SNS COLLEGE OF TECHNOLOGY

Coimbatore - 35

19BAT612– Operation Management

UNIT-2 FORECASTING

Quantitative Forecasting

Presented by

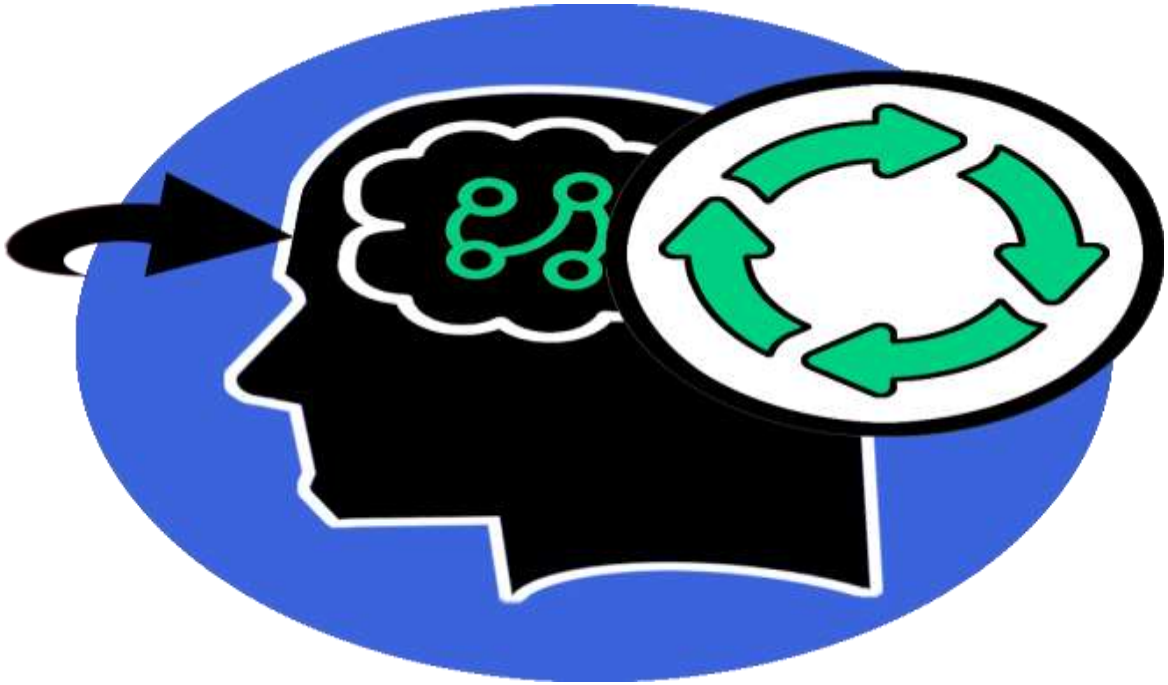
Ms. A. Hanis Sultana

Assistant Professor,

