MANAGERIAL ECONOMICS AND FINANCIAL ANALYSIS

Online Lecture Series

Topic: Demand Forecasting

Lecture-08

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Impact of Inflation during decades

IN 2020 =$2.62

Dominant sectors of economy

PRODUCTION & SERVICE

What is Forecasting?

- **Process of predicting a future event**
- **Underlying basis of all business decisions**
  - **Production**
  - **Inventory**
  - **Personnel**
  - **Facilities**

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

Forecasting analysis

SO WHAT IS DEMAND FORECASTING ???

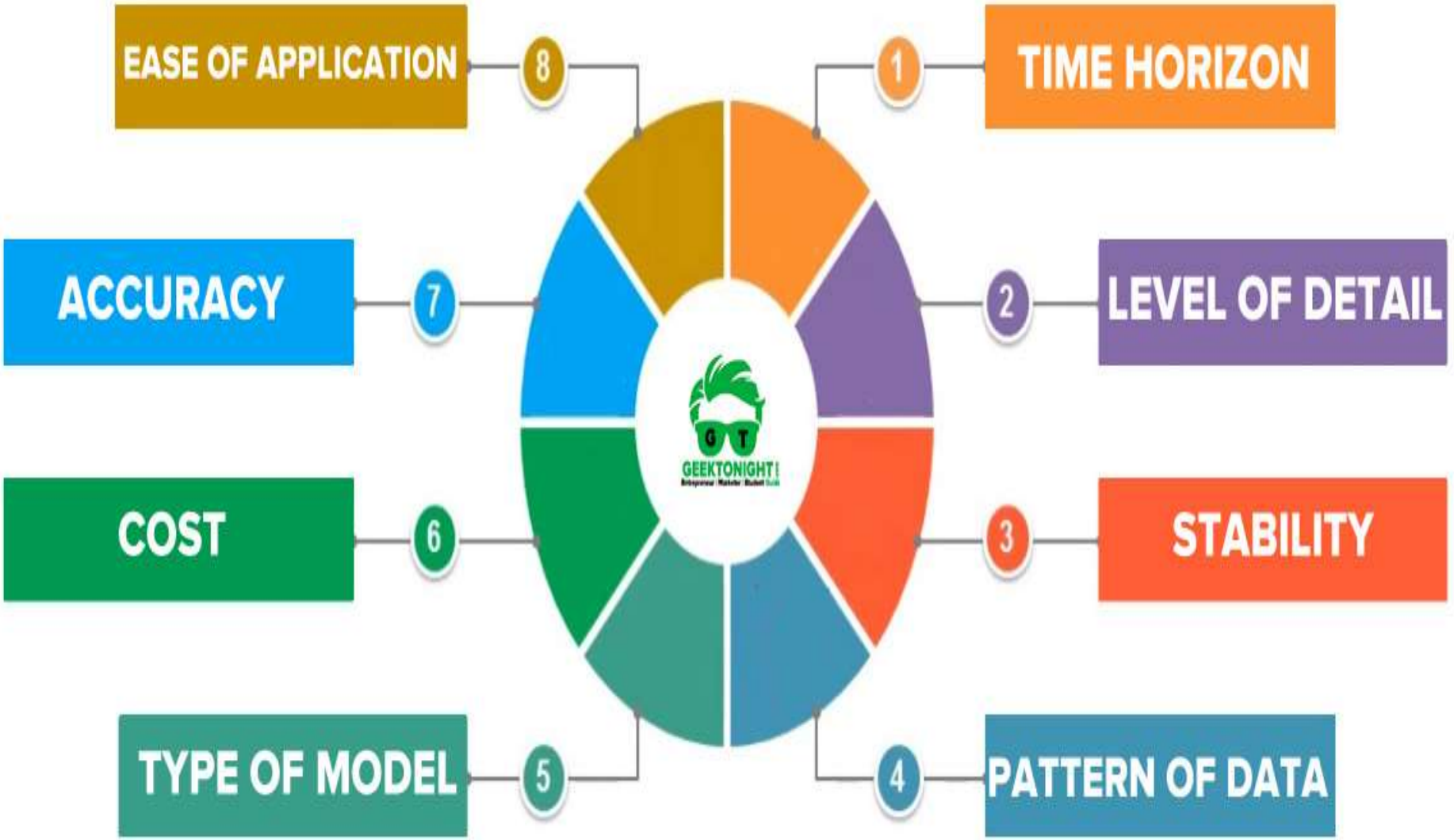
Definition of Demand Forecasting

According to Cundiff and Still, "Demand forecasting is an estimation of sales during a specified future period based on proposed marketing plan and a set of particular uncontrollable and competitive forces".

MEANING

- A forecast is a guess or anticipation or a prediction about any event which is likely to happen in the future.
- For example : An individual may forecast his job prospects, a consumer may forecast an increase in his income and therefore purchases, similarly a firm may forecast the sales of its product.
- *Demand Forecasting means predicting or estimating the future demand for a firm's product or products .*
- Important aid in effective and efficient planning
- It is backbone of any business

