Chapter - 18
Index Numbers

An index number is a ratio of two or more time periods, one of which

→ is base time

From which comparison has to be made

For eg :

In 2009 a pen costs 10 rupees ÷
But in 2024 it costs 20 rupees ÷

I have to make a comparison

So let base year = p_0
current year = p_1

Ratio : $\frac{\text{Current period}}{\text{Base period}}$ = Price relative (P_{01})

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

And it is expressed in % as:

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

- Simple Aggregative method :

Total

Simple aggregative price index

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

Eg

	Pen	Pencil	Eraser
2009 (B)	20	20	50
2021 (C)	40	50	60

Now : $\frac{150}{90} = 1.6666$

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Simple average of price relatives :

$$\text{Index} = \frac{\Sigma \left(\frac{P_1}{P_0} \times 100 \right)}{N}$$

First find out P_{01} of all commodies And then find out their average.

For eg

	A	B	C	D	E
Price (2011)	115	108	95	80	90
Price 2012	125	117	108	95	95

= 111 (With calculator)

Weightage average method :

General index = $\frac{\text{Sum of products}}{\text{Sum of weights}}$

Example :

		W	Products
2018	100	→ 1	100
2019	300	→ 2	600
2020	700	→ 3	2100
			2800

So. $100 \times 600 \times 2100 = 2800$

Weighted average

$$= \frac{\text{Sum of products}}{\text{Sum of weights}}$$

$$= \frac{2800}{6}$$

$$= 466.67$$

If SA = Equal importance
WA = Weighted importance.

The weights are usually the quantities of the commodities.

1. Weighted aggrevative index
2. Weighted average of relatives.

• Weighted aggregative index :

As there, p_{01} will be found

So there will be $\frac{P_1}{P_0}$

Now it is aggregative

Means there will be Σ so $\frac{\Sigma P_1}{\Sigma P_0}$

Now it is weighted too

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So some quantity will be divided to take weight

$$\frac{\Sigma P_1}{\Sigma P_0} \times \frac{\square}{\square} \times 100$$

Now :

- Laspeyre's method : [LAST] / BASE YEAR

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

- Paasche's method : [Present] / Current

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

- Marshall method :

Take weights of average together.

$$= \frac{\sum P_1 (Q_0 + Q_1)}{\sum P_0 (Q_0 + Q_1)} \times 100$$

- Bowley's method :

$$\frac{\text{Laspeyre's} + \text{Paasche's}}{2}$$

$$\frac{\frac{\sum p_1 q_0}{\sum p_0 q_0} + \frac{\sum p_1 q_1}{\sum p_0 q_1}}{2} \times 100$$

- Fisher's method :

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

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

Now :

Just take a example of cost inflation index :

2001 - 2	=	100 ... → Base year index.
2002 - 3	=	150
2003 - 4	=	160
2004 - 5	=	170
2005 - 6	=	180

Till now we have a fixed base,

But sometimes a fixed base doesn't suits rapidly the required needs.

- In such a case changing base is more situable

for eg:

We want & the base year for

1999 → 1998
2000 → 1999 (not 1998)
2001 → 1999 (not 1998, 2000)

So if we allocate these relatives to a common base, the results are (changed) chained.

So under:

The chain index numbers it is to be done

Under this method

- Relatives of each year are first related to Preceeding year

Called link relative

And then they are chained together by successive multiplication to form a chain together.

Chain index :

- Link relative of the current year × Chain index of the previous year / 100

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Quantity index numbers :-

1 - Simple aggregative of quantities index :

$$= \frac{\Sigma Q_1}{\Sigma Q_0} \times 100$$

2 Simple average of quantity relatives

$$= \frac{\frac{\Sigma Q_1}{\Sigma Q_0}}{n} \times 100$$

3. Weighted average quantity indices :-

1. Laspeyre's index

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

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2. Paasche's index.

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

$$= \frac{\Sigma Q_0 P_1}{\Sigma Q_0 P_1} \times 100$$

3. Fisher's ideal (GM mean of L+P)

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

- Base year average of quantity relatives :-

$$= \frac{\Sigma \left(\frac{Q_1}{Q_0} \times (P_0 q_0) \right)}{\Sigma P_0 q_0} \times 100$$

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★ Value Indices :-

Value = Price × Quantity

i.e = Value Index = $\frac{\Sigma V_n}{\Sigma V_0} = \frac{\Sigma P_1 Q_1}{\Sigma P_0 q_0}$

Deflating time series using index numbers

Deflated value = $\frac{\text{Current value}}{\text{Price index of the current year.}}$

Current value = $\frac{\text{Base Price} = P_0}{\text{Current price } P_n}$

Real wage: Current year $\frac{q}{p}$ Index or wage ke hisab se base year ki wage