Department of Management Studies

Recall

Qualitative Forecasting



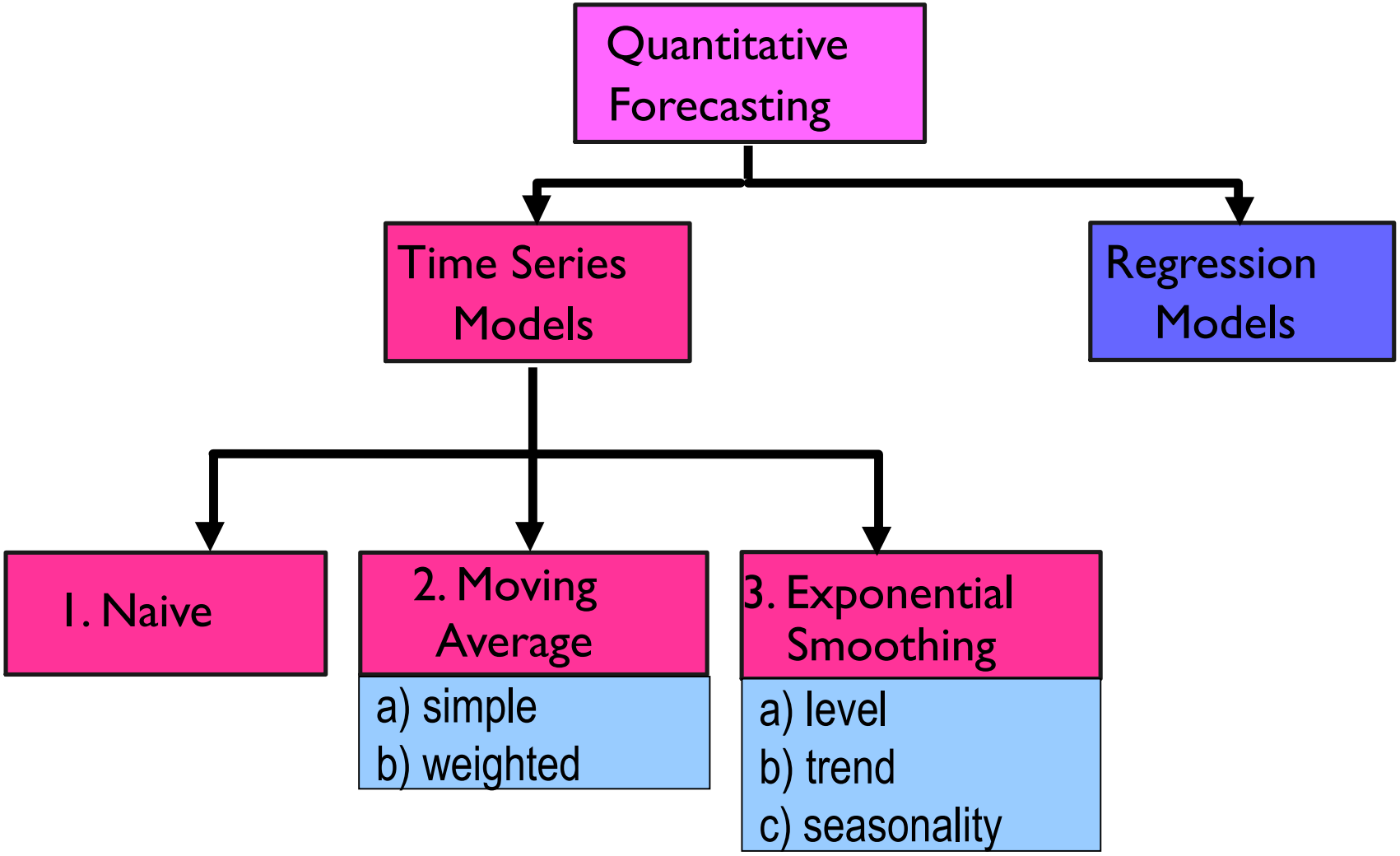
Recall

- Qualitative Forecasting
    1. Executive Judgment
    2. Market Research / Survey
    3. Sales Force composite
    4. Delphi method