Forecasting areas, techniques and tools



Components of Demand

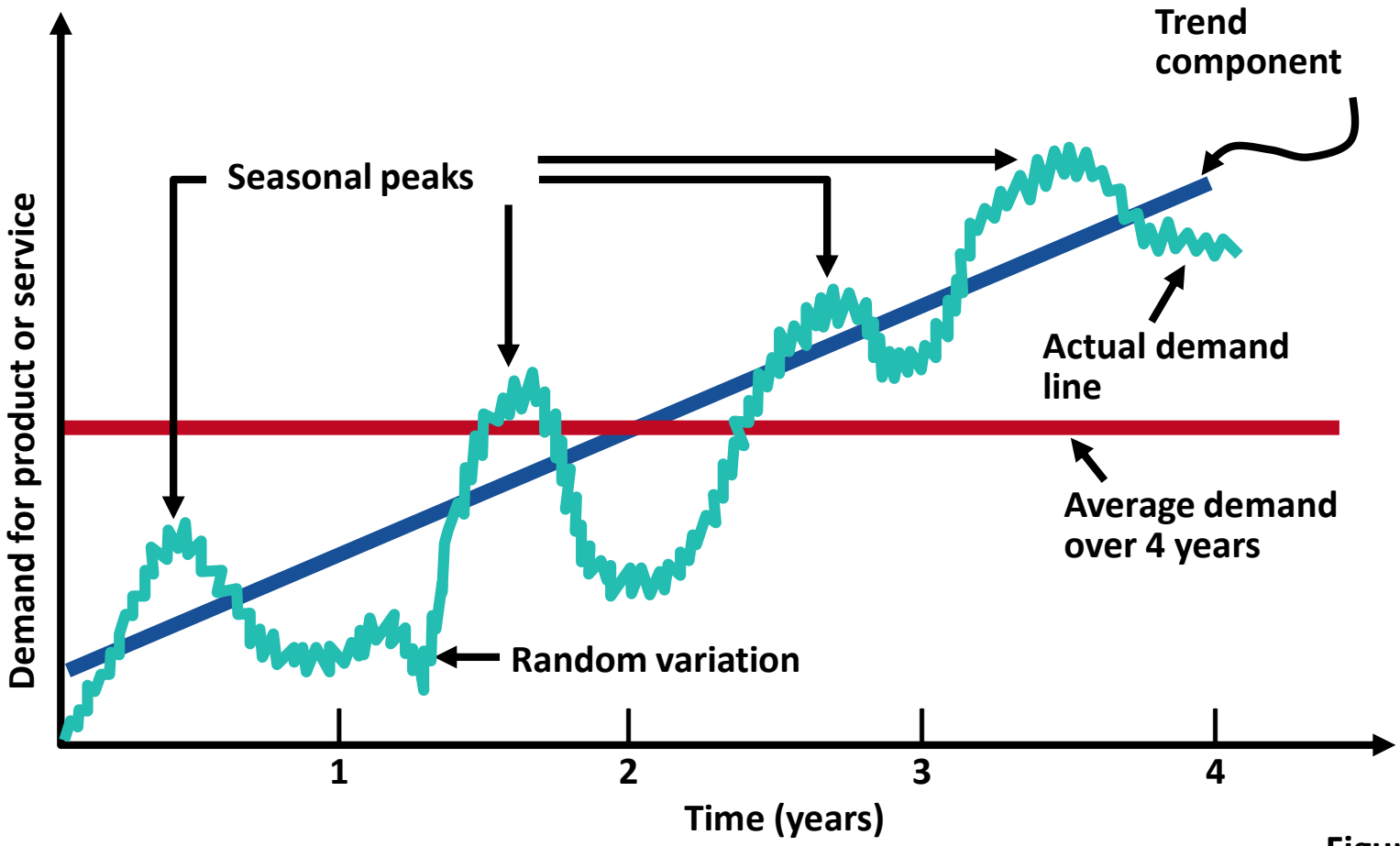
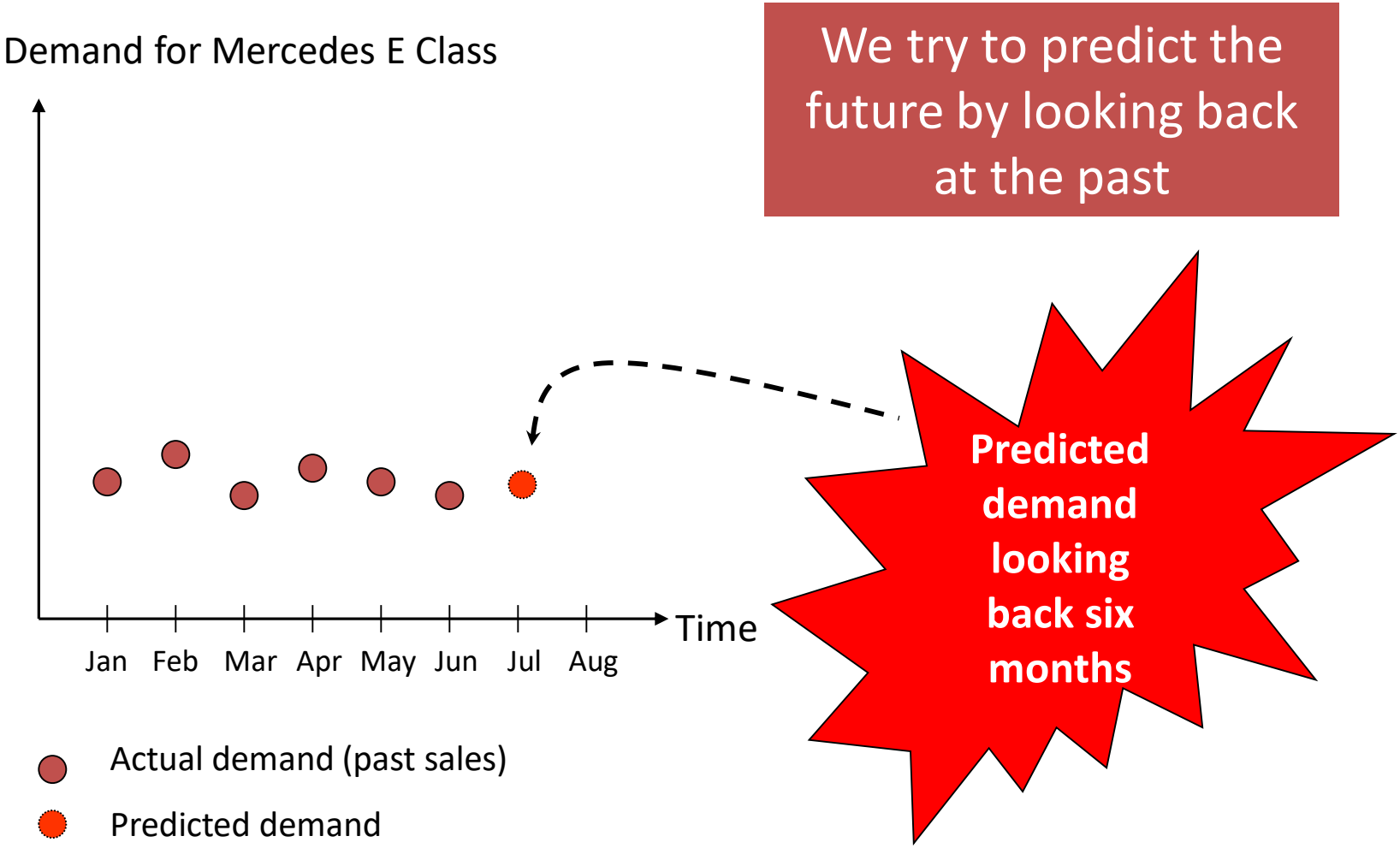


Figure 4.1

What is forecasting all about?



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

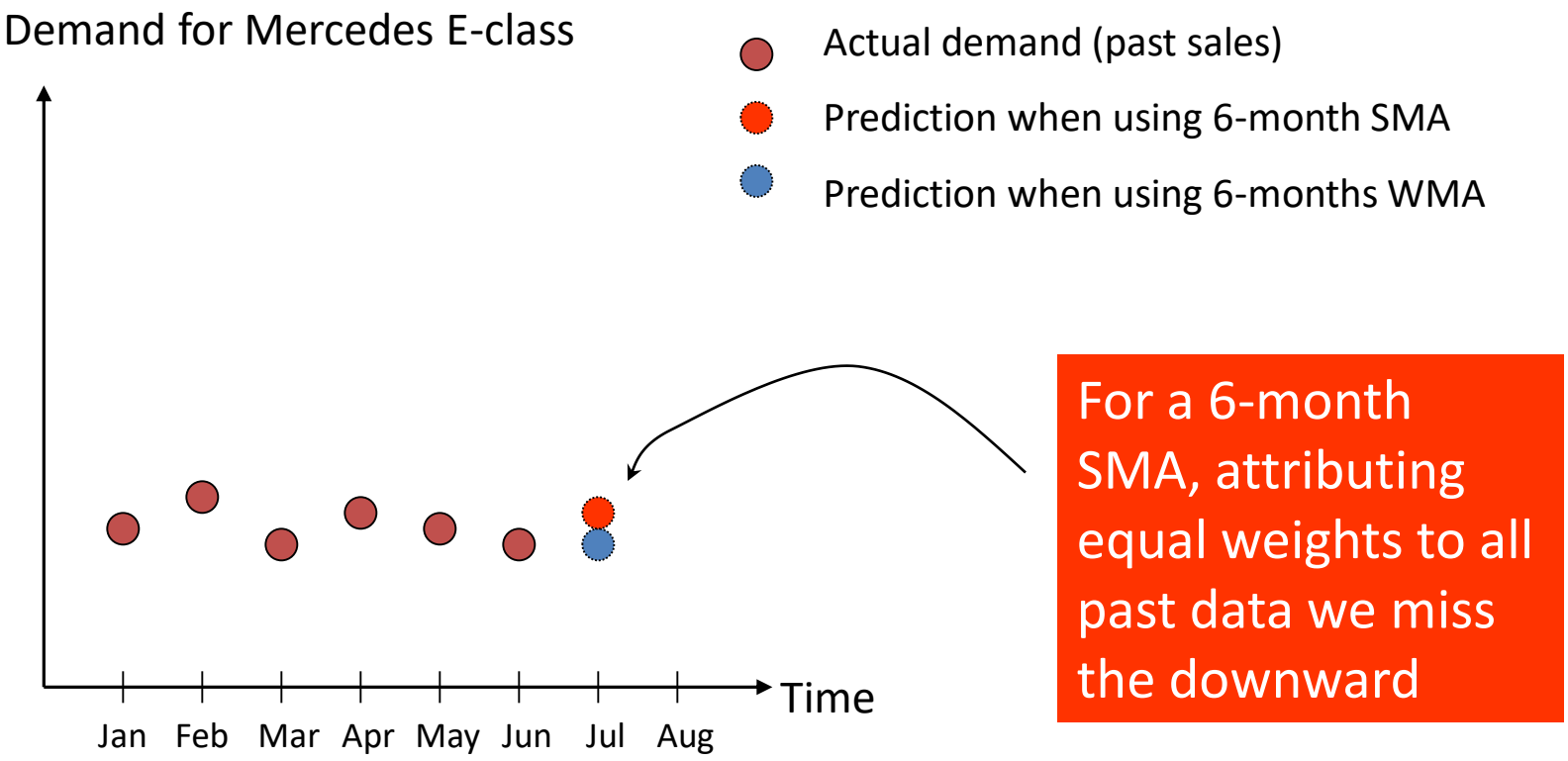
Month	E-class Sales	M-class Sales
Jan	*23,345*	-
Feb	*22,034*	-
Mar	*21,453*	-
Apr	*24,897*	-
May	*23,561*	-
Jun	*22,684*	-
Jul	*?*	*?*

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

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

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)

REMEMBER: 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…

Some Important Questions

- What is the purpose of the forecast?
- Which systems will use the forecast?
- How important is the past in estimating the future?

