CH-18

Index Number

[5 Marks]

↓

Percentage Value

Introduction

2023	2024
Rs. 40/kg	Rs. 45/kg
↓	↓
100	112.5

$$\% \text{ growth} = \frac{FV - IV}{IV} \times 100$$

$$= \frac{45 - 40}{40} \times 100$$

$$= \frac{5}{40} \times 100$$

$$= 12.5\%$$

$$\text{Index Number} = \frac{\text{Current Year Value}}{\text{Base Year Value}} \times 100$$

CY Price → P_1 / P_n

BY Price → P_0

$$\text{I No.} = \frac{P_1}{P_0} \times 100$$

↓

If ques. is silent it will always be 100 but if states about the BY Price or Index then the value of it will apply.

Example.1 BY → 52 , CY → 60

$$I.No. = \frac{60}{52} \times 100 = 115.38$$

Example.2 W.R.T. BY → 120 CY → 150
BY → 90 Rs. CY → ?

120 → 90

150 → $\frac{150}{120} \times 90$

$= 112.5$

Q.1 BY Price → 46 CY Price → 51
BY Index → 105 CY Index → ?

46 → 105

51 → $\frac{51}{46} \times 105 = 116.41$

Q.2 BY Price → 46 CY Price → 51
BY Index → 100 CY Index → ?

$$CY\ Index = \frac{51}{46} \times 100 = 110.86$$

Q.3- BY Index → 150 CY Index → 250
BY Price → 58 CY Price → ?

$$CY\ Price = \frac{250}{150} \times 58 = 96.66$$

Example.1 At a place on an average the prices have gone up by 28%, then the new index no. is ?

$$100 + 28\% = 128$$

Example.2 At a place on an average the prices have gone up by 102%, then what is the new index?

$$100 + 102\% = 202$$

Example.3 If the CY index is 157 then the price has increased by how much % ?

$$157 - 100 = 57\%$$

Example.4 If the CY index is 243 then the price has increased by how much % ?

$$243 - 100 = 143\%$$

Example.5 The price has become (→ ×) 1.42 times of original prices then the new index no. is

$$100 \times 1.42 = 142$$

Example.6 The price has increased by (→ ×, +) 1.3 times then the new index no. is

S.I. $100 \times 1.3 = 130$ OR $100 + (1.3 \times 100) = 230$

A $100 + 130 = 230$

Example.7 The price has decreased by 21% then new index?

$$100 - 21\% = 79$$

Example.8

2023	2024
₹ 12,000	₹ ?
100	117

If corresponding to the base year, current year index is 117. What should be the new salary of the person if he is rightly compensated?

$$\frac{12,000}{100} \times 117 = 14,040$$

Example.9

	Base Year	Current Year
Index No.	110	140
Prices	6,050	?

$$\frac{6050}{110} \times 140 = 7,700$$

Example.10 W.R.T. the BY Index is 120 and CY Index is 160. A person was getting ₹15,000 last year then what is the additional amount he should be given for right compensation?

$$\text{CY Price} = \frac{15,000}{120} \times 160 = 20,000$$

Additional Amount given = 20,000 − 15,000 = 5,000

Concept of Deflated Value or Real Wages

$$\text{Deflated Value} = \frac{\text{C.Y. Value}}{\text{C.Y. Index}} \times \text{B.Y. Index } (100)$$

Example.1

Last Year Salary	Current Year Salary	Growth
₹ 20,000	₹ 30,000	50%

Index	Index
100	120

$$\text{Deflated Value} = \frac{30,000}{120} \times 100 = 25,000$$

Actual Growth = 25%

Example.2 A company gives the growth of 30% but the index has grown by 15% what is the actual growth?

Index	100	115
Salary	100	130

$$\text{Deflated Value} = \frac{130}{115} \times 100 = 113.04$$

Actual Growth = 13.04%

Types of Index Numbers

1. Simple Aggregative Method

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

Disadvantage: Jiski Lathi, uski Bhais!!

Higher value sabse jayda Impact karegi

Example

	2023	2024
A	80	85
B	104	108
C	120	132
D	14	20
	318	345

$\frac{345}{318} \times 100 = 108.49$

Example

	BY	CY
A	50	55
B	70	82
C	200	180
D	60	63
	380	380

$\frac{380}{380} \times 100 = 100$

This is not true So, we will do it with the method given below

2. Simple Relative Method

	BY	CY		
A	50	55	110	$\frac{55}{50} \times 100$
B	70	82	117.14	$\frac{82}{70} \times 100$
C	200	180	90	$\frac{180}{200} \times 100$
D	60	63	105	$\frac{63}{60} \times 100$

Using A.M. Method = $\frac{110 + 117.14 + 90 + 105}{4} = 105.53$

D.O.C. → 55 ÷ 50 = M+
82 ÷ 70 = M+
180 ÷ 200 = M+
63 ÷ 60 = M+
MRC ÷ 4 × 100 =

$$GM = \left(\frac{55}{50} \times \frac{82}{70} \times \frac{180}{200} \times \frac{63}{60}\right)^{1/4} = 105.04$$

D.O.C. → 55 × 82 × 180 × 63 ÷ 50 ÷ 70 ÷ 200 ÷ 60 = √ √
× 100

$$P_{01} = \frac{\Sigma I_R}{4} \quad ; \quad I_R = \frac{P_1}{P_0} \times 100$$

Concept: Sabka sath, sabka vikas
Equal Importance

Disadvantage:
EQUAL IMPORTANCE

3. Weighted Aggregative Method → Consumption kai hissab se importance milna chaiye ||

(i) Laspeyres's Index (L) = $\frac{\Sigma P_1 Q_0}{\Sigma P_0 Q_0} \times 100$

* It always uses base year quantity

(ii) Passche's Index (P) = $\frac{\Sigma P_1 Q_1}{\Sigma P_0 Q_1} \times 100$

* It always uses current year quantity

(iii) Marshall - Edgeworth (ME) = $\frac{\Sigma P_1 (Q_0 + Q_1)}{\Sigma P_0 (Q_0 + Q_1)} \times 100$