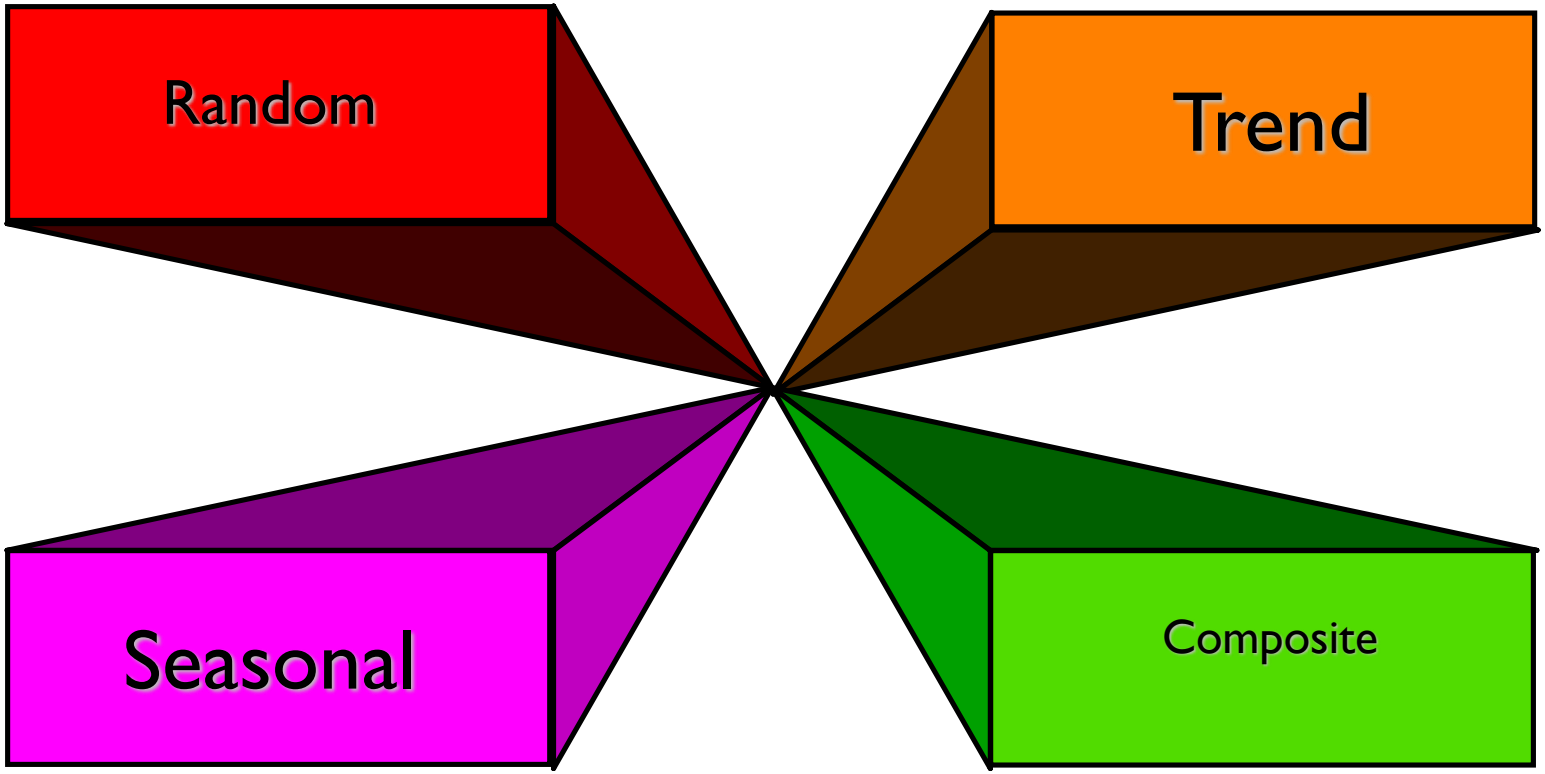

GUESS
WHAT?