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

USES OF DEMAND FORECASTING

IN SHORT-RUN

- Production planning.
- Helps to formulate right purchase policy.
- Help to frame realistic pricing policy.
- Helps in estimating short-run financial requirements.
- Helps to evolve a suitable labor policy.

NEED AND SIGNIFICANCE

- It is necessary to forecast demand in buisness because :

1. **Effective planning** : provides scientific and reliable basis for anticipating future operations
2. **Reduction of uncertainty** : aims at reducing the area of uncertainty that surrounds mangerial decision making with respect to costs , production, sales , profit etc .
3. **Investment decision** : investments are made keeping in mind the the returns and returns depend on market demand.
4. **Resource allocation** : efficient allocation of resources when future estimates are available .

5. Pricing decisions : in order to pursue optimal pricing strategies firm need to have complete information about the future demand.Two concepts arises here :

(a)Overoptimistic :these estimates may lead to an excessively high price and lost sales.

(b)Overpessimistic : these estimates of demand may lead to a price which is set too low resulting in losses.

6.Competitve strategy : the level of demand for a product will influence decisions , which the firm will take regarding the non-price factors .

7. Managerial control : forecasting disclose the areas where control is lacking . It is must in order to control costs of production .


Factors Affecting Demand Forecasting
Price of Goods
Type of Goods
Competition
Technology
Economic Perspective

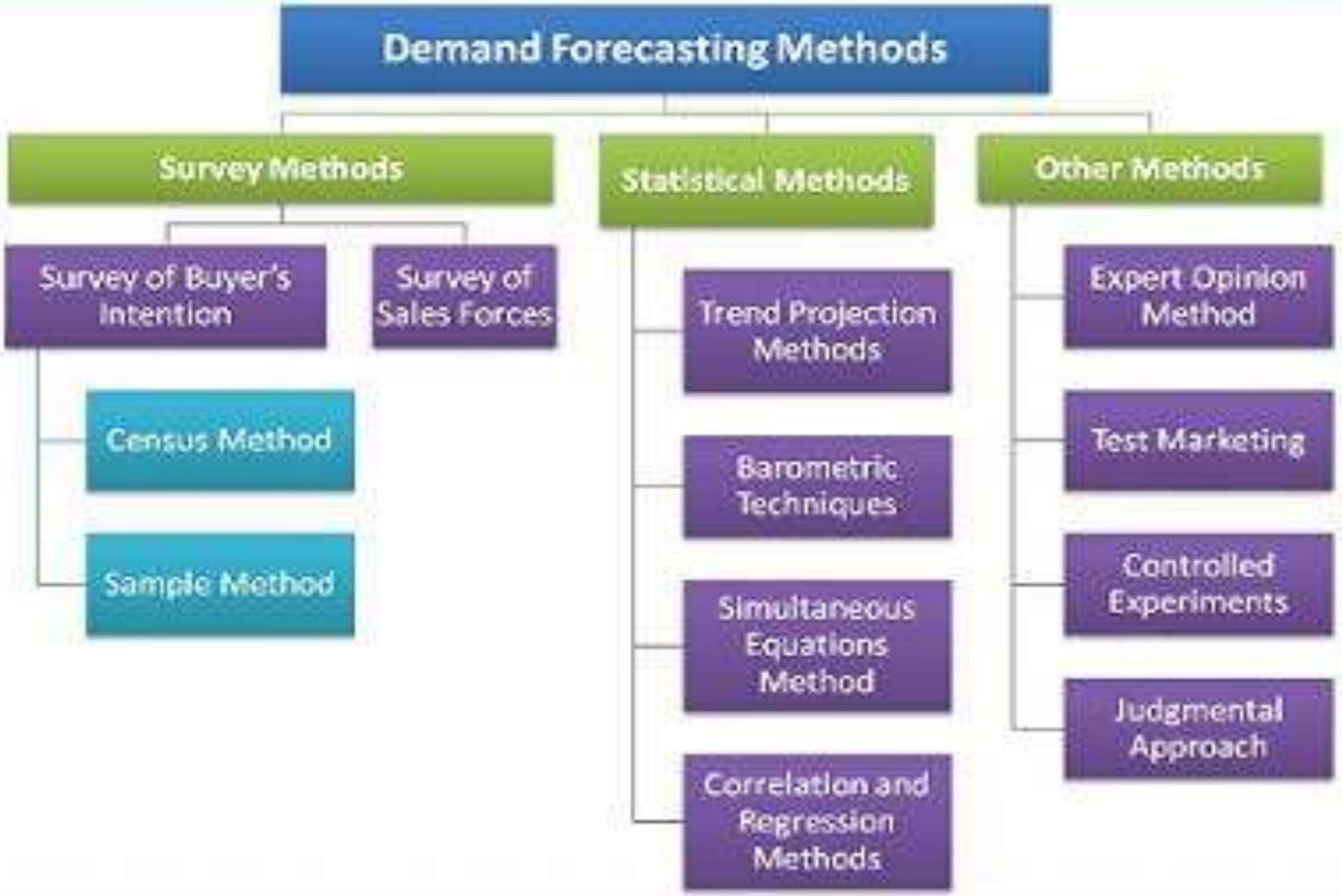
How should we pick our forecasting model?

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

SO ,WE KNOW WHAT IT'S ALL ABOUT!!!

NOW LETS ANALYSE THE METHODS OF DEMAND FORECASTING.

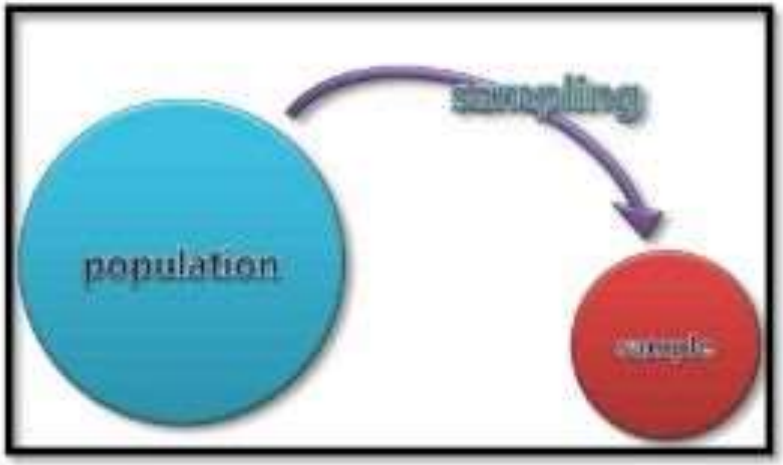
Methods of Demand Forecasting

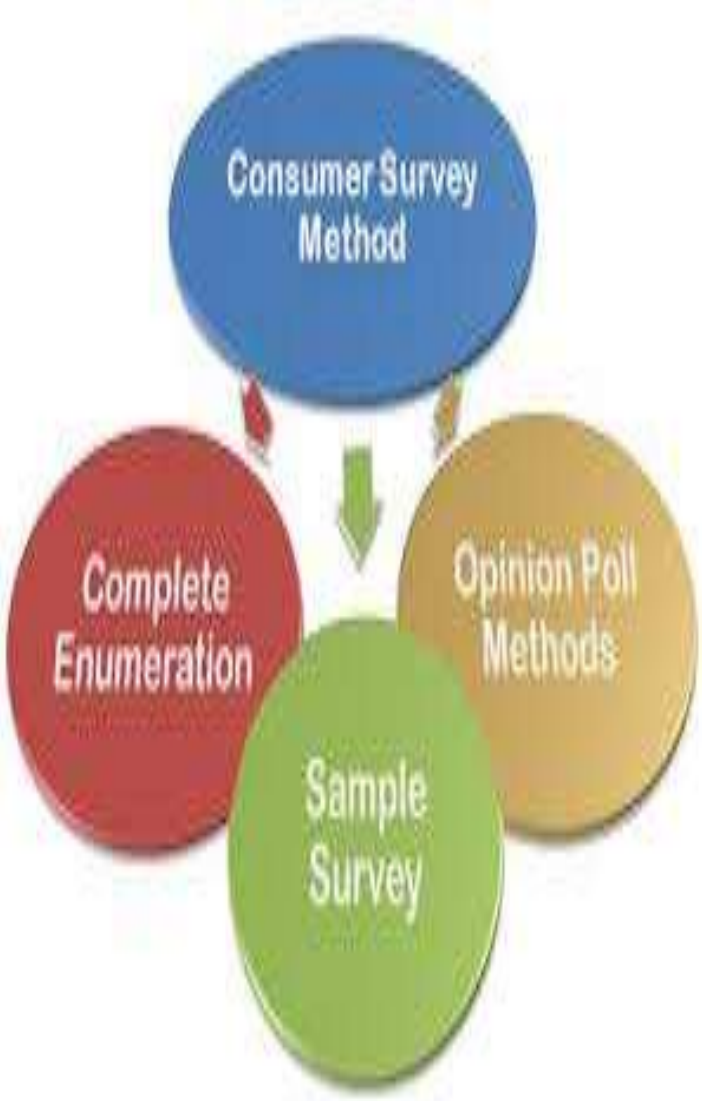


DEMAND FORECASTING TECHNIQUES

Survey Method:

- Census method
- Sample Method





Survey Methods

1. **Survey of Buyer's Intention :** the consumers are contacted personally to disclose their future purchase plans.

