5 Index Numbers

Let's Study

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Introduction

The value of money does not remain the same for all the time. It cannot be observed directly, but can be understood by observing the general level of prices. A rise in the price level indicates a fall in the value of money and a fall in the price level indicates a rise in the value of money. Changes in the value of money are reflected in changes in general level of prices over a period of time. Changes in the value of money are found to be inversely related to changes in price levels. So, changes in the value of money can be understood by observing changes in the general level of prices over a specified time period. Changes in the general level of prices are measured using a statistical tool known as **index numbers**. Index numbers provide one of the most popular statistical tools used in economics.

Index numbers cannot be measured directly, but are constructed with help of some mathematical formula. Index numbers are not expressed in terms of any units of measurement because they are ratios. Index numbers are usually expressed as percentages.

Maslow describes an index number as a numerical value characterizing the change in a complex economic phenomenon over a period of time. According to Spiegel, an index number is a statistical measure designed to show changes in a variable or a group of related variables with respect to time, geographical location or some other characteristic. Gregory and Ward describe it as a measure designed to show an average change, over time, in the price, quantity or value of a group of items. Croxton and Cowden say that an index number is a device that measures differences in the magnitude of a group of related variables. B. L. Bowley describes an index number as a series that reflects in its trend and fluctuations the movements of some quantity to which it is related. Blair puts an index number as a special kind of average.

Let's Learn

5.1 Definition of Index Numbers.

Index Numbers are defined in different ways by different experts. Some of the most popular definitions of Index Numbers are given below.

1. An Index Number is a statistical measure of changes in a variable or a group of variables with respect to time, geographical location, or some other characteristic such as production, income, etc.
2. An Index Number is used for measuring changes in some quantity that can not be measured directly.
3. An Index Number is a single ratio, usually expressed as percentage, that measures aggregate (or average) change in several

variables between two different times, places, or situations.

After reading the above definitions, we can conclude that an Index Number is an *'economic indicator'* of business activities.

Examples of index numbers.

NIFTY:

The NIFTY 50 index is National Stock Exchange of India's benchmark broad based stock market index for the Indian equity market. It represents the weighted average of 50 Indian company stocks in 13 sectors and is one of the two main stock indices used in India, the other being the BSE Sensex.

SENSEX:

The BSE SENSEX (also known as the S&P Bombay Stock Exchange Sensitive Index or simply the SENSEX) is a free-float market-weighted stock market index of 30 well-established and financially sound companies listed on Bombay Stock Ex change

5.2 Types of Index Numbers

Following are three major types ot index numbers.

1. **Price Index Number**

   Price index numbers measure changes in the level of prices in the economy. It compares the price of the current year, with that of the base year to indicate the relative variation. It is a very good measure of inflation in the economy.

2. **Quantity Index Number**

   As the name suggests, quantity index numbers measure changes in the quantities of goods between the two specified years. This can be the number of goods produced, sold, consumed, etc. It is a good indication of the output of an economy.

3. **Value Index Number**

   A value index number is the ratio of the aggregate value of a given commodity (or a group of commodities) in the current year and its value in the base year. A value index number combines prices and quantities by taking the product of price and quantity as the value. The value index number thus measures the percentage change in the value of a commodity or a group of commodities during the current year in comparison to its value during the base year.

5.3 (a) : Terminology.

Base Period: The base period of an index number is the period against which comparisons are made. For example, the Central Statistical Organisation (CSO) is constructing the Consumer Price Index by taking 2010 as the base year. It means that the prices in 2015 are compared with 2010 prices by taking them as 100. The base period is indicated by subscript Zero.

Current Period : The present period is called the current period of an index number. An index number measures the changes between the base period and the current period. The current period is indicated by subscript 1.

Note:

The period used in index numbers can be a day, a month, or a year. We shall use a year as the period in our study.

5.3 (b) : Notation.

p_0 : Price of a commodity in the base year.

q_0 : Quantity (produced, purchased, or consumed) of a commodity in the base year.

p_1 : Price of a commodity in the current year.

q_1 : Quantity (produced, purchased, or consumed) of a commodity in the current year.

w : Weight assigned to a commodity according to its relative importance in the group.

I : Simple index number. It is also called the price relative. It is given by

$$I = \frac{p_1}{p_0} \times 100 \qquad (1)$$

P_{01}: Price index for the current year with respect to the base year.

Q_{01}: Quantity index for the current year with respect to the base year.

V_{01} : Value index for the current year with respect to the base year.

5.4 Construction of Index Numbers

Index number are constructed by the following two methods

1. Simple Aggregate Method.
2. Weighted Aggregate Method.

Let us now learn how index numbers are constructed by these two methods.

5.4.1 Method 1: Simple Aggregate Method

This is the simplest method of constructing index numbers. This method assumes that every commodity is equally important.

(a) Simple Aggregate Method to find Price Index Number

The procedure of calculating Price Index Number by the Simple Aggregate Method is as follows.

Step I : Prices of all commodities are added for the base year. This total is denoted by $\sum p_0$

Step II : Prices of all commodities are added for the current year. This total is denoted by $\sum p_1$.

Step III : The total obtained in Step II is divided by the total obtained in Step I. The ratio is then multiplied by 100.