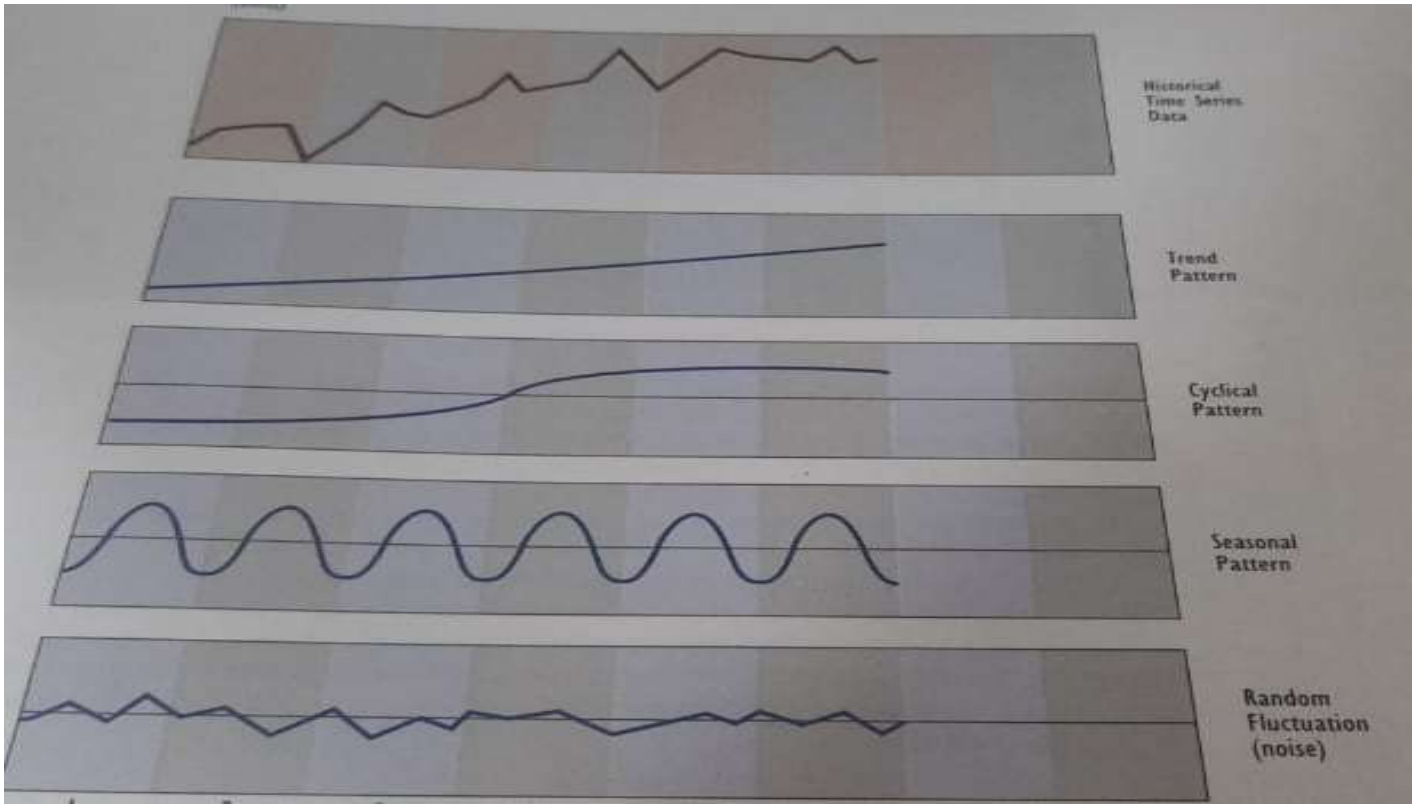

SALES FORECASTING METHODS
Quantitative forecasting
Qualitative forecasting

Quantitative Forecasting Methods

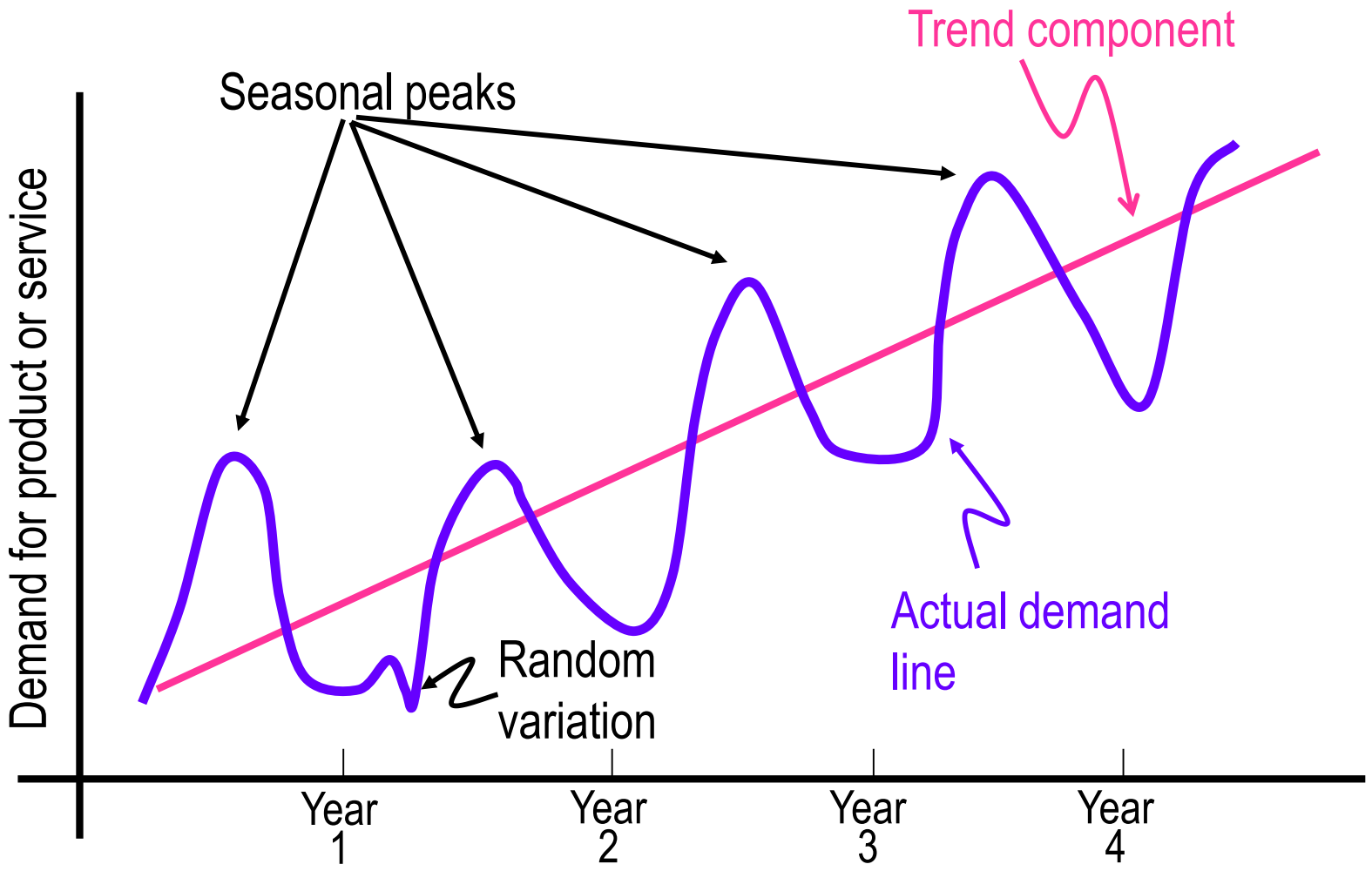


Time Series Models: Components

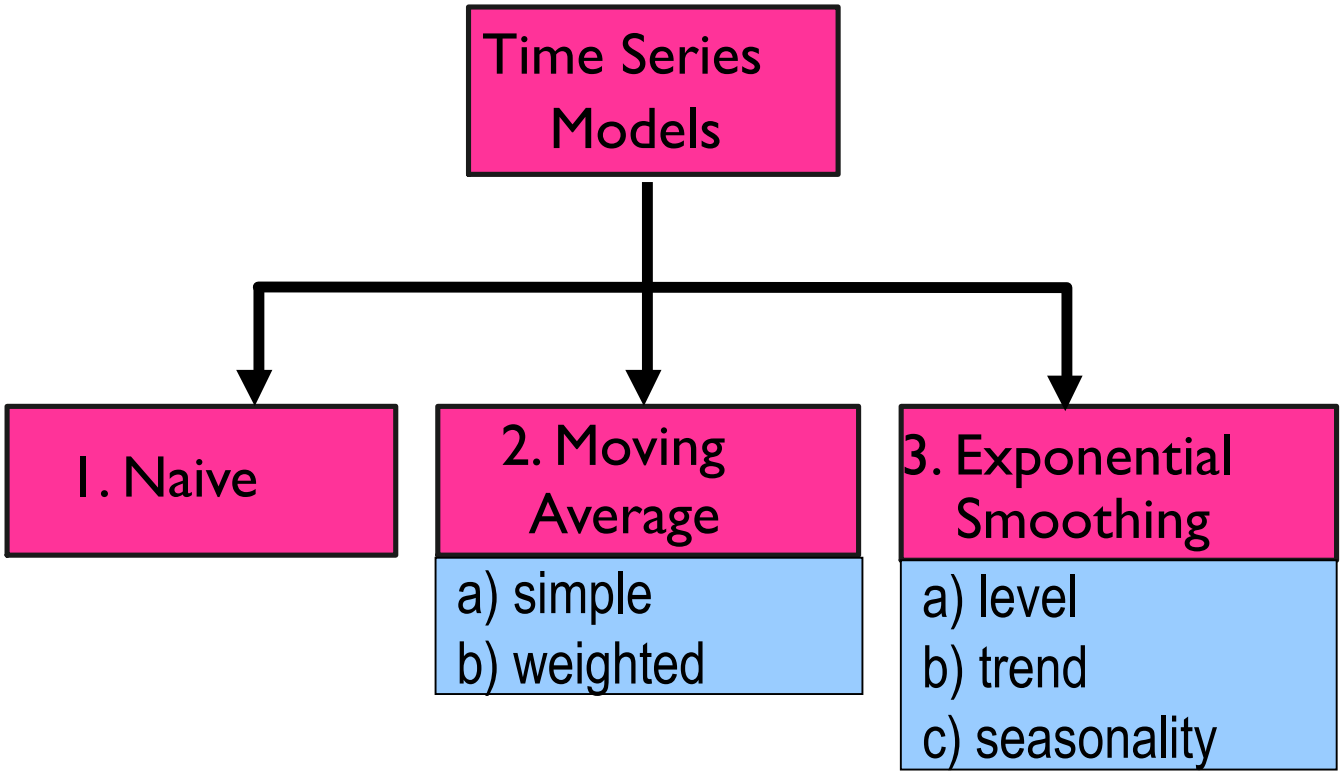



Historical Time Series Data
Trend Pattern
Cyclical Pattern
Seasonal Pattern
Random Fluctuation (noise)

Product Demand over Time



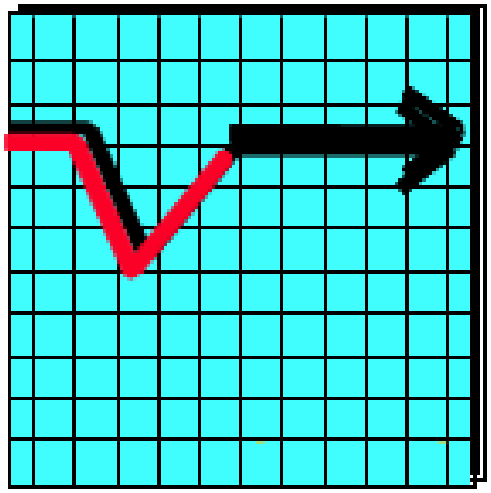
Quantitative Forecasting Methods



1. Naive Approach

- Demand in *next* period is the same as demand in *most recent* period
  - ✓ May sales = 48 → June forecast = 48

- Usually not good



2a. Simple Moving Average

- **Assumes an average is a good estimator of future behavior**
  - Used if *little or no trend*
  - Used for smoothing

$$F_{t+1} = \frac{A_t + A_{t-1} + A_{t-2} + \ldots + A_{t-n+1}}{n}$$

F_{t+1} = Forecast for the upcoming period, t+1
n = Number of periods to be averaged
A_t = Actual occurrence in period t

2b. Weighted Moving Average

- Gives more emphasis to recent data

$$F_{t+1} = w_1 A_t + w_2 A_{t-1} + w_3 A_{t-2} + \ldots + w_n A_{t-n+1}$$

- Weights
  - decrease for older data
  - sum to 1.0

Simple moving average models weight all previous periods equally

2b. Weighted Moving Average: 3/6, 2/6, 1/6

$$F_{t+1} = w_1 A_t + w_2 A_{t-1} + w_3 A_{t-2} + \ldots + w_n A_{t-n+1}$$

Month	Sales (000)	Weighted Moving Average
1	4	NA
2	6	NA
3	5	NA
4	?	31/6 = 5.167
5	?	
6	?	