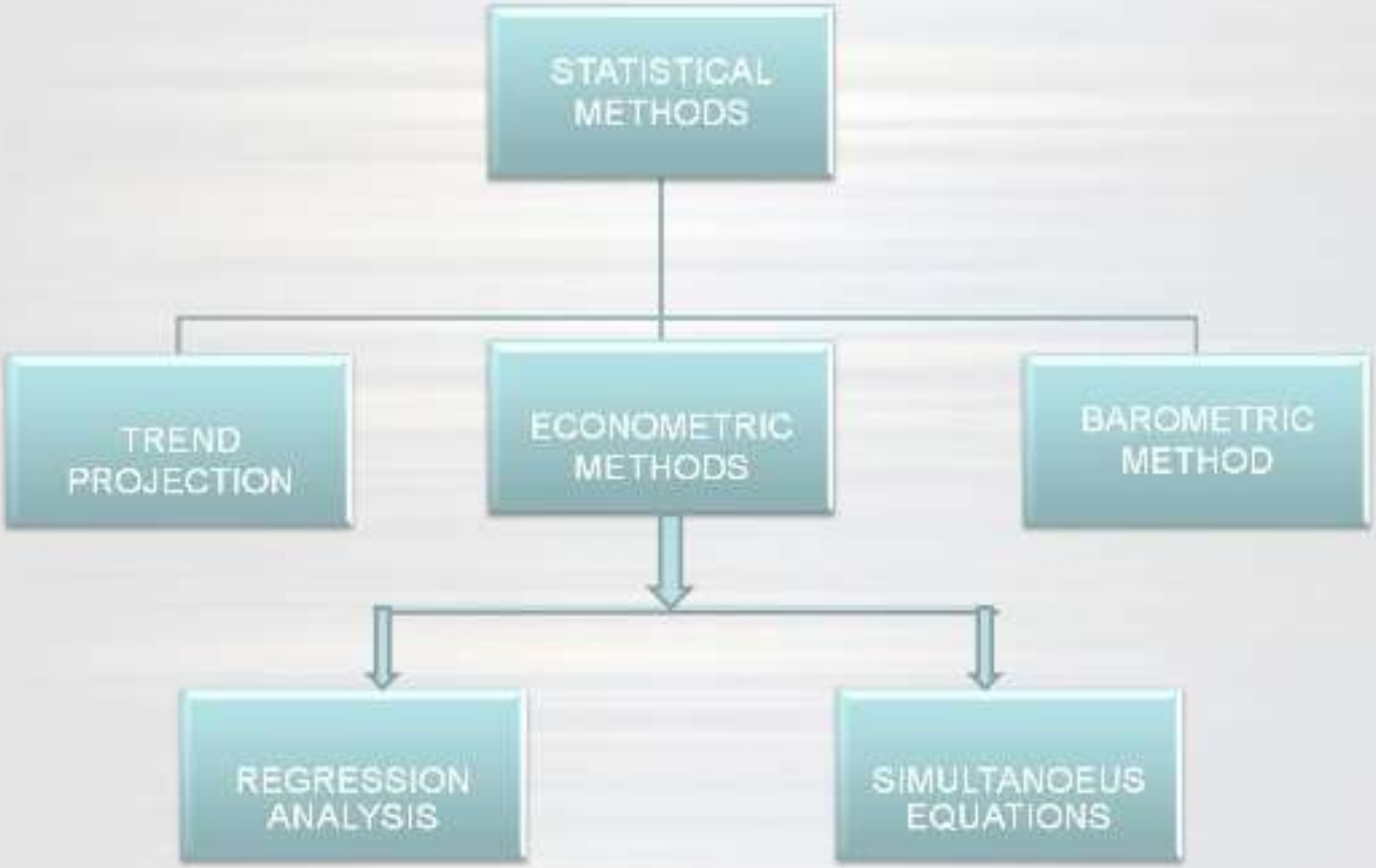
   A. **Census Method**: All consumers are contacted to know their preferences for the products in future.

   B. **Sample Method:** method a sample of consumers is selected for interview.

2. **Survey of Sales Forces :** The company elicits the opinion of its sales force regarding the future demand for the product given an outline of its features and prices

   ✓ *Collective Opinion Techniques*

   ✓ *Delphi Techniques*


STATISTICAL METHODS
TREND PROJECTION
ECONOMETRIC METHODS
BAROMETRIC METHOD
REGRESSION ANALYSIS
SIMULTANOEUS EQUATIONS

a) Trend Projection Method :

- This method is used when a detailed estimate has to be made.
- Time plays a n important role in this method .
- This method uses historical and cross –sectional data for estimating demand

This technique assumes that whatever has been the pattern of demand in the past, will continue to hold good in the future as well.

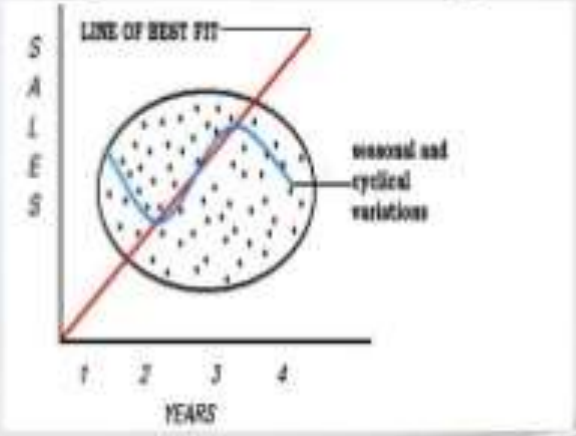
- In this method data is arranged chronologically which yields a ‘time series’.
- The time series represent the past pattern of effective demand for a particular product and is used to project the trend of the time series.
- To do so there are two methods :

a. Graphical method

b. Least Square method

Graphical method :

