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Index Numbers

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An index number is a statistical measure designed to show changes in a variable or group of related variables with respect to time, geographical location or other characteristic such as income, profession etc.

Notations Used In An Index Numbers

- For Price Index
  Ip = Price index
  Po = Price of an individual item in base period
  Pn = Price of an individual item in current period
- For Quantity Index
  Iq = Quantity index
  qo = Quantity of an individual item in base period
  qn = quantity of an individual item in current period

Single Item Index Numbers

In this method only one item can be considered. Single item index numbers are generally known as relatives.

Simple Price Index (Price Relative)

$$\mathbf{I}_p = \frac{\boldsymbol{P_n}}{\boldsymbol{P_o}} \times \mathbf{100}$$

Simple Quantity Index (Quantity Relative)

$$\mathbf{I}_q = \frac{\sum \mathbf{q_n}}{\sum \mathbf{q_o}} \times \mathbf{100}$$

Example 1

Price per Kg of sugar in Rs. And quantity sold in thousands of Kgs. By a firm during the year 2000-2005 are given below. Find the price and quantity relatives for each year by using 2000 as base year.

Year	2000	2001	2002	2003	2004	2005
Price (Rs.)	85	87	90	93	96	100
Quantity (Kg)	40	42	45	48	50	53

Multi Item Index Numbers

In this method number of items are considered. Multiitem index numbers are generally knows as simple aggregate index numbers.

Simple Aggregate Price Index

$$I_{p(sa)} = \frac{\sum p_n}{\sum p_o} \times 100$$

Simple Aggregate Quantity Index

$$I_{p(SA)} = \frac{\sum q_n}{\sum q_o} \times 100$$

Example 2

By using the data given below calculate

(i) Simple aggregate price index

(ii) Simple aggregate quantity index for 2007 and 2008 by taking 2006 as base year

Item	2006		2007		2008	
	Price (Rs.	Qty (Units)	Price (Rs.	Qty (Units)	Price (Rs.	Qty (Units)
A	10	40	12	50	15	60
B	03	120	04	125	05	130
C	20	30	25	35	30	40
D	50	10	60	15	70	20

Weighted Aggregate Index Numbers

In this method the relative importance of the items are considered and this method overcome the disadvantage of the simple aggregate method by assigning suitable weights for each item.

Weighted Aggregate Price Index

$$\mathbf{I_{P(WA)} = \frac{\sum wp_n}{\sum wp_o} \times 100}$$

Weighted Aggregate Quantity Index

$$\boldsymbol{I_{p(WA)} = \frac{\sum wq_n}{\sum wq_o} \times 100}$$

Example 3

By using the data given below, calculate:

(i) Weighted aggregate price index

(ii) Weighted aggregate quantity index by considering 2010 as base year.

Item	Price (Rs.)		Qty. (Units		Weight
	2010	2012	2010	2012	
A	10	12	40	50	5
B	05	06	120	130	3
C	50	60	10	15	10

Laspeyre's And Paashe's Index Numbers

Laspeyre and paasche introduced a method of assigning weighs for the relative importance of each item and they used quantities as weights when computing price index and prices as weights when computing quantity index.

Laspeyre's Price Index

This is an index number by considering base period quantity (qo) as a weighting factor

$$\mathbf{I_{p(L)}} = \frac{\sum q_o p_n}{\sum q_o p_o} \times \mathbf{100}$$

Paasche's Price Index

This is an index number by considering current period quantity (qn) as weighting factor

$$\mathbf{I_{p(p)}} = \frac{\sum p_n q_n}{\sum p_n q_o} \times \mathbf{100}$$

Example 4

By using the data given below calculate

(i) Laspeyre's price index
(ii) Laspeyre's quantity index
(iii) Paasche's price index
(iv) Paasche's quantity index by considering 2005 as base year.

Item	2005		2006	
	Price (Rs.)	Qty. (Units)	Price (Rs.)	Qty. (Units)
A	10	50	15	60
B	40	30	60	40
C	120	10	150	15
D	55	80	40	100

Example 5

The table below shows details of sales of four items for the years 2010 and 2012. Considering year 2010 as base year calculate:

(i) Laspeyre's price index
(ii) Laspeyre's quantity index
(iii) Paasche's price index
(iv) Paasche's quantity index

Item	Price (Rs.)		Quantity (Units)	
	2010	2012	2010	2012
A	20	40	08	06
B	50	60	10	05
C	40	50	15	10
D	20	20	20	15