2b. Weighted Moving Average: 3/6, 2/6, 1/6

$$F_{t+1} = w_1 A_t + w_2 A_{t-1} + w_3 A_{t-2} + \ldots + w_n A_{t-n+1}$$

Month	Sales (000)	Weighted Moving Average
1	4	NA
2	6	NA
3	5	NA
4	3	31/6 = 5.167
5	7	25/6 = 4.167
6		32/6 = 5.333

3a. Exponential Smoothing

- **Assumes the most recent observations have the highest predictive value**
  - **gives more weight to recent time periods**

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

e_t

F_{t+1} = Forecast value for time $t+1$

A_t = Actual value at time t

α = Smoothing constant

Need initial forecast F_t to start.

3a. Exponential Smoothing – Example 1

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

i	Ai
Week	Demand
1	820
2	775
3	680
4	655
5	750
6	802
7	798
8	689
9	775
10	

Given the weekly demand data what are the exponential smoothing forecasts for periods 2-10 using α=0.10?

Assume $F_1=D_1$

3a. Exponential Smoothing – Example 1

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

i	Ai	Fi	
Week	Demand	α=0.1	
1	820	820.00	
2	775	820.00	
3	680		
4	655		
5	750		
6	802		
7	798		
8	689		
9	775		
10			

=820+.1(820–820)

=820

$F_2 = F_1 + \alpha(A_1 - F_1)$

3a. Exponential Smoothing – Example 1

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

i	Ai	Fi
Week	Demand	$\alpha = 0.1$
1	820	820.00
2	775	820.00
3	680	
4	655	
5	750	
6	802	
7	798	
8	689	
9	775	
10		

$F_3 = F_2 + \alpha(A_2 - F_2)$

$=820+.1(775-820)$

$=815.5$

3a. Exponential Smoothing – Example 1

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

	i	Ai	Fi
	Week	Demand	$\alpha = 0.1$
	1	820	820.00
	2	775	820.00
	3	680	815.50
	4	655	
	5	750	
	6	802	
	7	798	
	8	689	
	9	775	
	10		

This process continues through week 10

3a. Exponential Smoothing – Example 1

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

i	Ai	Fi	
Week	Demand	α = 0.1	α = 0.6
1	820	820.00	820.00
2	775	820.00	820.00
3	680	815.50	793.00
4	655	801.95	725.20
5	750	787.26	683.08
6	802	783.53	723.23
7	798	785.38	770.49
8	689	786.64	787.00
9	775	776.88	728.20
10		776.69	756.28

What if the α constant equals 0.6

3a. Exponential Smoothing – Example 2

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

	i	Ai	Fi	
	Month	Demand	$\alpha = 0.3$	$\alpha = 0.6$
	January	120	100.00	100.00
	February	90	106.00	112.00
	March	101	101.20	98.80
	April	91	101.14	100.12
	May	115	98.10	94.65
	June	83	103.17	106.86
	July		97.12	92.54
	August			
	September			

What if the α constant equals 0.6

3a. Exponential Smoothing – Example 3

Company A, a personal computer producer purchases generic parts and assembles them to final product. Even though most of the orders require customization, they have many common components. Thus, managers of Company A need a good forecast of demand so that they can purchase computer parts accordingly to minimize inventory cost while meeting acceptable service level. Demand data for its computers for the past 5 months is given in the following table.

3a. Exponential Smoothing – Example 3

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

	i	Ai	Fi	
	Month	Demand	$\alpha = 0.3$	$\alpha = 0.5$
	January	80	84.00	84.00
	February	84	82.80	82.00
	March	82	83.16	83.00
	April	85	82.81	82.50
	May	89	83.47	83.75
	June		85.13	86.38
	July		??	??