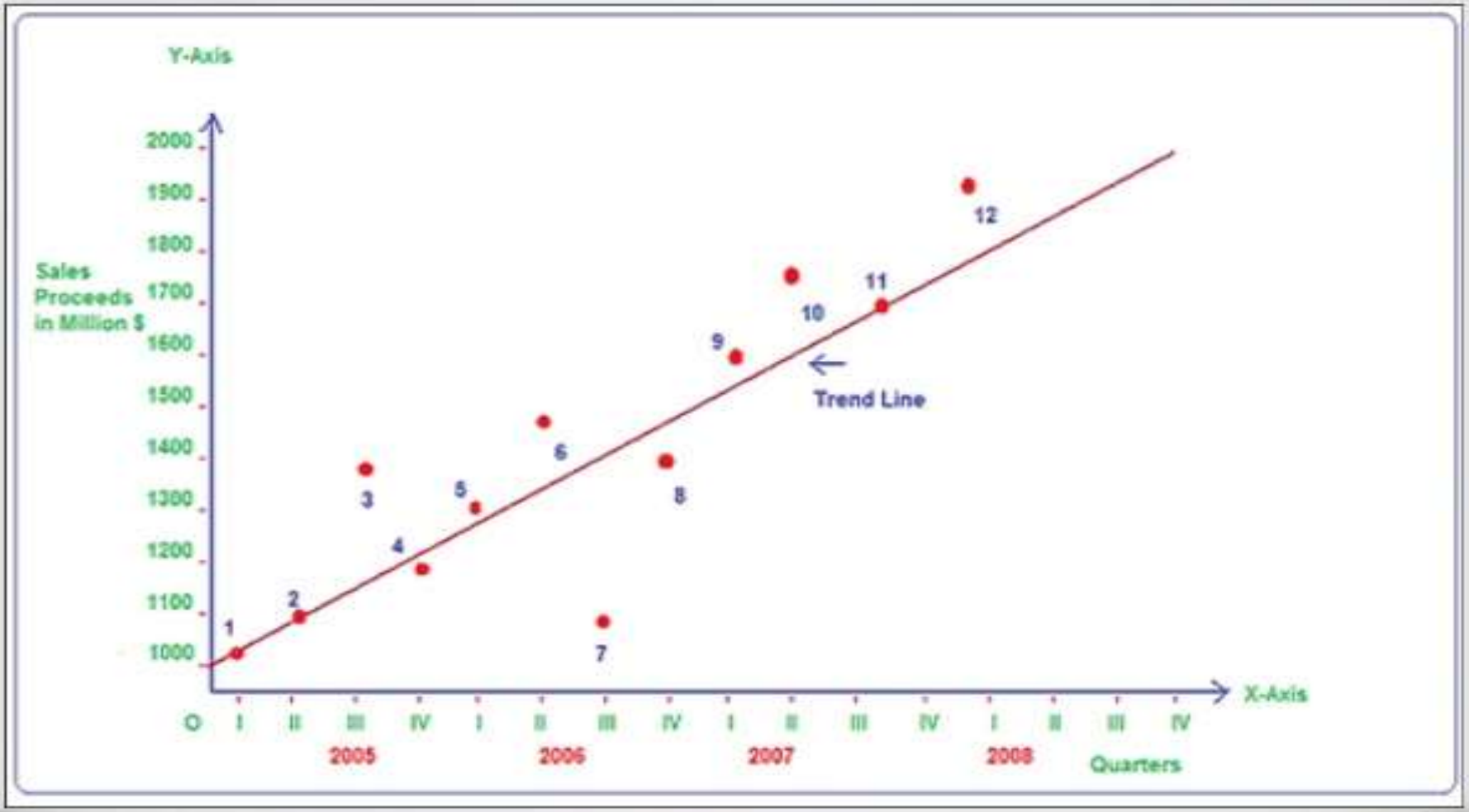
- A trend line can be fitted through a series graphically .
- Old values of sale for different areas are plotted on graph and a free hand curve is drawn passing through as many points as possible .
- Based on trend equation, we find 'Line of Best Fit' and then it is projected in a scatter diagram,dividing points equally on both sides



Least Square Method :

- It is a mathematical procedure for fitting a line to a set of observed data points in a manner that the sum of the squared differences between the calculated and observed value is minimised.
- The linear trend is the most widely used mode of time series analysis.

Graphical representation of trend line



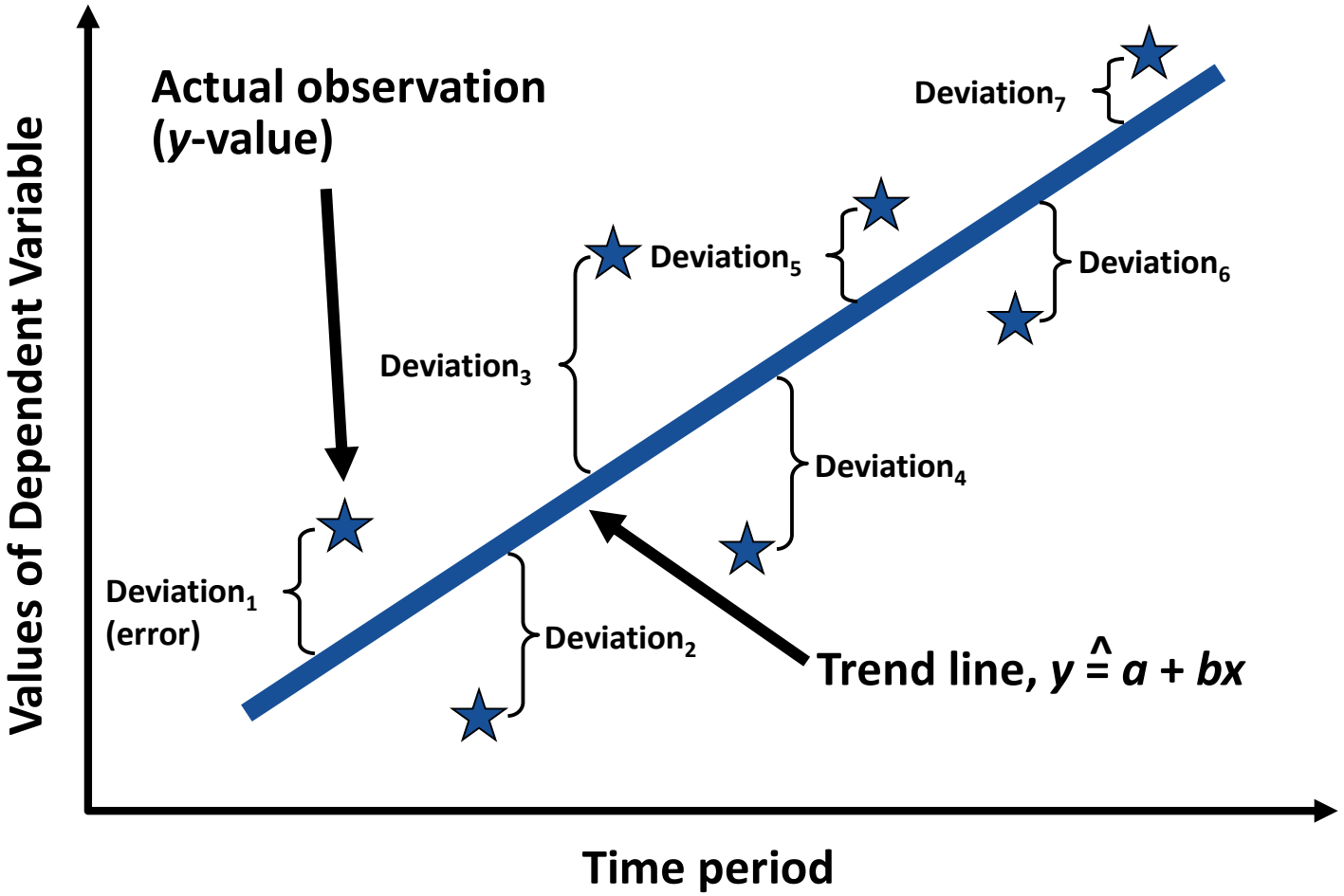
It is represented: $Y = a + b x$

- Y=Demand
- X= Time Period
- a & b are constants .
- For calculation of Y for any value of X requires the values of a & b .These are calculated using :

