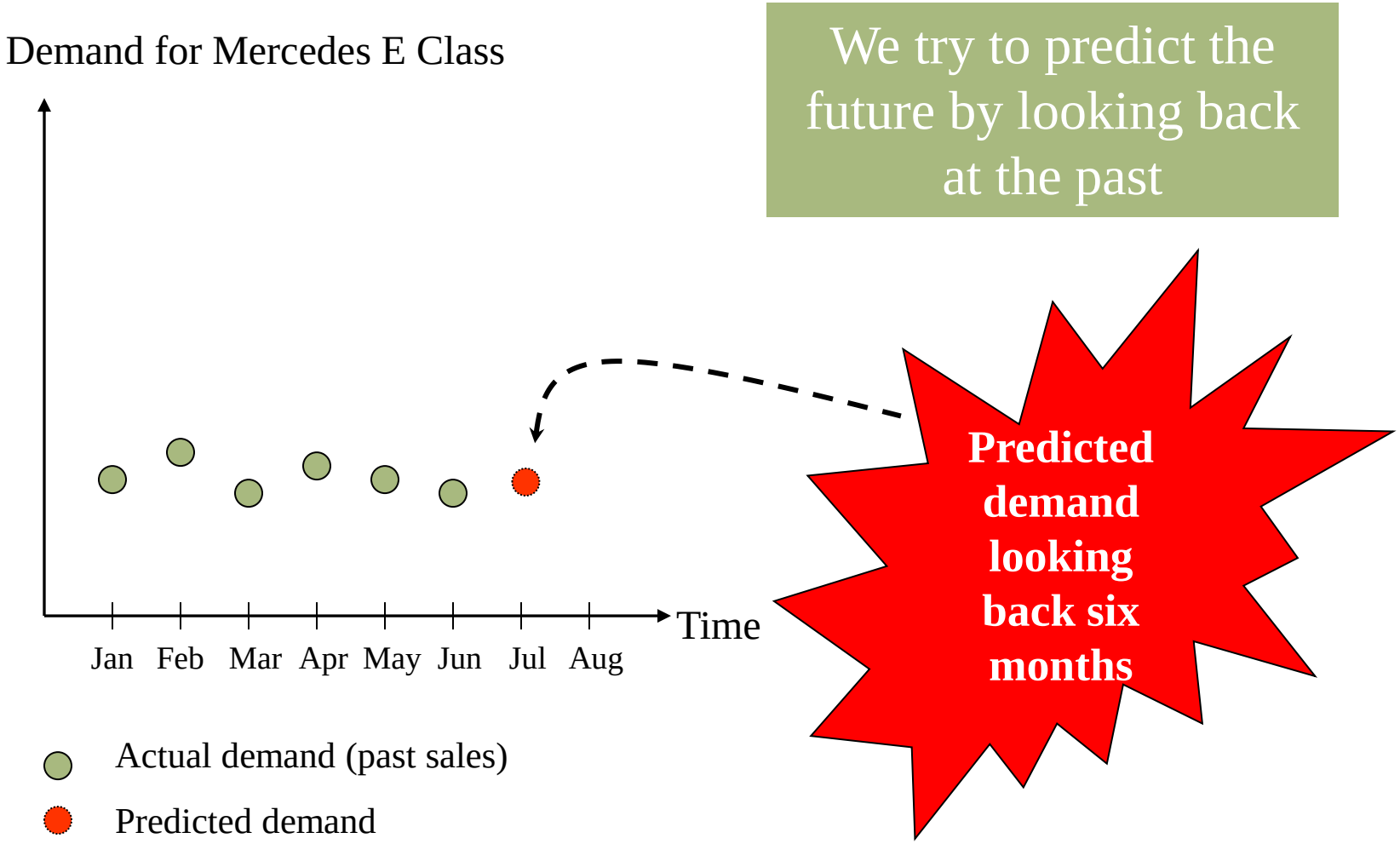
Why is forecasting important?

Demand for products and services is usually *uncertain*.

Forecasting can be used for…

- Strategic planning (long range planning)
- Finance and accounting (budgets and cost controls)
- Marketing (future sales, new products)
- Production and operations

What is forecasting all about?



Some general characteristics of forecasts

- Forecasts are more accurate for groups or families of items
- Forecasts are more accurate for shorter time periods
- Every forecast should include an error estimate
- Forecasts are no substitute for calculated demand.

Classification of Demand Forecasts

Active vs passive forecasting

Active forecasting is a method of forecasting the demand on the consideration that a firm is likely to initiate some action like changes in product quality, size, price etc.

Passive forecasting based on the assumption that the same product is being offered without any changes.

Short-run vs long run forecasting

Short-run forecasting normally extends up to one year. These forecasts are useful for product scheduling, inventory planning, and mobilization of working capital etc.

Long-run forecasts extend beyond one year. They are helpful in capital budgeting, product diversification, personnel recruitment etc.

Contd..

Company forecasting vs Industry forecasting

Forecasting the demand for the products of a particular firm is company forecasting.

These are firm specific and designed to serve the individual firms in planning their policies.

Industry forecasting forecasts the demand for the products of the industry as a whole.

The association of manufacturers or trade associations undertake them and serve the needs of all the firms in the industry.

Contd...

Durable Vs. Perishable goods

Durable goods forecasting involves forecasting of goods which are durable in nature.

Eg: furniture, electronics products etc.

Perishable goods forecasting is for those goods which are perishable.

Eg: vegetables, fruits etc.

Contd..

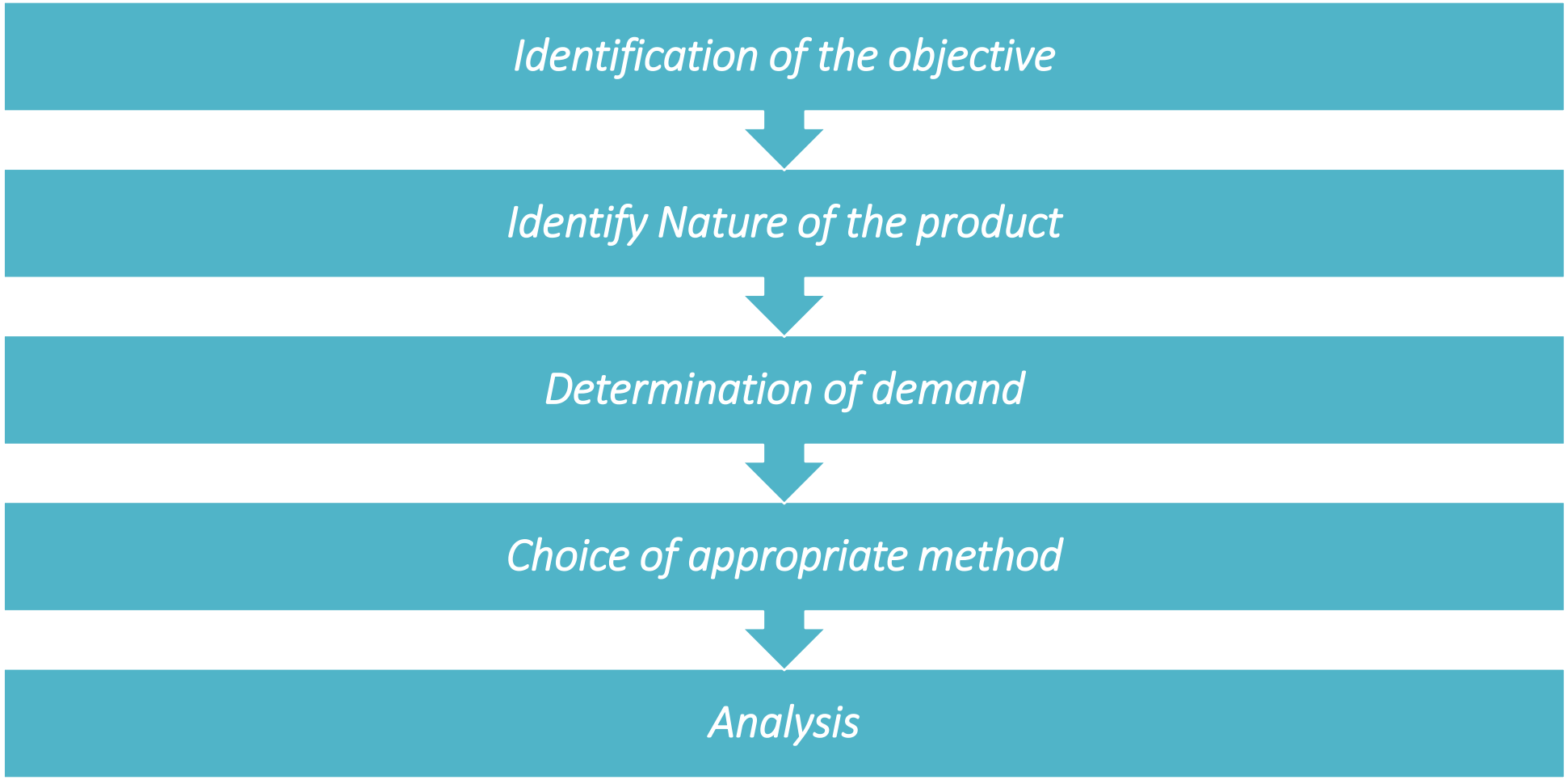
Micro level forecasting vs Macro level forecasting

Micro level forecasting may take the form of company forecasting or industry forecasting.

Macro level forecasting on the other hand is concerned with forecasting general economic environment and business conditions in the country as a whole.

The national income growth rates, production indices, price indices provide useful insights into the future demand for most of the commodities. Governmental organizations provide the base data to forecast the demand.