What if the α constant equals 0.5

3a. Exponential Smoothing

- How to choose α
  - depends on the emphasis you want to place on the most recent data
- Increasing α makes forecast more sensitive to recent data

To Use a Forecasting Method

- Collect historical data
- Select a model
  - Moving average methods
    - Select *n* (number of periods)
    - For weighted moving average: select weights
  - Exponential smoothing
    - Select α
- Selections should produce a good forecast

…but what is a good forecast?

A Good Forecast

- Has a small error
  - Error = Demand - Forecast

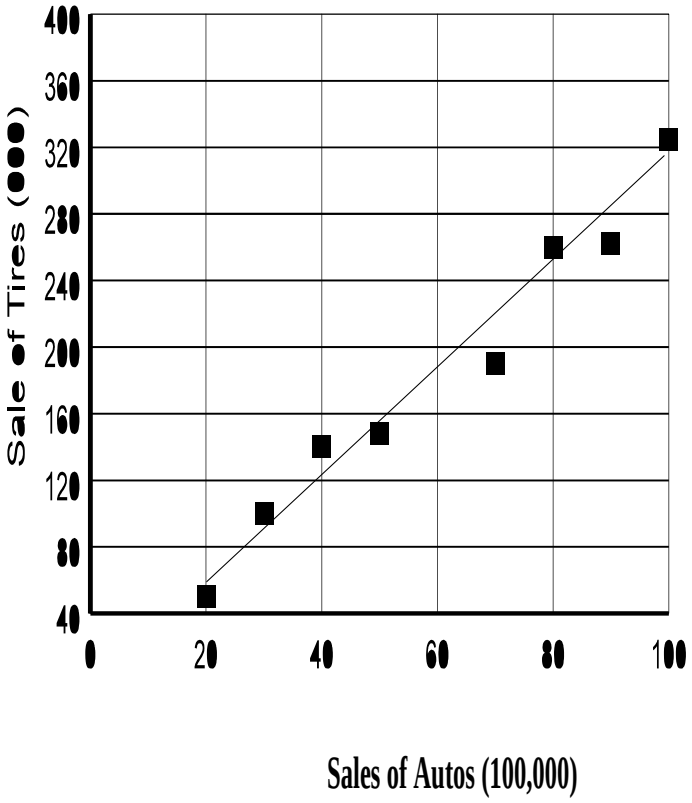
Regression Analysis as a Method for Forecasting

Regression analysis takes advantage of the relationship between two variables. Demand is then forecasted based on the knowledge of this relationship and for the given value of the related variable.

Ex: Sale of Tires (Y), Sale of Autos (X) are obviously related

If we analyze the past data of these two variables and establish a relationship between them, we may use that relationship to forecast the sales of tires given the sales of automobiles.

The simplest form of the relationship is, of course, linear, hence it is referred to as a regression ***line***.



Formulas

$y = a + b\,x$

where,

$$b = \frac{\sum xy - n\bar{x}\bar{y}}{\sum x^2 - n\bar{x}^2}$$

$$a = \bar{y} - b\bar{x}$$

Regression – Example

$$y = a + b\,X$$

$$b = \frac{\sum xy - n\bar{x}\bar{y}}{\sum x^2 - n\bar{x}^2} \qquad a = \bar{y} - b\bar{x}$$

Month	Advertising	Sales	X^2	XY
January	3	1	9.00	3.00
February	4	2	16.00	8.00
March	2	1	4.00	2.00
April	5	3	25.00	15.00
May	4	2	16.00	8.00
June	2	1	4.00	2.00
July				
TOTAL	20	10	74	38

Assessment

- Regression analysis use to test the ---------- of X and Y.

Summary

- Quantitative forecasting
    1. Time series analysis
        a. Naïve method
        b. Simple moving average
        c. Exponential moving average
        d. Weighted moving average
    2. Regression model

References

- https://www.investopedia.com/terms/d/delphi-method.asp
- https://corporatefinanceinstitute.com/resources/economics/delphi-method/

REACH US @

snsinstitutions

snsinstitutions

snsinstitutions

Snsinstitution

snsinstitutions