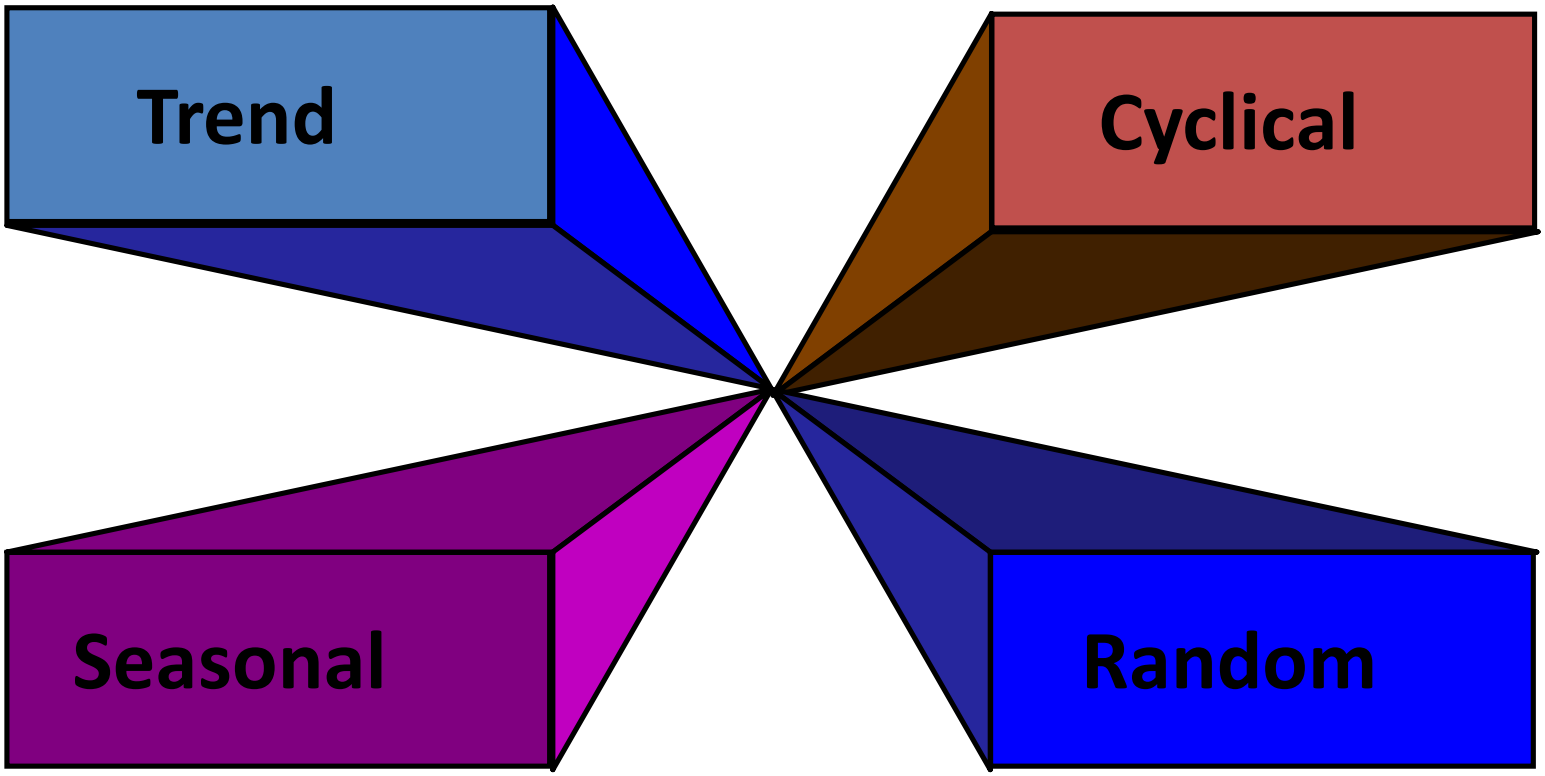
$$\sum Y = na + b\sum X$$

$$\sum XY = a\sum X + b\sum X^2$$

Least Squares Method



Time Series Components

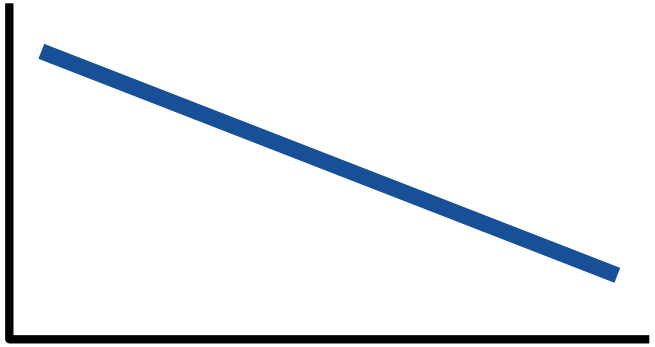


Time Series Forecasting

- Set of evenly spaced numerical data
  - Obtained by observing response variable at regular time periods
- Forecast based only on past values, no other variables important
  - Assumes that factors influencing past and present will continue influence in future

Trend Component

- Persistent, overall upward or downward pattern
- Changes due to population, technology, age, culture, etc.
- Typically several years duration
- Combination of cyclical trend, seasonal trend and erratic trend



Seasonal Variations In Data

The multiplicative seasonal model can adjust trend data for seasonal variations in demand (jet skis, snow mobiles)

Seasonal Variations In Data

Steps in the process:

1. Find average historical demand for each season
2. Compute the average demand over all seasons
3. Compute a seasonal index for each season
4. Estimate next year's total demand
5. Divide this estimate of total demand by the number of seasons, then multiply it by the seasonal index for that season

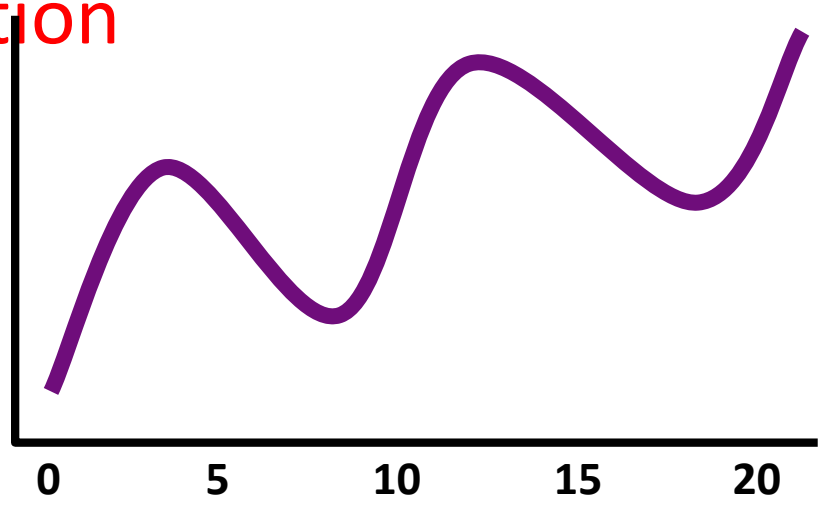
Seasonal Component

- Regular pattern of up and down fluctuations
- Due to weather, customs, holidays etc.
- Occurs within a single year

Period	Length	Number of Seasons
Week	Day	7
Month	Week	4-4.5
Month	Day	28-31
Year	Quarter	4
Year	Month	12
Year	Week	52

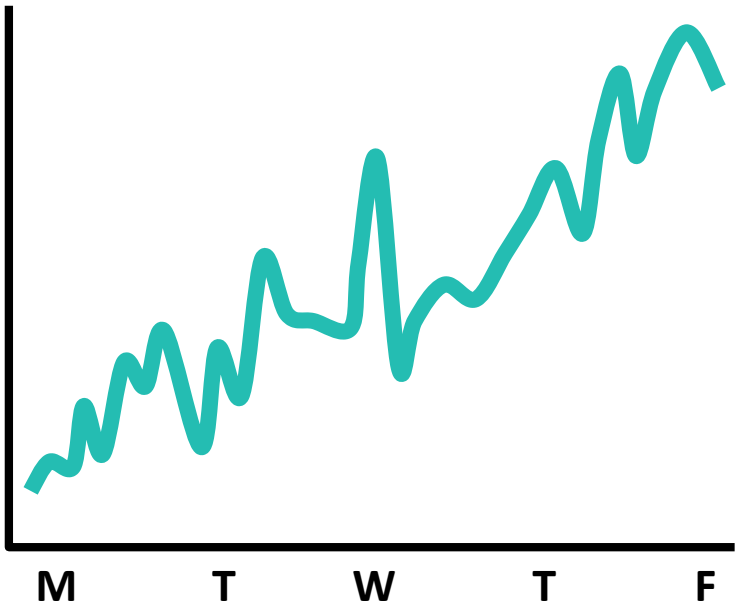
Cyclical Component

- Repeating up and down movements of inflation and recession
- Affected by business cycle, political, and economic factors
- Multiple years duration



Random Component

- Erratic, unsystematic, 'residual' fluctuations
- Due to random variation or unforeseen events
- Short duration and nonrepeating