Steps in Demand Forecasting



Key issues in forecasting

1. A forecast is only as good as the information included in the forecast (past data)
2. History is not a perfect predictor of the future (i.e.: there is no such thing as a perfect forecast)

Forecasting is based on the assumption that the past predicts the future! When forecasting, think carefully whether or not the past is strongly related to what you expect to see in the future…

Example: Mercedes E-class vs. M-class Sales

Month	E-class Sales	M-class Sales
Jan	*23,345*	-
Feb	*22,034*	-
Mar	*21,453*	-
Apr	*24,897*	-
May	*23,561*	-
Jun	*22,684*	-
Jul	*?*	*?*

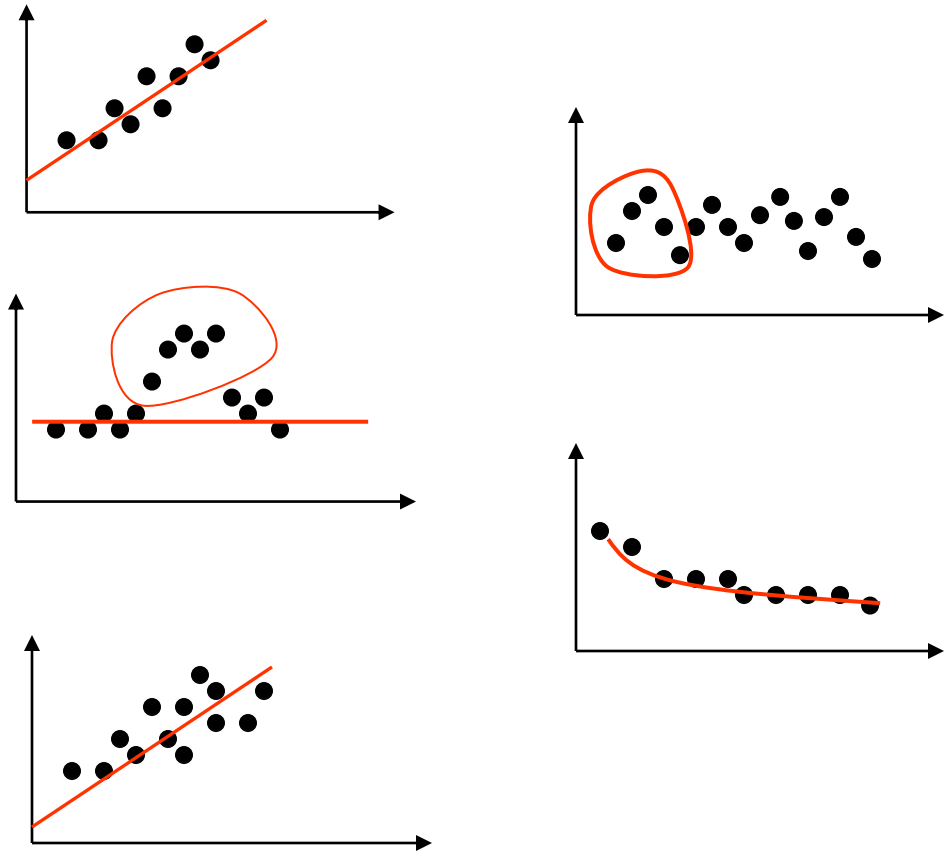
Question: Can we predict the new model M-class sales based on the data in the the table?

Answer: Maybe... We need to consider how much the two markets have in common

What should we consider when looking at past demand data?

Data = historic pattern + random variation

- Trends
- Seasonality
- Cyclical elements
- Autocorrelation
- Random variation



Some Important Questions

1. What is the purpose of the forecast?
2. Which systems will use the forecast?
3. How important is the past in estimating the future?

Answers will help determine time horizons, techniques, and level of detail for the forecast.

Types of forecasting methods

Qualitative methods

Rely on subjective opinions from one or more experts.

Quantitative methods

Rely on data and analytical techniques.

Qualitative Models

Consumer's Opinion Survey Method

Expert opinion method or Delphi method

Collective opinion survey or sales force opinion survey method

Qualitative Methods

Consumer's opinion survey

The consumer opinion survey can be either **census** or **sample survey**. Where the numbers of buyers are limited, census survey methods hold. In this case, the opinion of the entire universe is obtained.

On the other hand, where the number of buyers is large, universal survey is not feasible; hence, sample survey methods are used.

The sample survey can be either **purposive sampling** or **random sampling** based on the nature of the product or the objectives of the survey.

Limitations

consumer opinion surveys are not perfectly reliable

expensive and time-taking.

Expert opinion method or Delphi method

- Expert opinion method is a variant of the consumer's opinion survey method. It was also popular as Delphi method and first used by Rand Corporation in USA for predicting the demand under conditions of intractable technological changes. It is used under conditions of nonexistence of data or when a new product is being launched.
- The fairest step in this method is the identification of experts and eliciting their opinions about the likely demand for the product. The experts may differ in their views in which case the firm has to pass on the opinions of one expert to the other, of course under strict anonymity and seek their reactions. This exercise should go on until a common line of thinking emerges.
- This method will be useful tool of demand forecasting provided the experts did not have biased opinions.

Collective opinion survey or sales force opinion survey method

- In this method, the firm will extract the opinions of the sales team, which is on the payrolls of the company about the future demand for the product. The sales personnel are very close to the consumers and dealers. They express their opinions about the future demand for the product.

- The opinions so gathered are tabulated and the demand forecasts will be arrived at.

- However, care be taken before forming an opinion about the future demand. The opinions of the sales team should not be taken on the face value as an ambitious sales man gives an over estimate of the demand for the product while a sceptic fearing the fixation of higher sales targets always quotes a lesser figure.

- This method is an inexpensive but more reliable method of demand forecasting.

End – Use Method

- This method is quite useful for industries which are mainly producer's goods. In this method, the sale of the product under consideration is projected as the basis of demand survey of the industries using this product as an intermediate product.
- The end user demand estimation of an intermediate product may involve many final good industries using this product at home and abroad. It helps us to understand inter-industry' relations. An intermediate product may have many end-users, **for e.g., steel** can be used for making various types of agricultural and industrial machinery, for construction, for transportation, etc.
- It may have demand both in the domestic market as well as the international market. Thus, end – use demand estimation of an intermediate product may involve many final goods ' industries using this product, at home and in abroad.
- After we know the demand for final consumption of goods including their exports, we can estimate the demand for the product which is used as intermediate goods in the production of these final goods with the help of input – output coefficients.

How should we pick our forecasting model?

1. Data availability
2. Time horizon for the forecast
3. Required accuracy
4. Required Resources

Time Series: Moving average

- The moving average model uses the last t periods in order to predict demand in period $t+1$.
- There can be two types of moving average models: simple moving average and weighted moving average
- The moving average model assumption is that the most accurate prediction of future demand is a simple (linear) combination of past demand.

Time series: simple moving average

In the simple moving average models the forecast value is

$$F_{t+1} = \frac{A_t + A_{t-1} + \ldots + A_{t-n}}{n}$$

t	is the current period.
F_{t+1}	is the forecast for next period
n	is the forecasting horizon (how far back we look),
A	is the actual sales figure from each period.

Example: forecasting sales at Kroger

Kroger sells (among other stuff) bottled water

Month	Bottles
Jan	*1,325*
Feb	*1,353*
Mar	*1,305*
Apr	*1,275*
May	*1,210*
Jun	*1,195*
Jul	*?*

What if we use a 3-month simple moving average?

$$F_{Jul} = \frac{A_{Jun} + A_{May} + A_{Apr}}{3} = 1{,}227$$

What if we use a 5-month simple moving average?

$$F_{Jul} = \frac{A_{Jun} + A_{May} + A_{Apr} + A_{Mar} + A_{Feb}}{5} = 1{,}268$$

Time series: weighted moving average

We may want to give more importance to some of the data…

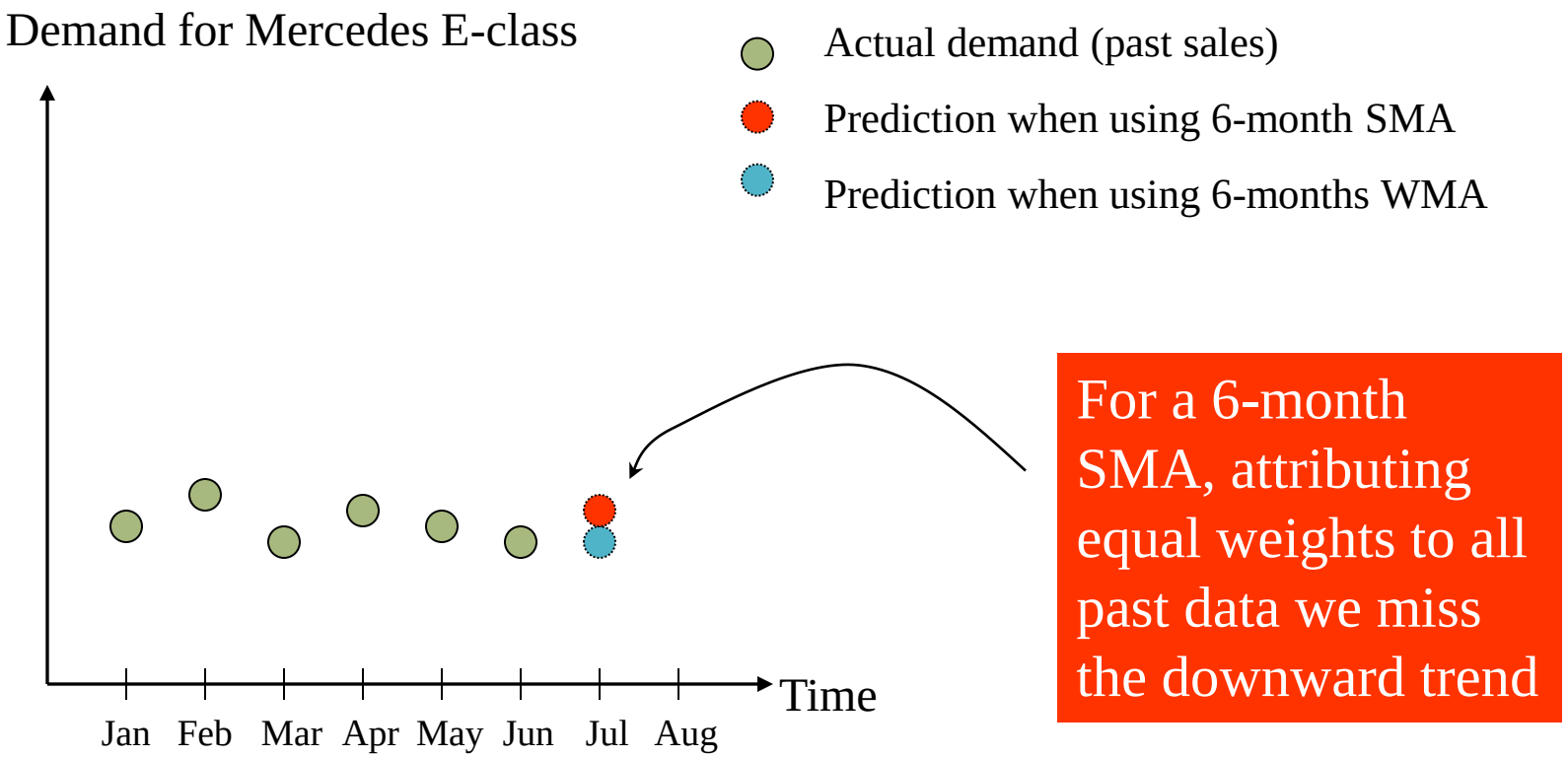
$$F_{t+1} = w_t A_t + w_{t-1} A_{t-1} + \ldots + w_{t-n} A_{t-n}$$