$ME = \frac{\Sigma P_1 Q_0 + \Sigma P_1 Q_1}{\Sigma P_0 Q_0 + \Sigma P_0 Q_1} \times 100$ (OR)

(iv) Bowley's OR DORBISM Bowley's (B) = AM of L & P = $\frac{L+P}{2}$

* (v) Fisher's Index (F) = GM of L & P = $\sqrt{LP}$

* F < B → G.M. < A.M.

$F = \sqrt{\frac{\Sigma P_1 Q_0 \times \Sigma P_1 Q_1}{\Sigma P_0 Q_0 \times \Sigma P_0 Q_1}} \times 100$

Example

	Price		Quantity	
	BY (P_0)	CY (P_1)	BY (Q_0)	CY (Q_1)
A	15	20	5	6
B	21	22	6	8
C	10	12	10	11
D	16	18	9	8
	62	72		

$\Sigma P_0 Q_0 = 445$

$\Sigma P_0 Q_1 = 496$

$\Sigma P_1 Q_0 = 514$

$\Sigma P_1 Q_1 = 572$

(i) $L = \frac{514}{445} \times 100 = 115.50$

(ii) $P = \frac{572}{496} \times 100 = 115.32$

(iii) $ME = \frac{514 + 572}{445 + 496} \times 100 = 115.40$

(iv) $B = \frac{115.50 + 115.32}{2} = 115.41$

(v) $F = \sqrt{115.50 \times 115.32} = 115.40$ OR $\sqrt{\frac{514}{445} \times \frac{572}{496}} \times 100 = 115.40$

4. Weighted Index No.

$$\frac{\Sigma IW}{\Sigma W}$$

Example

Reliance	Adani Group	HUL	TATA	Aditya Birla
131	128	110	105	115
0.9	1	0.5	0.6	0.6

$= 3.6$

$131 \times 0.9 = M + 128 \times 1 = M + 110 \times 0.5 = M +$

$105 \times 0.6 = M + 115 \times 0.6 = M +$ MRC $\div 3.6 =$

Ans = 120.25

5. Chain Index No. → $\frac{\text{Link Relative of CY} \times \text{Chain Index of PY}}{100}$

(OR) $\frac{\text{LC} \times \text{CP}}{100}$

Years	Sales	Link Relative (PY)	Chain Index (BY)
2018	50	100	100
2019	53	106	106
2020	60	113.20	120
2021	62	103.33	124
2022	65	104.83	130
2023	70	107.69	140
2024	73	104.28	146

$\frac{53}{50} \times 100$ $\quad$ $\frac{60}{50} \times 100$

$\frac{60}{53} \times 100$ $\quad$ $\frac{62}{50} \times 100$

6. Value Index

Value Index = Price Index × Quantity Index (Volume)

OR

$V_{01} = P_{01} \times Q_{01}$

$\frac{FV - IV}{IV} \times 100$

$2,00,000 = 10,000 \times 20$

$3,00,000 = 12,000 \times 25$

P - 20% Q - 25%

Example.

	BY	CY	
Value	100	120	20%
P	100	140	40%
Q	100	?	

$$\frac{100}{120} = \frac{100 \times 100}{140 \times x}$$

$$x = \frac{100 \times 100 \times 120}{100 \times 140}$$

$$\boxed{x = 85.71}$$

- P_{01} → Index No. of 1 on 0 $P_1/P_0 \times 100$
- P_{10} → Index No. of 0 on 1 $P_0/P_1 \times 100$
- P_1 → Price of the C.Y.
- P_0 → Price of the B.Y.

Splicing & Base Shifting

Decision of changing the base is known as 'Base Shifting' and the calculation of index is known as 'Splicing'.

Example.

Years	Index	Splicing Index
2018	100	→ 88.33 $100/113.20 \times 100$
2019	103.6	→ 91.51 $103.6/113.20 \times 100$
2020	109.85	→ 97.04 $109.85/113.20 \times 100$
2021	113.20	→ 100
2022	115	→ 101.59 $115/113.20 \times 100$
2023	118.5	→ 104.68 $118.5/113.20 \times 100$
2024	121.62	→ 107.43 $121.62/113.20 \times 100$

Base shifts from 2018 to 2021

Test of Adequacy

Q. How many test of adequacy are there?

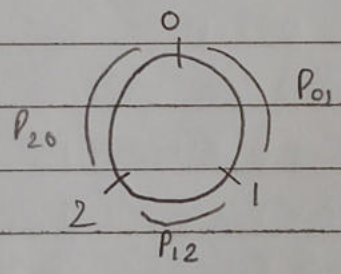
A. There are 4 test of adequacy:

(i) Unit Test: It should be a unit free quantity

(ii) Time Reversal Test: $P_{01} \times P_{10} = 1$

(iii) Factor Reversal Test: $P_{01} \times Q_{01} = V_{01}$

(iv) Circular Test: $P_{01} \times P_{12} \times P_{20} = 1$



The simple geometric mean of price relatives and the weighted aggregative with fixed weights

	U	TR	FR	C
L	✓	×	×	×
P	✓	×	×	×
ME	✓	×	×	×
B	✓	✓	×	×
F	✓	✓	✓	×