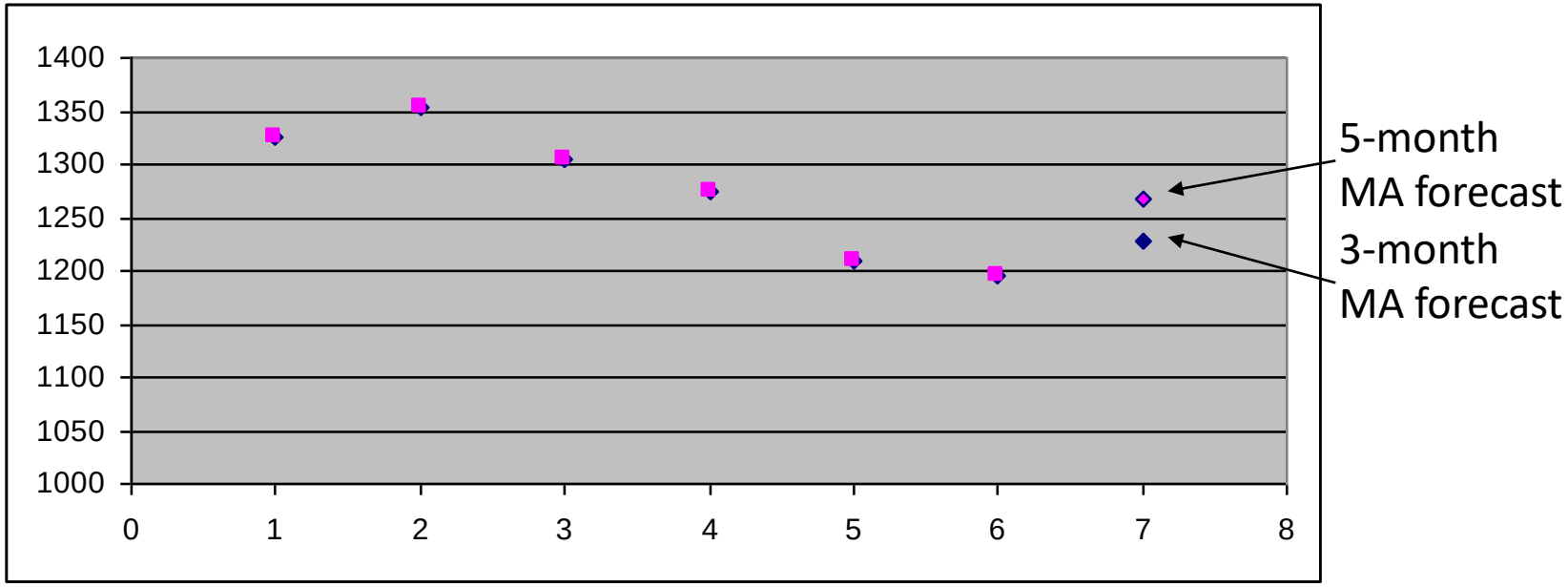
Moving average method

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?

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



What do we observe?

5-month average smoothes data more;
3-month average more responsive

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…

Exponential Smoothing

- Form of weighted moving average
  - Weights decline exponentially
  - Most recent data weighted most
- Requires smoothing constant (α)
  - Ranges from 0 to 1
  - Subjectively chosen
- Involves little record keeping of past data

Exponential Smoothing

New forecast = Last period's forecast
+ α (Last period's actual demand
– Last period's forecast)

$$F_t = F_{t-1} + \alpha(A_{t-1} - F_{t-1})$$

where

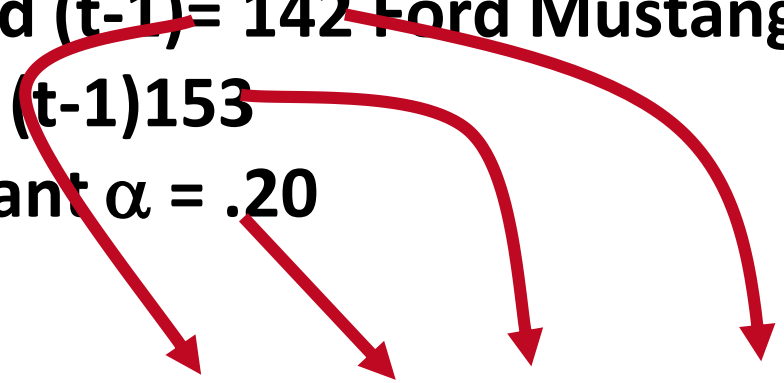
- F_t = **new forecast**
- F_{t-1} = **previous forecast**
- α = **smoothing (or weighting) constant ($0 \leq \alpha \leq 1$)**

Exponential Smoothing Example

Predicted demand(t-1) = 142 Ford Mustangs
Actual demand (t-1)= 153
Smoothing constant α = .20

Exponential Smoothing Example

Predicted demand (t-1)= 142 Ford Mustangs
Actual demand = (t-1)153
Smoothing constant α = .20



New forecast (t) = 142 + .2(153 – 142)

Exponential Smoothing Example

Predicted demand = 142 Ford Mustangs
Actual demand = 153
Smoothing constant α = .20

New forecast = 142 + .2(153 – 142)

= 142 + 2.2

= 144.2 ≈ 144 cars

Why use exponential smoothing?

1. Uses less storage space for data
2. Extremely accurate
3. Easy to understand
4. Little calculation complexity
5. There are simple accuracy tests

Example: forecasting sales at Kroger

Kroger sells (among other stuff) bottled spring 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 weighted moving average?

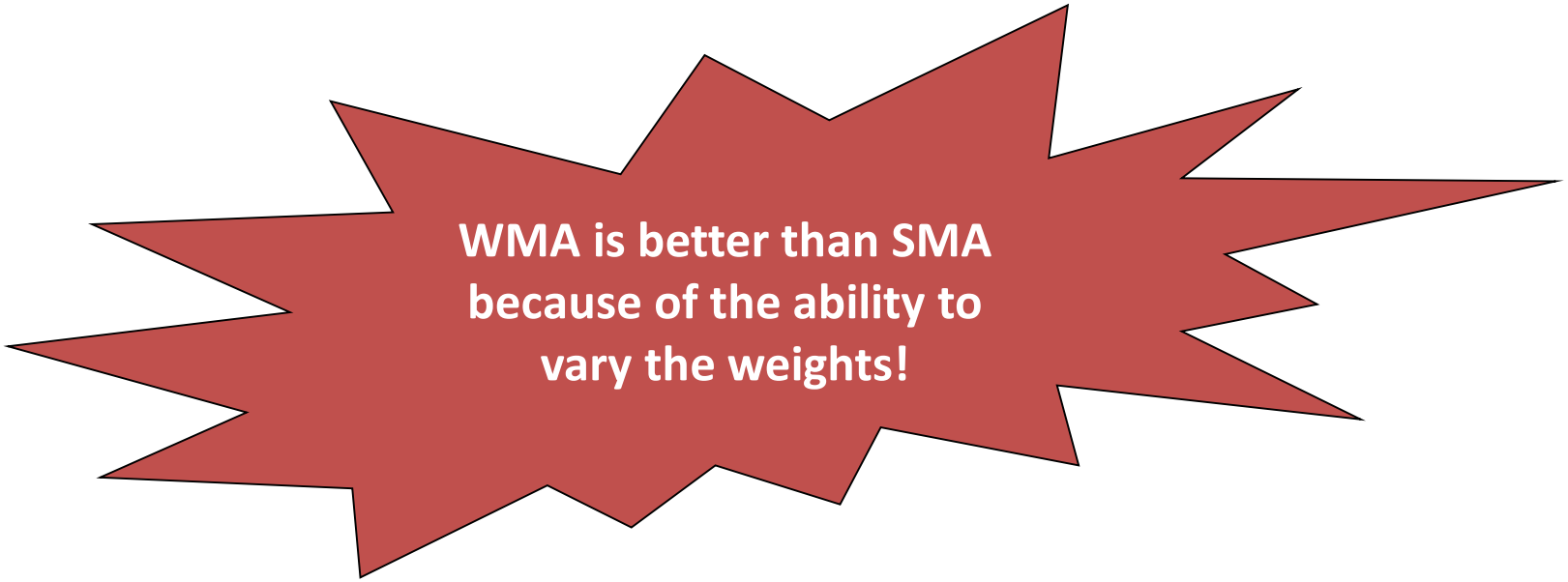
Make the weights for the last three months more than the first three months…

	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).