$$w_t + w_{t-1} + \ldots + w_{t-n} = 1$$

t	is the current period.
F_{t+1}	is the forecast for next period
n	is the forecasting horizon (how far back we look),
A	is the actual sales figure from each period.
w	is the importance (weight) we give to each period

Why do we need the WMA models?

Because of the ability to give more importance to what happened recently, without losing the impact of the past.



For a 6-month SMA, attributing equal weights to all past data we miss the downward trend

Example: Kroger sales of bottled water

Month	Bottles
Jan	*1,325*
Feb	*1,353*
Mar	*1,305*
Apr	*1,275*
May	*1,210*
Jun	*1,195*
Jul	*?*

6-month simple moving average…

$$F_{Jul} = \frac{A_{Jun} + A_{May} + A_{Apr} + A_{Mar} + A_{Feb} + A_{Jan}}{6} = 1{,}277$$

In other words, because we used equal weights, a slight downward trend that actually exists is not observed…

What if we use a weighted moving average?

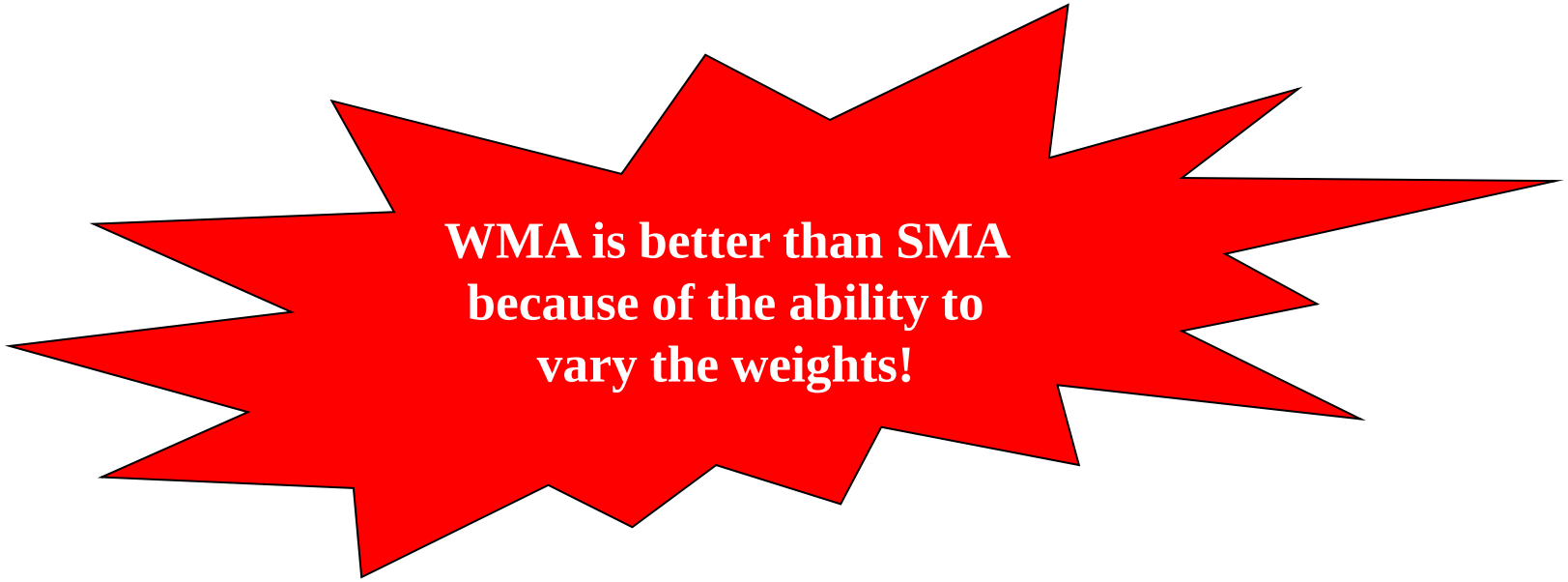
Make the weights for the last three months more than the first three months…

	6-month SMA	WMA 40% / 60%	WMA 30% / 70%	WMA 20% / 80%
July Forecast	*1,277*	*1,267*	*1,257*	*1,247*

The higher the importance we give to recent data, the more we pick up the declining trend in our forecast.

How do we choose weights?

1. Depending on the importance that we feel past data has
2. Depending on known seasonality (weights of past data can also be zero).

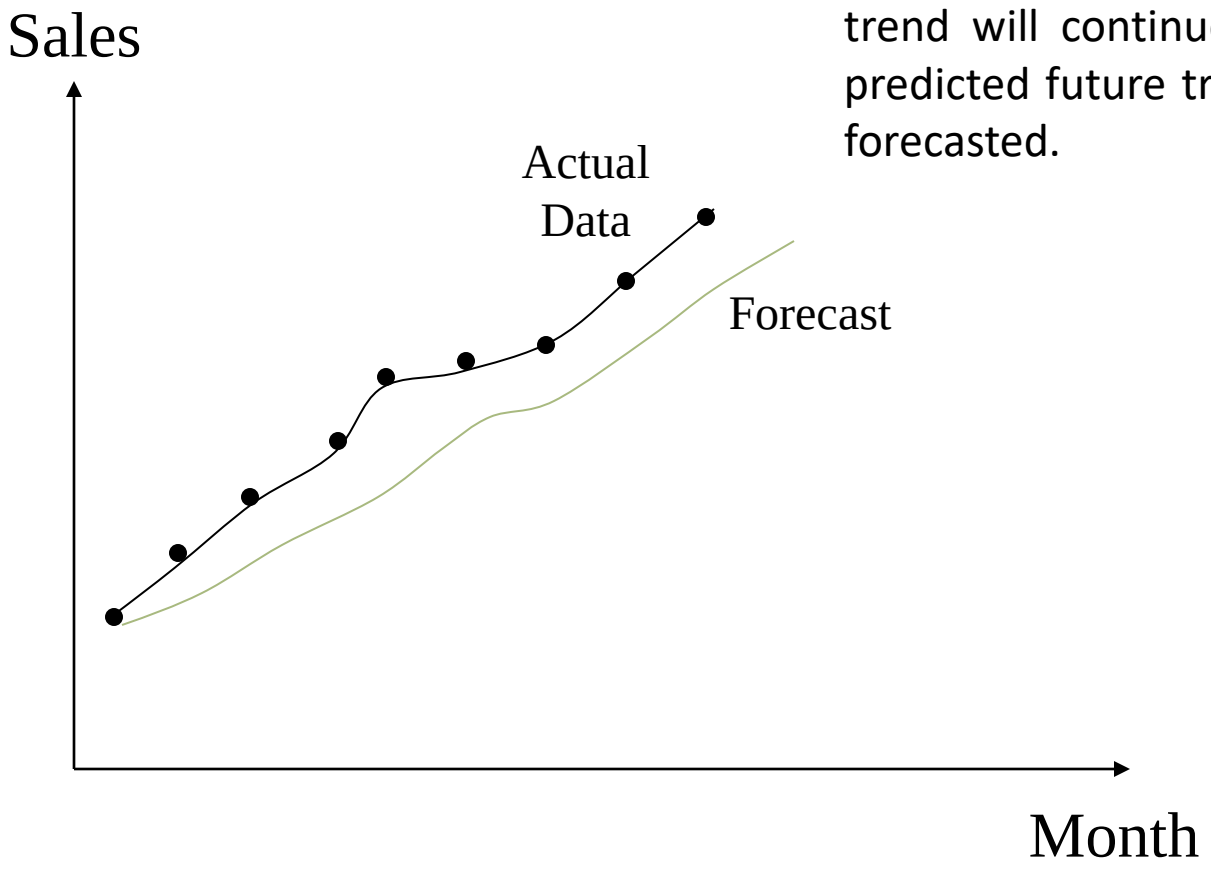


Trend..

What do you think will happen to a moving average when there is a *trend* in the data?

Impact of trend

This method is useful where the organization has a sufficient amount of accumulated past data of the sales. This date is arranged chronologically to obtain a time series. Thus, the time series depicts the past trend and on the basis of it, the future market trend can be predicted. It is assumed that the past trend will continue in the future. Thus, on the basis of the predicted future trend, the demand for a product or service is forecasted.



