

Index Number [Quantitative Aptitude]

①

Introduction :-

- Index Number $\rightarrow$ % changes in variable $\rightarrow$ Price, Quantity,
- Method evaluation % changes in variable with respect to Geographical location, time and other features.
- Method of constructing Price of index number
 - Simple (unweighted)
 - Aggregative
 - Relative
 - Weighted
 - Aggregative
 - Relative

Simple aggregative method :-

$$P_{01} = \frac{\sum P_1}{\sum P_0} \times 100$$

Base year $\downarrow$ current year

Eg :-

	P_0	P_1
x	100	160
y	120	180
z	105	140
Total	325	480

$$P_{01} = \frac{\sum P_1}{\sum P_0} \times 100$$

$$= \frac{480}{325} \times 100$$

$$= 147.69.$$

Simple relative method.

Simple relative

- Arithmetic method $\rightarrow P_{01} = \frac{\sum (\frac{P_1}{P_0} \times 100)}{N}$
- Geometric method $\rightarrow P_{01} = \left[\frac{\sum \log (\frac{P_1}{P_0} \times 100)}{N} \right] \div A1$

Eg.

	P_0	P_1
12	36	
15	60	
18	36	
45	126	

$$P_{01} = \frac{\sum (\frac{P_1}{P_0} \times 100)}{N}$$

$$= \frac{126}{45} \times 100$$

Step I

Step II

$$= \frac{900}{3} \times 100$$

$$= 300$$

Step I

$$\frac{36}{12} \times 100 = 300$$

$$\frac{60}{15} \times 100 = 400$$

$$\frac{36}{18} \times 100 = 200$$

$$\frac{900}{3} = 300$$

Weighted method. [Aggregative
Relative .

(2)

Weighted aggregative method In this

① Laspeyre = $P_{01} = \frac{\sum P_1 q_0}{\sum P_0 q_0} \times 100$

② Paasches .

$P_{01} = \frac{\sum P_1 q_1}{\sum P_0 q_1} \times 100$

③ Fisher $\rightarrow$

In this Geometric mean can use.

$P_{01} = \sqrt{L \times P}$

$P_{01} = \sqrt{\frac{\sum P_1 q_0}{\sum P_0 q_0} \times \frac{\sum P_1 q_1}{\sum P_0 q_1}} \times 100$

④ Dobish & Bowley

$P_{01} = \frac{L + P}{2}$

⑤ Marshall Edgeworth (Average of quantity)

$P_{01} = \frac{\sum P_1 \left(\frac{q_0 + q_1}{2} \right)}{\sum P_0 \left(\frac{q_0 + q_1}{2} \right)} \times 100$

Weighted Relative method [Arithmetic mean
Geometric mean

- Arithmetic mean = $P_{01} = \frac{\sum W_i \left(\frac{P_1}{P_0} \times 100 \right)}{\sum W_i}$

- Geometric mean

$P_{01} = AL \left[\frac{\sum W \log \left(\frac{P_1}{P_0} \times 100 \right)}{\sum W} \right]$

Eg :-

commodity	Base year	Current year	weight .
X	80	40	3
Y	60	25	2
Z	40	50	5

P_0 P_1 w_i

80	40	3
60	25	2
40	50	5
180	115	10

Step I

$\frac{P_1}{P_0} \times 100 =$

X	3.375
Y	2.5
Z	6.25
	<u>12.125</u>

Step II

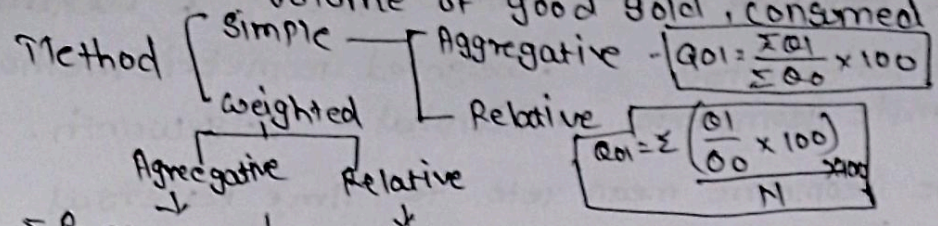
$P_{01} = \frac{\sum w_i \left(\frac{P_1}{P_0} \times 100 \right)}{\sum w_i}$

$= \frac{12.125}{10}$

$= 12.125$

Quantitative Index (Volume index)

- change in quantity or volume of good sold, consumed or produced.