6) Barometric Method :

- Method uses business barometers or indicators of various economic phenomena.
- The term Barometer is used to indicate the economic phenomena.
- The assumption behind this is that the past pattern tend to repeat themselves in future and future can be predicted with the help of certain happenings of the present.
- *Forecasting Techniques that **use the lead and lag relationship between Economic variable** for predicting the directional changes in the concerned variables are known as Barometric Techniques.*

- Some of the important indicators are :

  a. Employment

  b. Wholesale prices

  c. Industrial production

  d. Gross national product

- **Example :** The bhuj earthquake in January 2001, led to a massive destruction of Property and buildings in Gujrat. This necessitated constructions of building. The construction was followed by a spurt in demand for cement, fans, Tube lights etc. Thus one can say, that the construction of buildings leads to the demand for cement.
- In this case the **construction of building is the leading indicator or the barometer.**

c) Econometric methods :

- Refers to the application of mathematical economic theory and statistical procedures to economic data to establish quantitative results.
- These models are very complex in practice as they combine the knowledge of economics , mathematics and statistics.
- Employs the following two :

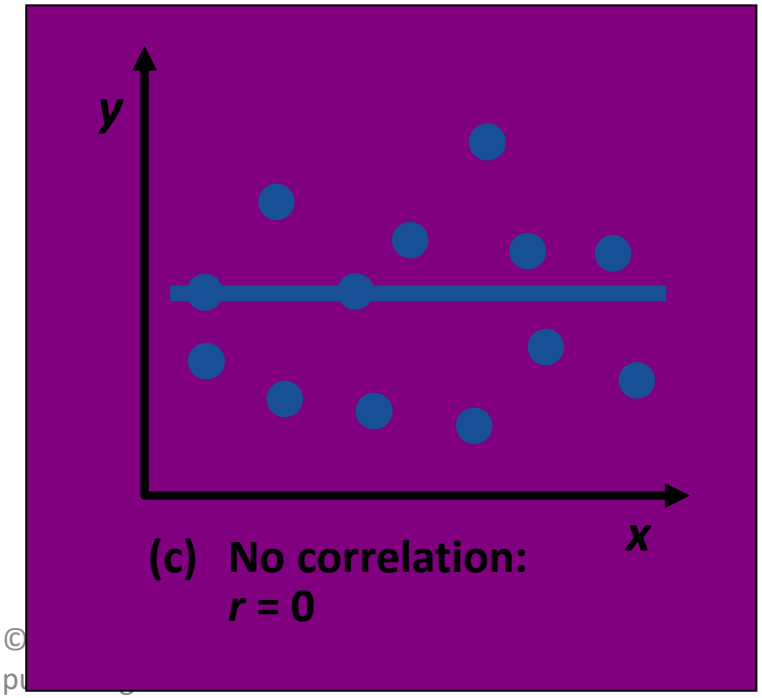
1. Regression method
2. Simultaneous Equations

Correlation

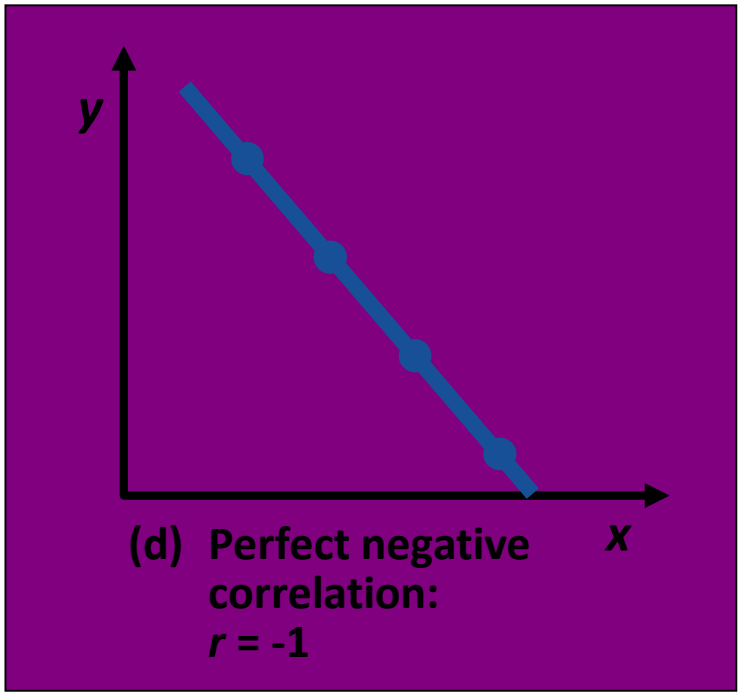
- How strong is the linear relationship between the variables?
- Correlation does not necessarily imply causality!
- Coefficient of correlation, *r*, measures degree of association
  - Values range from -1 to +1

Correlation Coefficient

$$r = \frac{n\Sigma xy - \Sigma x \Sigma y}{\sqrt{[n\Sigma x^2 - (\Sigma x)^2][n\Sigma y^2 - (\Sigma y)^2]}}$$

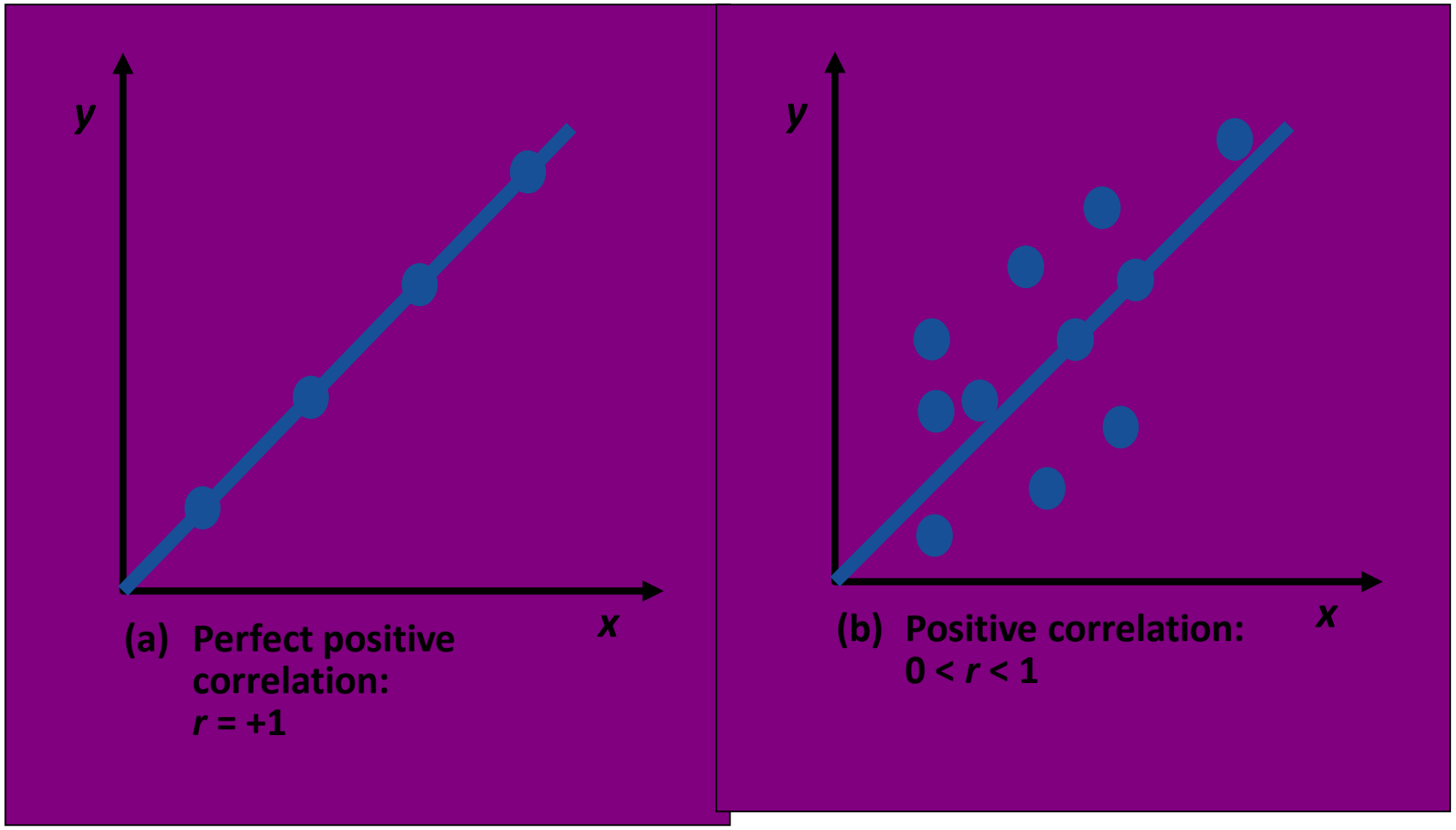


(c) No correlation:
$r = 0$



(d) Perfect negative correlation:
$r = -1$

Positive Correlation



Regression Method

This method is undertake to measure the relationship between two variables where correlation appears to exist.

Ex: The age of the air condition machine and the annual repair expenses.

Other Methods

- **Expert Opinion**
- **Test Marketing**
- **Controlled experiments**
- **Judgemental approach**

Forecasting factors

THANK YOU