Linear regression in forecasting

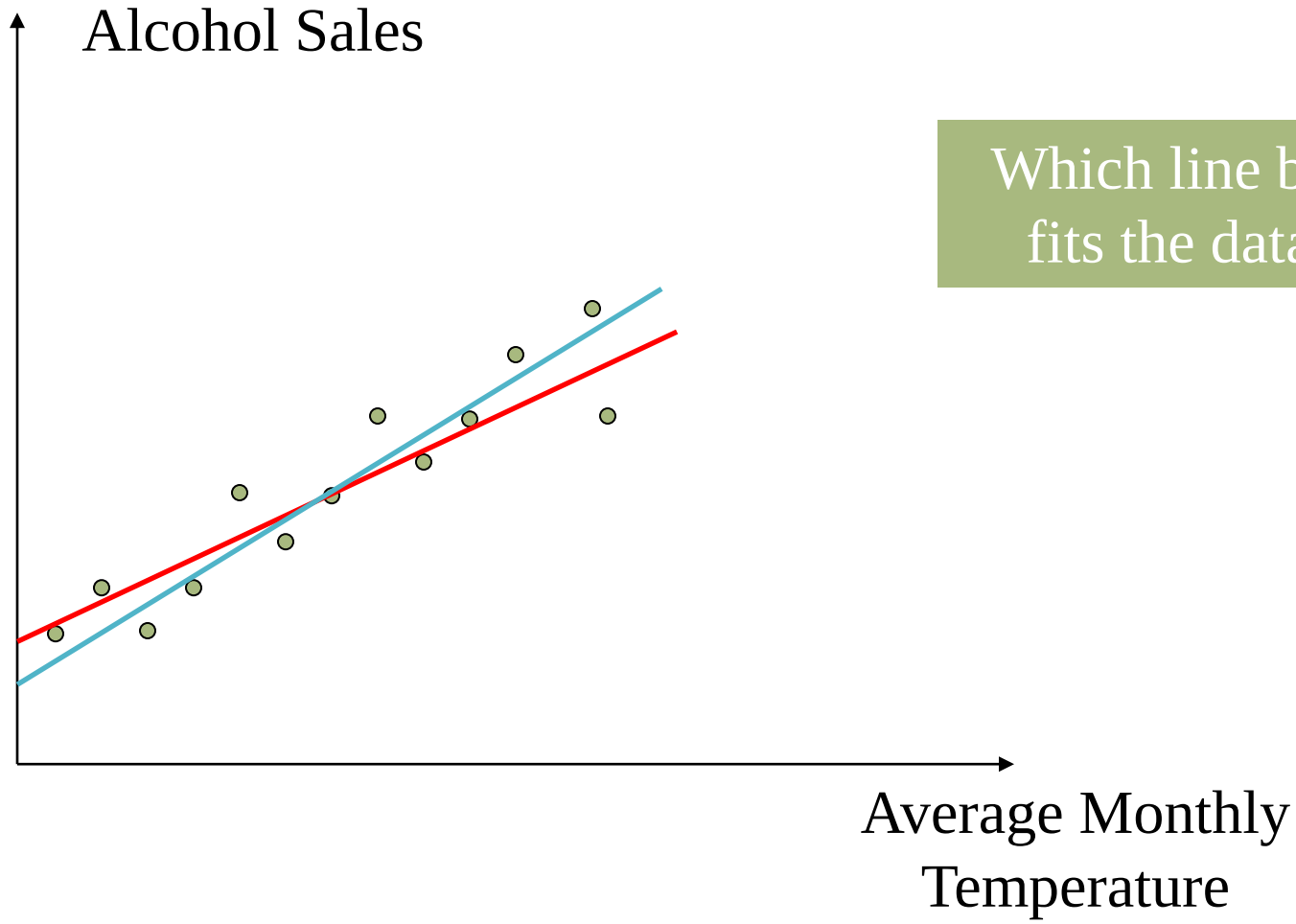
Linear regression is based on

1. Fitting a straight line to data
2. Explaining the change in one variable through changes in other variables.

$$dependent\ variable = a + b \times (independent\ variable)$$

By using linear regression, we are trying to explore which independent variables affect the dependent variable

Example: do people drink more when it's cold?



Which line best fits the data?

The best line is the one that minimizes the error

The predicted line is …

$$Y = a + bX$$

So, the error is …

$$\varepsilon_i = y_i - Y_i$$

Where: ε is the error

y is the observed value

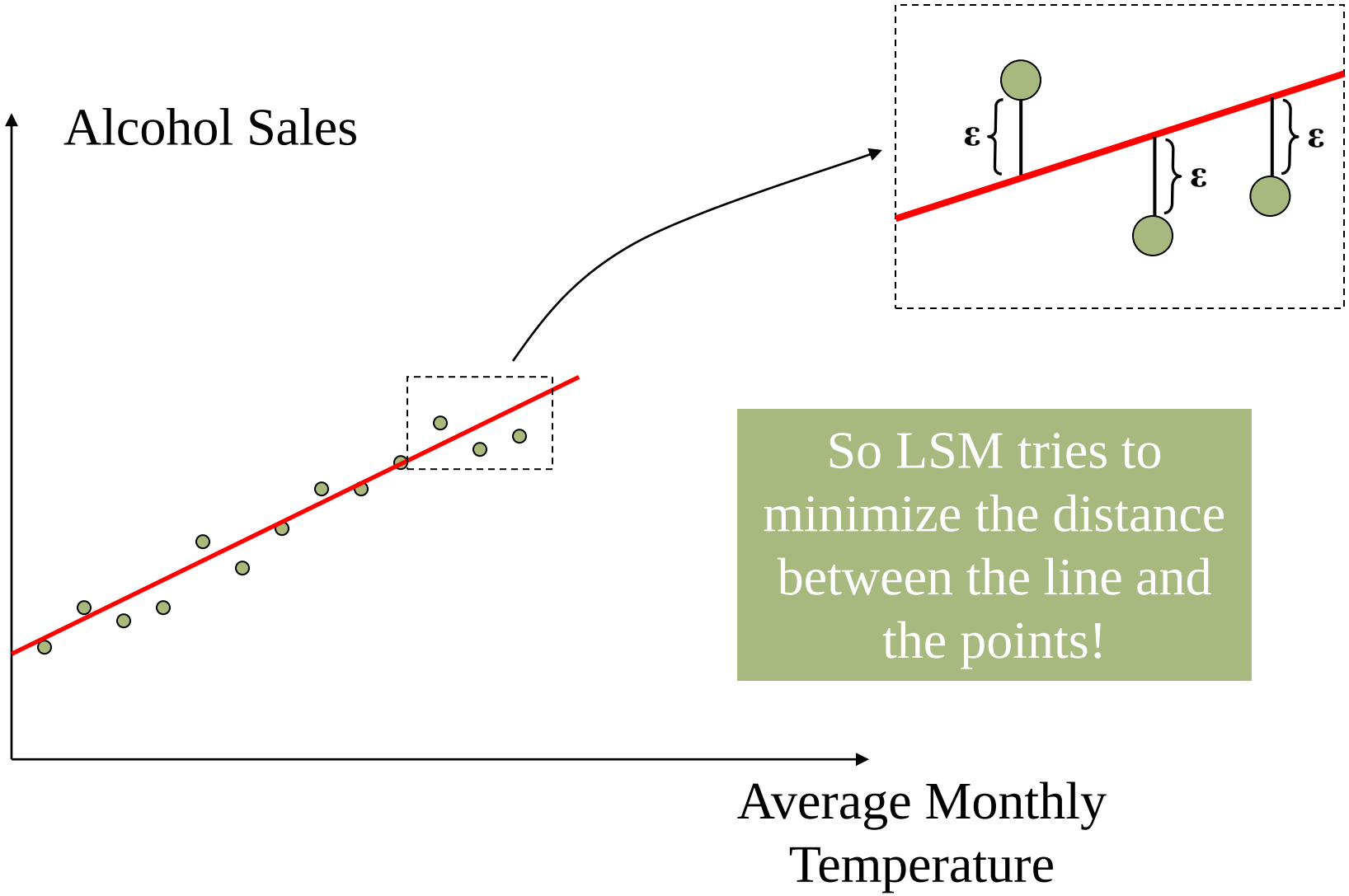
Y is the predicted value

Least Squares Method of Linear Regression

The goal of LSM is to minimize the sum of squared errors…

$$\text{Min} \sum \varepsilon_i^2$$

What does that mean?



So LSM tries to minimize the distance between the line and the points!

How can we compare across forecasting models?

We need a metric that provides estimation of accuracy

Errors can be:

1. biased (consistent)
2. random

Forecast error = Difference between actual and forecasted value (also known as *residual*)

Measuring Accuracy: MFE

MFE = Mean Forecast Error (Bias)

It is the average error in the observations

$$\text{MFE} = \frac{\sum_{i=1}^{n} A_t - F_t}{n}$$

1. A more positive or negative MFE implies worse performance; the forecast is biased.

Measuring Accuracy: MAD

MAD = Mean Absolute Deviation

It is the average absolute error in the observations

$$\text{MAD} = \frac{\sum_{i=1}^{n} |A_t - F_t|}{n}$$

1. Higher MAD implies worse performance.

2. If errors are normally distributed, then $\sigma_\varepsilon = 1.25\text{MAD}$

Key Point

Forecast must be measured for accuracy!

The most common means of doing so is by measuring the either the mean absolute deviation or the standard deviation of the forecast error

Criteria for Good Demand Forecasting

1. Time frame
2. Pattern of the data
3. Cost /economy of forecasting
4. Accuracy desired
5. Availability of data
6. Plausibility/ Ease of understanding
7. Durability
8. Flexibility

Supply

Supply comes from the behavior of sellers.

The **quantity supplied** of any good is the amount that sellers are willing and able to sell.

Law of supply: the claim that the quantity supplied of a good rises when the price of the good rises, other things equal

The Supply Schedule

Supply schedule:
A table that shows the relationship between the price of a good and the quantity supplied.

Example:
Firm A supply of X.

Price of X	Quantity of X supplied
$0.00	0
1.00	3
2.00	6
3.00	9
4.00	12
5.00	15
6.00	18

- Notice that supply schedule obeys the Law of Supply.