(L)

$$Q_1 = \frac{\sum P_0 Q_1}{\sum P_0 Q_0} \times 100$$

(F)

$$Q_1 = \frac{\sum P_1 Q_1}{\sum P_1 Q_0} \times 100$$

(L)

$$Q_{01} = \frac{\sum W \left(\frac{Q_1}{Q_0} \times 100 \right)}{\sum W}$$

(F)

$$Q_{01} = \sqrt{L \times P}$$

Value index number

$$Vol = \frac{\sum P_1 Q_1}{\sum P_0 Q_0} \times 100$$

method I

$$Vol = \frac{19 \times 32}{10 \times 28} \times 100$$

$$= \frac{608}{280} \times 100 = 217.14$$

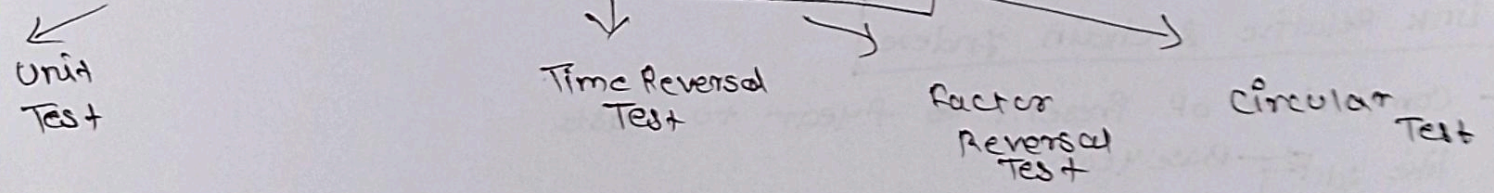
Eg. 2004 → 2020

	P ₀	Q ₀	P ₁	Q ₁	P ₀ Q ₀	P ₁ Q ₁
A	2	10	6	12	20	72
B	3	12	5	15	36	75
C	5	6	8	5	30	40
	10	28	19	32	86	187

Method II

$$Vol = \frac{\sum P_1 Q_1}{\sum P_0 Q_0} \times 100 = \frac{187}{86} \times 100 = 217.44$$

Tests of Adequacy of Index number



Unit Test :-

- Formula does not change the value the unit of price or quantities change
- All Method are satisfy this test except, simple aggregative method

its index number even its is

Eg: P₀ P₁

	P ₀	P ₁
A	2	4
B	3	6
C	5	12

Eg

	P ₀	P ₁
A	2	4
B	3	6
C	20	48

$$P_{01} = \frac{P_1}{P_0} \times 100$$

$$= \frac{64}{28} \times 100 = 228.57$$

- ② Time Reversal method.
- Given method work both way in the time, forward & backward.
 - Satisfied by :-
 - Fisher's method
 - weighted Geometric method
 - Simple geometric
 - Marshal - Edgeworth.
 - But formula madhe Geometric mean yeto te Time Reversal method La Satisfied Karto.

③ Factor Reversal method :-

- Price index & quantity index should be equal to corresponding value index

$$P_{01} \times Q_{01} = V_{01} \quad \text{or.}$$

$$P_{01} \times Q_{01} = \frac{\sum P_1 Q_1}{\sum P_0 Q_0} \times 100$$

- This Satisfied By
 - Fishers method.

④ Circular Test :-

- Extension of Time Reversal.

$$P_{01} \times P_{12} \times P_{20} = 1$$

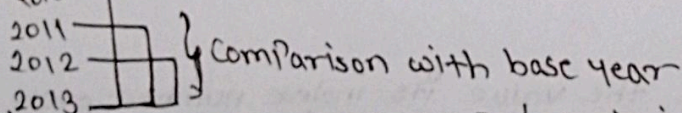
- met by simple geometric mean & Price relative
- weighted aggregative with fixed weight.

P_{01}
 Eg $\frac{2018}{2010} = 2$ $\frac{2018}{2024} = \frac{1}{2}$ $P_{12} = 4$
 $\frac{2010}{2024} = 0.5$ (80)
 $P_{20} = \frac{1}{2}$

* Link Relative & chain index

- Comparison of Present to year to Past

like 2011 ← Base year.



(1) Year	(2) Price	Link Relation $[1 \div 2 \times 100]$	chain index
1991	50	100	100
1992	60	$60/50 \times 100 = 120$	$100 \times 120\% = 120$
1993	62	$62/60 \times 100 = 103.33$	$120 \times 103.33\% = 124$
1994	65	$65/62 \times 100 = 104.83$	$124 \times 104.83\% = 130$
1995	70	$70/65 \times 100 = 107.69$	$130 \times 107.69\% = 140$
1996	78	$78/70 \times 100 = 111.42$	$140 \times 111.42\% = 156$