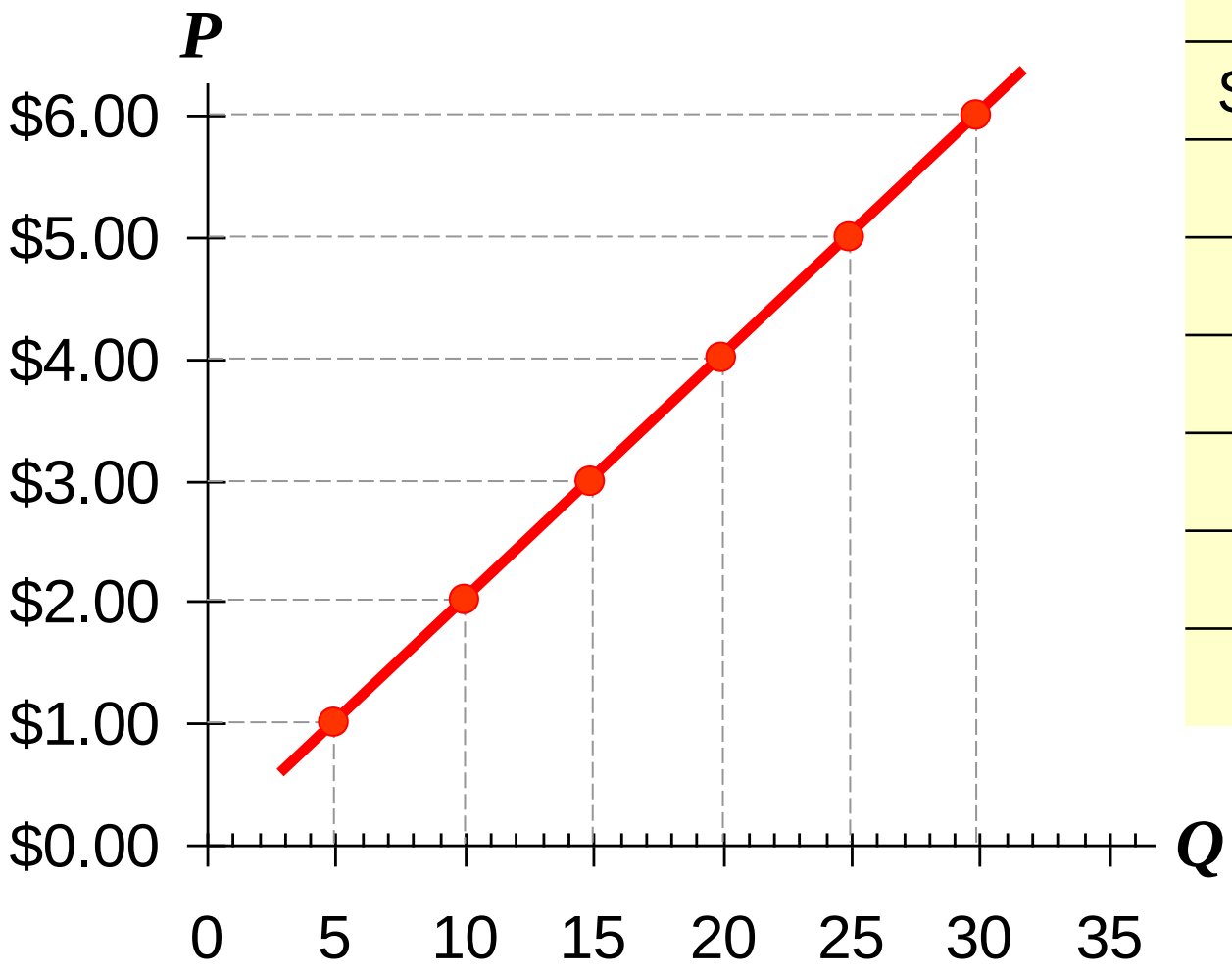
Market Supply versus Individual Supply

The quantity supplied in the market is the sum of the quantities supplied by all sellers at each price.

Suppose Firm A and Firm B are the only two sellers in this market. (Q^s = quantity supplied)

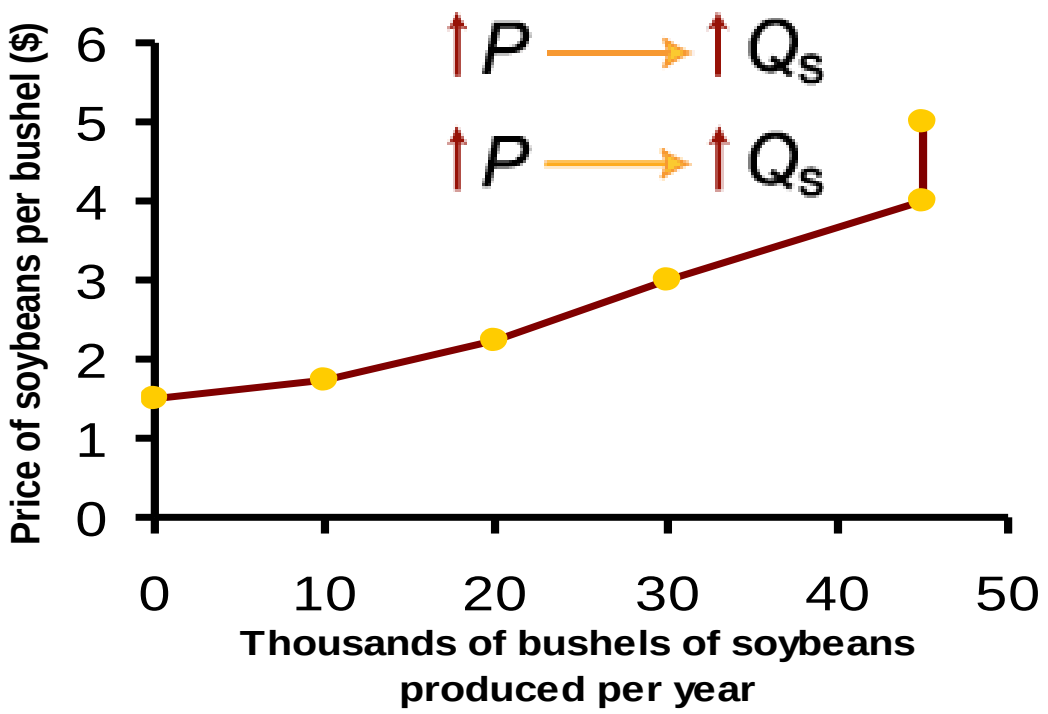
Price	Firm A		Firm B		Market Q^s
$0.00	0	+	0	=	0
1.00	3	+	2	=	5
2.00	6	+	4	=	10
3.00	9	+	6	=	15
4.00	12	+	8	=	20
5.00	15	+	10	=	25
6.00	18	+	12	=	30

The Market Supply Curve



P	Q^S (Market)
$0.00	0
1.00	5
2.00	10
3.00	15
4.00	20
5.00	25
6.00	30

The Law of Supply



The ***law of supply*** states that there is a positive relationship between price and quantity of a good supplied.

This means that supply curves typically have a positive slope.

Determinants of Supply

The ***price*** of the good or service.

The ***cost*** of producing the good, which in turn depends on:

- The ***price of required inputs*** (labor, capital, and land),
- The ***technologies*** that can be used to produce the product,

The ***prices of related products.***

The law of supply states that other things being equal, the supply of a commodity extends with a rise in price and contracts with a fall in price. There are however a few exceptions to the law of supply.

1. Exceptions of a fall in price

If the firms anticipate that the price of the product will fall further in future, in order to clear their stocks they may dispose it off at a price that is even lower than the current market price.

2. Sellers who are in need of cash

If the seller is in need of hard cash, he may sell his product at a price which may even be below the market price.

3. When leaving the industry

If the firms want to shut down or close down their business, they may sell their products at a price below their average cost of production.

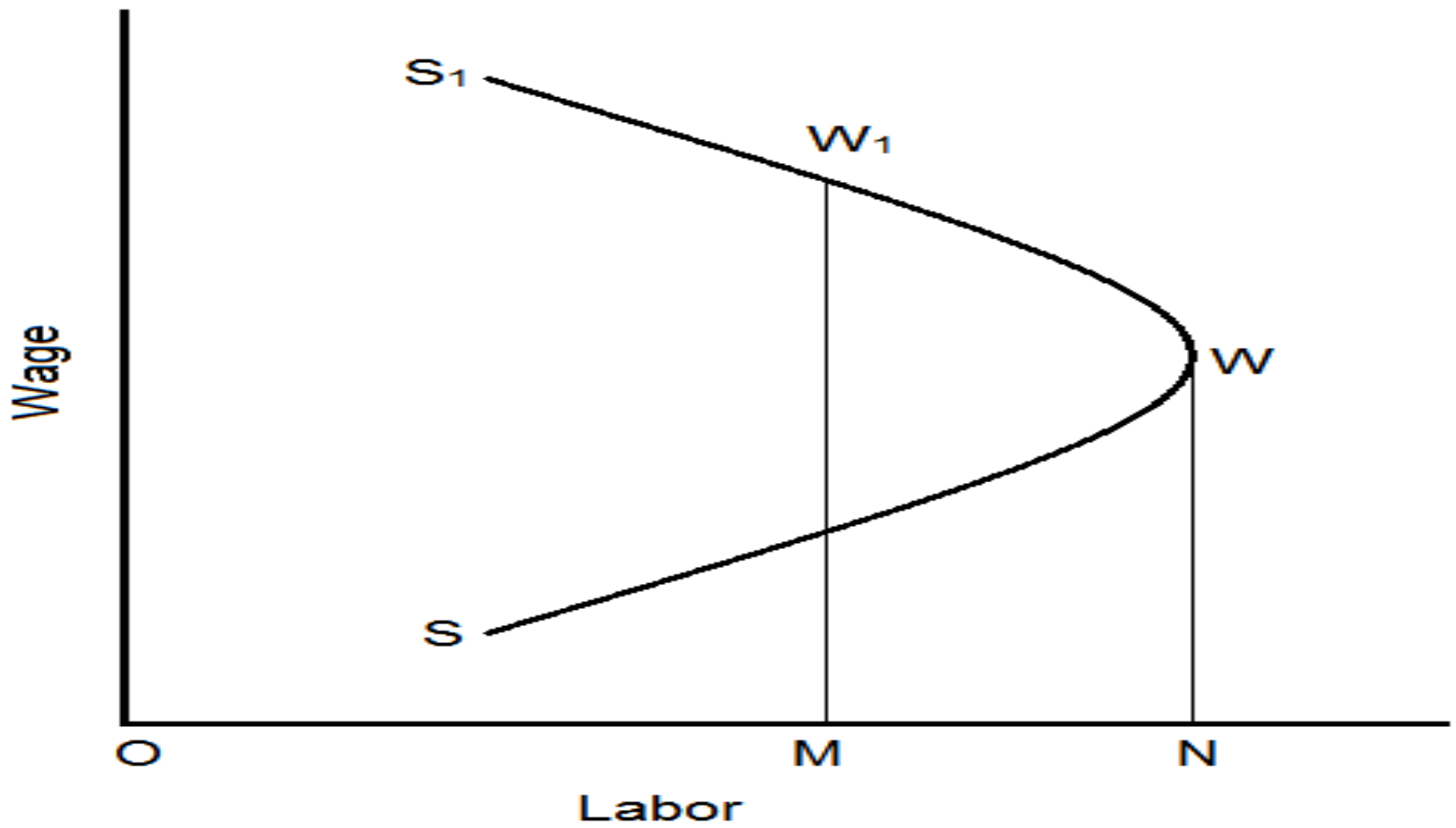
4. Agricultural output

In agricultural production, natural and seasonal factors play a dominant role. Due to the influence of these constraints supply may not be responsive to price changes

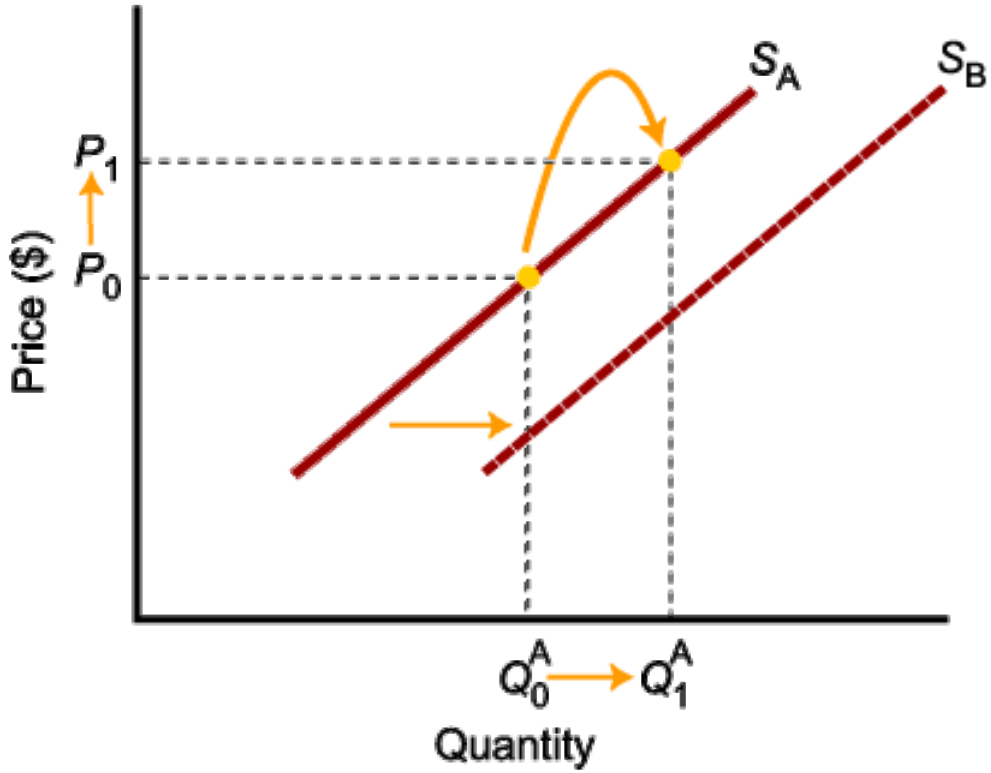
5. Backward sloping supply curve of labor

The rise in the price of a good or service sometimes leads to a fall in its supply. The best example is the supply of labor. A higher wage rate enables the worker to maintain his existing material standard of living with less work, and he may prefer extra leisure to more wages. The supply curve in such a situation will be ‘backward sloping’ SS1 as illustrated in figure.

Figure 3

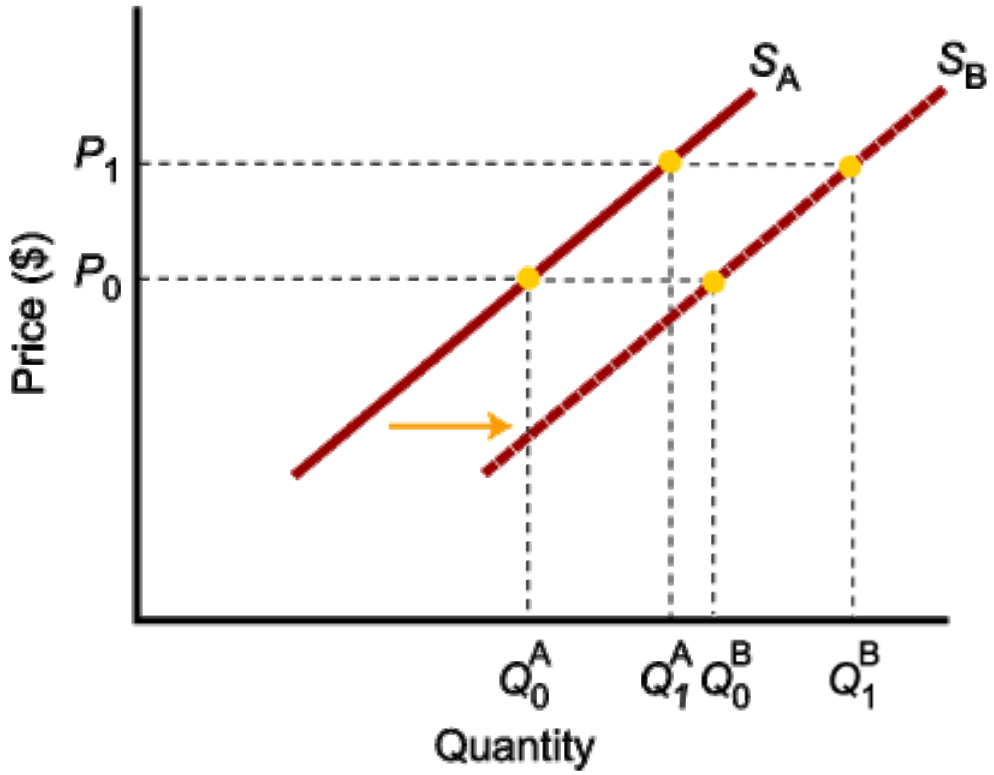


A Change in Supply Versus a Change in Quantity Supplied



- A change in ***supply*** is not the same as a change in ***quantity supplied***.
- In this example, a higher price causes ***higher quantity supplied***, and a ***move along*** the supply curve.
- In this example, changes in determinants of supply, other than price, cause an ***increase in supply***, or a ***shift*** of the entire supply curve, from S_A to S_B.

A Change in Supply Versus a Change in Quantity Supplied

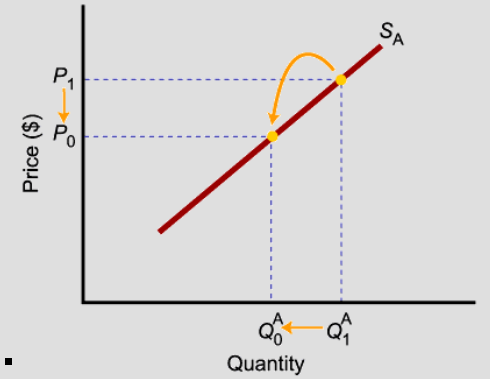


- When ***supply shifts*** to the right, supply increases. This causes ***quantity supplied*** to be greater than it was prior to the shift, ***for each and every price level.***

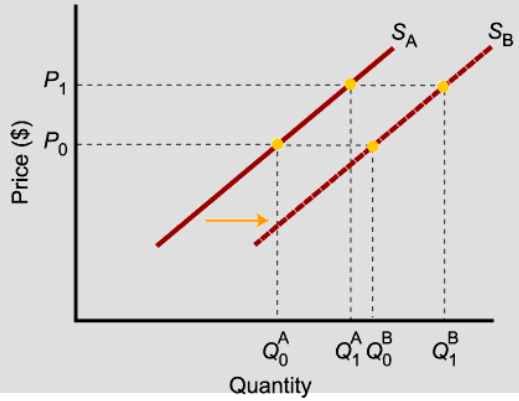
A Change in Supply Versus a Change in Quantity Supplied

To summarize:

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**).



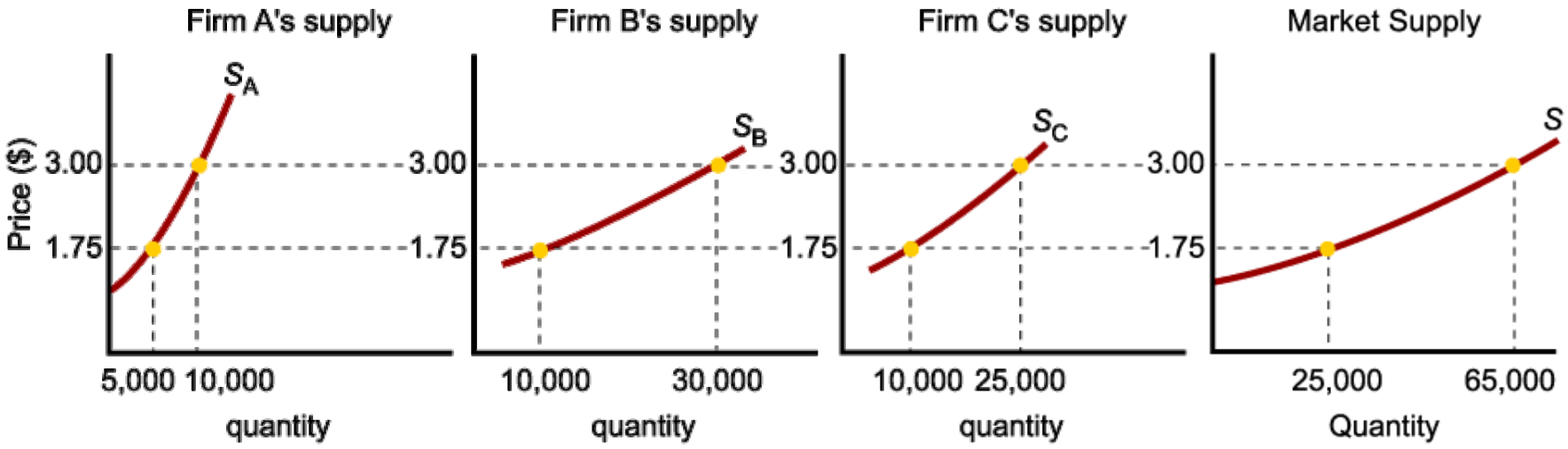
From Individual Supply to Market Supply

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

As with market demand, ***market supply*** is the horizontal summation of individual firms' supply curves.

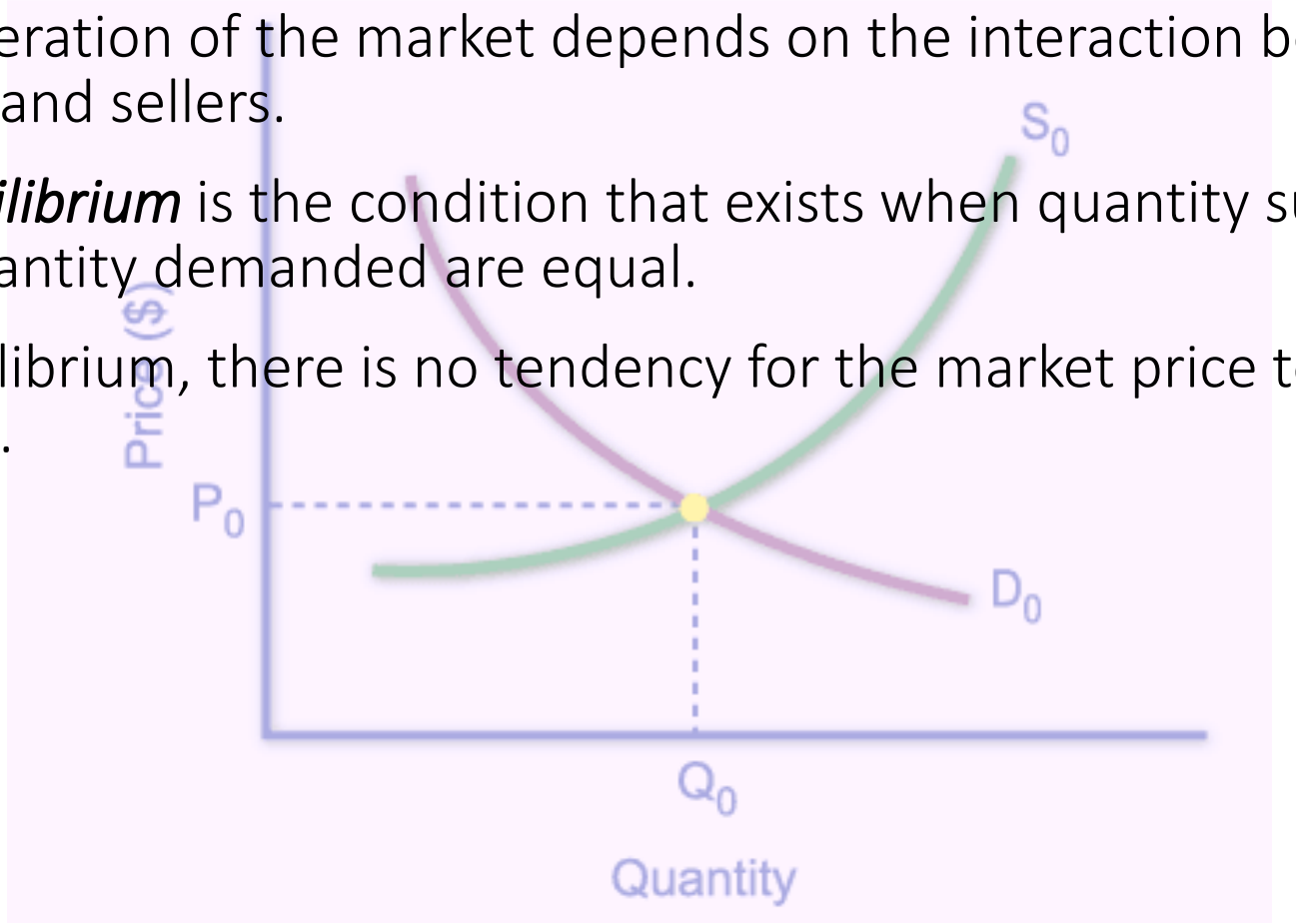


Market Equilibrium

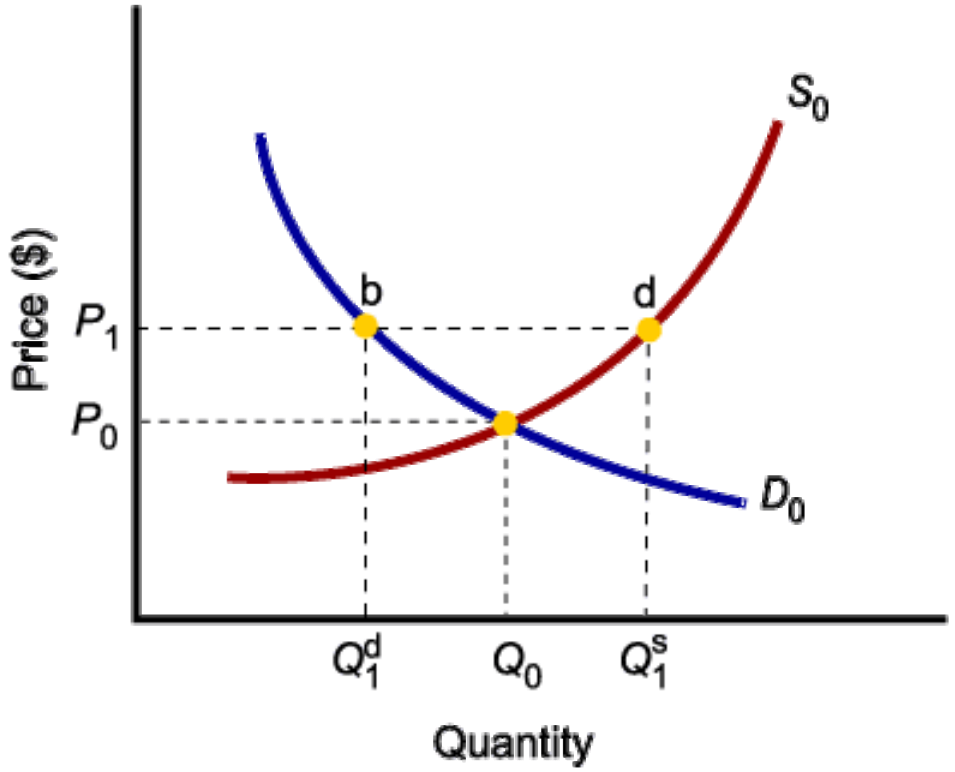
The operation of the market depends on the interaction between buyers and sellers.

An ***equilibrium*** is the condition that exists when quantity supplied and quantity demanded are equal.

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



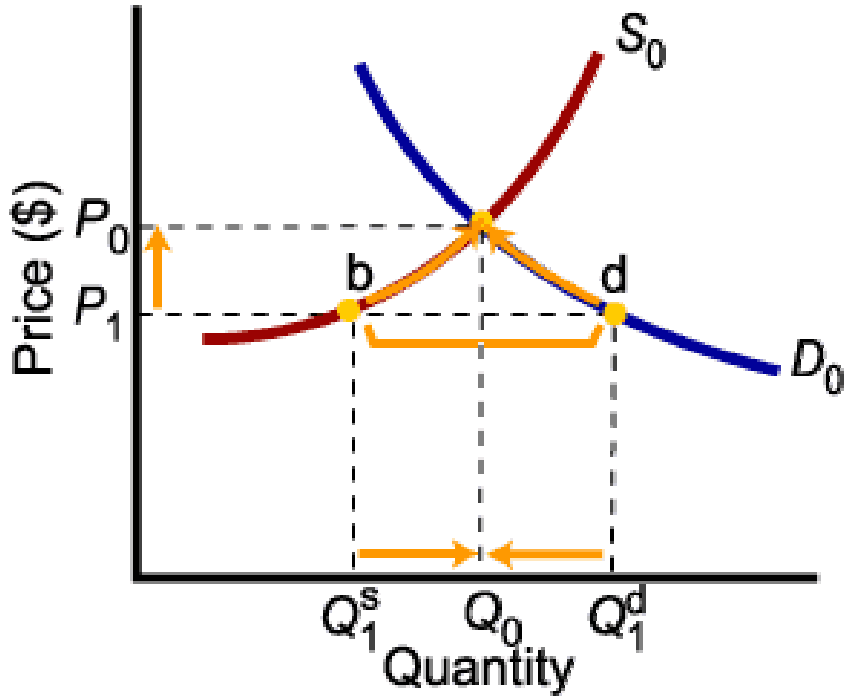
Market Equilibrium



Only in equilibrium is quantity supplied equal to quantity demanded.

- At any price level other than P_0, the wishes of buyers and sellers do not coincide.

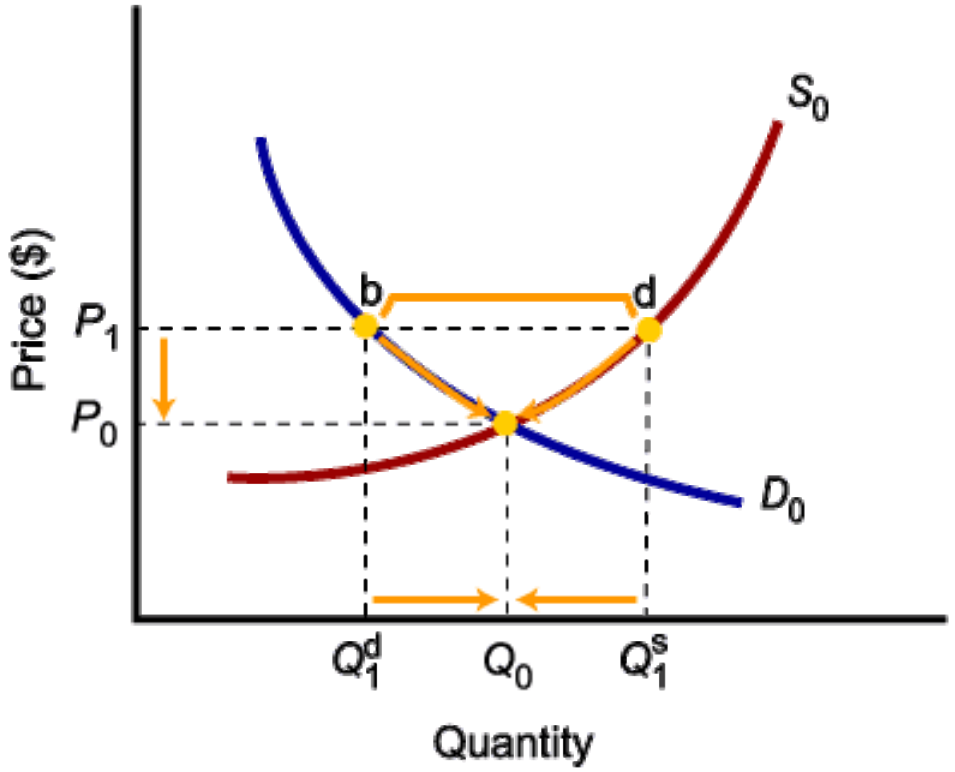
Market Disequilibria



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

- When quantity demanded exceeds quantity supplied, price tends to rise until equilibrium is restored.

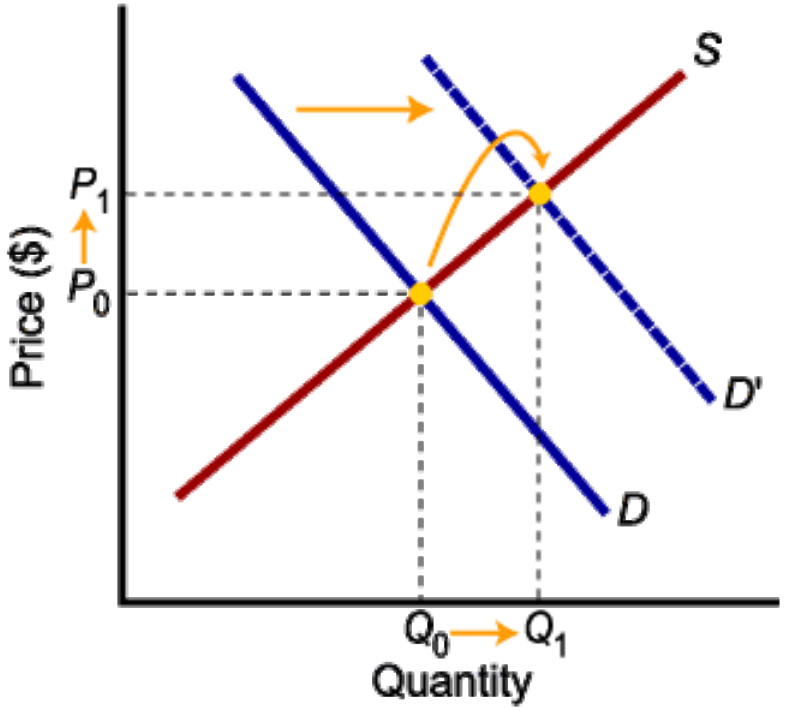
Market Disequilibria



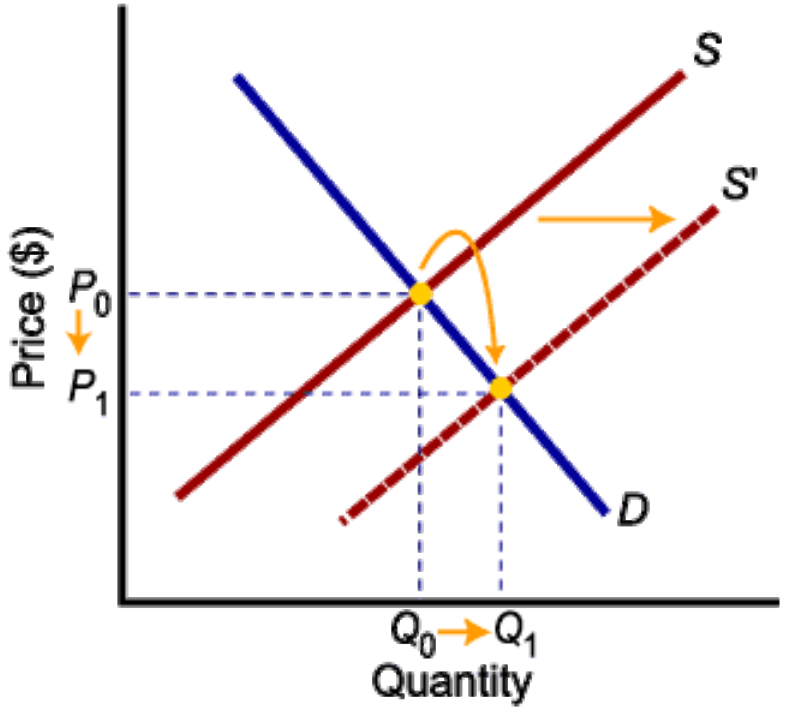
Excess supply, or surplus, is the condition that exists when quantity supplied exceeds quantity demanded at the current price.

- When quantity supplied exceeds quantity demanded, price tends to fall until equilibrium is restored.

Increases in Demand and Supply

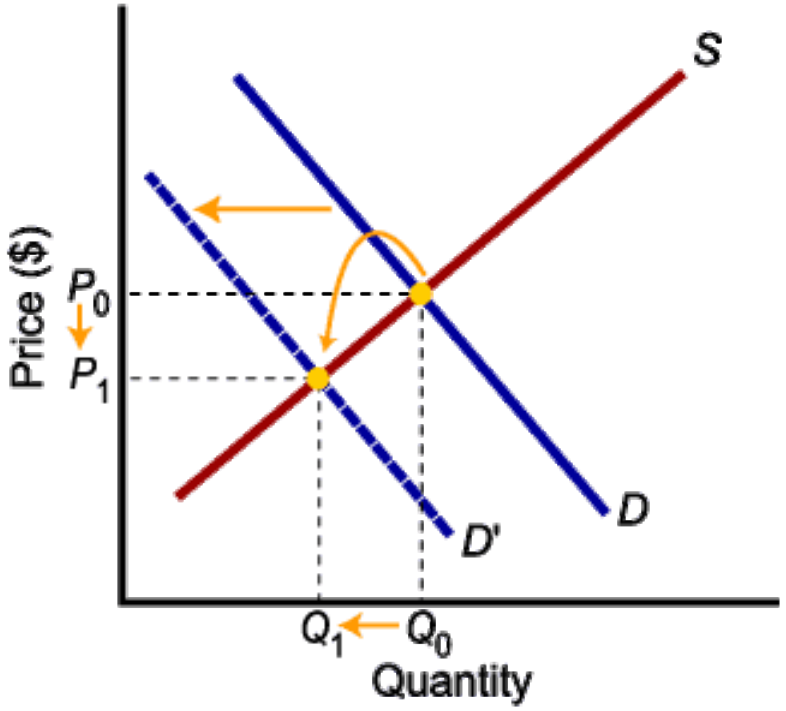


Higher demand leads to higher equilibrium price and higher equilibrium quantity.

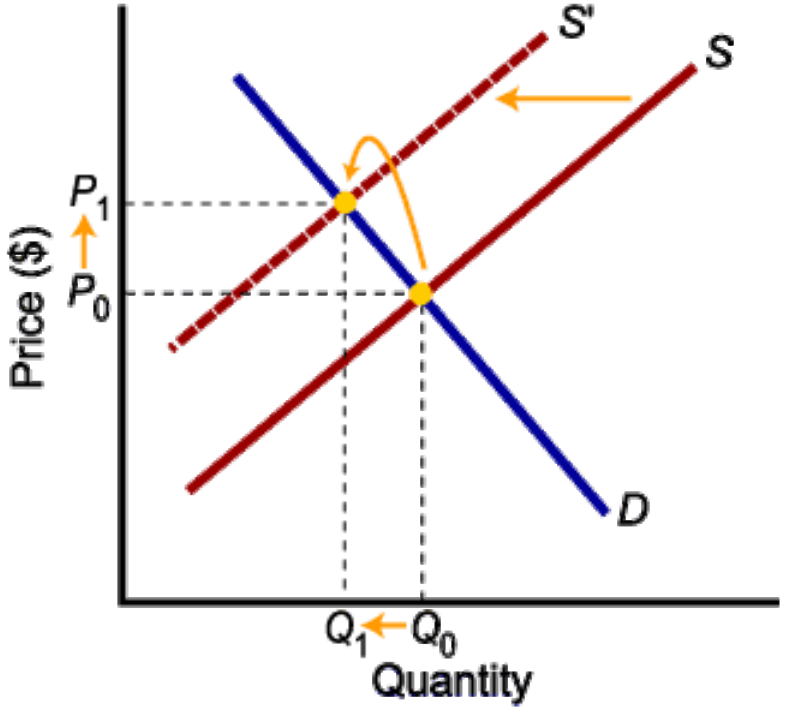


Higher supply leads to lower equilibrium price and higher equilibrium quantity.

Decreases in Demand and Supply



Lower demand leads to lower price and lower quantity exchanged.



Lower supply leads to higher price and lower quantity exchanged.