Thus, the required price index number is given by

$$P_{01} = \frac{\sum p_1}{\sum p_0} \times 100.$$

(b) Simple Aggregate Method to find Quantity Index Number

Quantity Index Number can be calculated by the same procedure as above, only replacing prices by quantities.

Step I : Quantities of all commodities are added for the base year. This total is denoted by $\sum q_0$

Step II : Quantities of all commodities are added for the current year. This total is denoted by $\sum q_1$

Step III : The total obtained in Step II is divided by the total obtained in Step I. The ratio is then multiplied by 100.

Thus, the required quantity index number is given by

$$Q_{01} = \frac{\sum q_1}{\sum q_0} \times 100.$$

(c) Simple Aggregate Method to find Value Index Number

Value of a commodity is defined as the product of its price and quantity. Value Index Number is then calculated using the same procedure as above, where price or quantity is replaced by value.

Step I : Values (that is, products of prices and quantities) of all commodities are added for the base year. This total is denoted by $\sum p_0 q_0$

Step II : Values (that is, products of prices and quantities) of all commodities are added for the current year. This total is denoted by $\sum p_1 q_1$

Step III : The total obtained in Step II is divided by the total obtained in Step I. The ratio is then multiplied by 100.

Thus, the required value index number is given by

$$V_{01} = \frac{\sum p_1 q_1}{\sum p_0 q_0} \times 100.$$

SOLVED EXAMPLES

1. Calculate the price index number for the following data using the Simple Aggregate Method. Take 2000 as the base year.

Commodities	A	B	C	D	E
Price (in Rs.) for 2000	30	35	45	55	25
Price (in Rs.) for 2003	30	50	70	75	40

Solution :

Let us first tabulate the data in the following tabular form.

Table 5.1

Commodities	Price in 2000 (Base year) p_0	Price in 2003 (Current year) p_1
A	30	40
B	35	50
C	45	70
D	55	75
E	25	40
Total	$\sum p_0 = 190$	$\sum p_1 = 275$

Price Index Number is then given by

$$P_{01} = \frac{\sum p_1}{\sum p_0} \times 100$$

$$= \frac{275}{190} \times 100$$

$$= 144.74$$

Interpretation:

If the price of a commodity was Rs.100 in the year 2000, then the price of the same commodity is approximately Rs.145 in the year 2003. Hence, the overall increase in the price level is 45% in three years.

2. Calculate the Quantity Index Number for the following data using Simple Aggregate Method. take year 2000 as the base year.

Commodity	I	II	III	IV	V	VI
Quantity in 2000	30	55	65	70	40	90
Quantity in 2004	40	60	70	90	55	95

Solution:

We first tabulate the data in the following tabular form.

Table 5.2

Commodities	Quantity in 2000 (Base year) q_0	Quantity in 2004 (Current year) q_1
I	30	40
II	55	60
III	65	70
IV	70	90
V	40	55
VI	90	95
Total	$\sum q_0 = 350$	$\sum q_1 = 410$

Quantity Index Number is then given by

$$Q_{01} = \frac{\sum q_1}{\sum q_0} \times 100$$

$$= \frac{410}{350} \times 100$$

$$= 117.14.$$

This means that the output in terms of quantity rose by approximately 17% in year 2004 from year 2000.

3. Calculate the Value Index Number for the following data using the Simple Aggregate Method.

Commodities	Base Year		Current Year	
	Price Rs. p_0	Quantity (units) q_0	Price Rs. p_1	Quantity (units) q_1
p	10	6	60	7
Q	20	4	70	6
R	30	7	80	8
S	40	8	90	9
T	50	3	100	5

Solution : First, prepare the following table.

Table 5.3

Commodity	Base Year		Current Year			
	p_0	q_0	p_1	q_1	$p_0 q_0$	$p_1 q_1$
p	10	6	60	7	60	420
Q	20	4	70	6	80	420
R	30	7	80	8	210	640
S	40	8	90	9	320	810
T	50	3	100	5	150	500
Total					820	2790

Note : that $\sum p_0 q_0 = 820$, $\sum p_1 q_1 = 2790$,

and, therefore, Value Index Number is given by

$$V_{01} = \frac{\sum p_1 q_1}{\sum p_0 q_0} \times 100$$

$$= \frac{2790}{820} \times 100$$

$$= 340.24$$

4. Find x in the following table if the Aggregate Price Index Number for year 1998 with respect to Base Year 1995 is 120.

Commodity	I	II	III	IV
Price in 1995	6	15	x	4
Price in 1998	8	18	28	6

Solution:

Table 5.4

Commodity	I	II	III	IV	Total
Price in 1995	6	15	x	4	$25 + x$
Price in 1998	8	18	28	6	60

From the above table, we have

$\sum p_0 = 25 + x$, $\sum p_1 = 60$, and

$P_{01} = 120$.

The value of x is then found from the formula

$$P_{01} = \frac{\sum p_1}{\sum p_0} \times 100$$

So that we obtain

$$120 = \frac{60}{25+x} \times 100$$

$$\therefore \quad 12 = \frac{60}{25+x} \times 10$$

$$\therefore \ 12(25 + x) = 600$$

$$\therefore \ 300 + 12x = 600$$

$$\therefore \quad 12x = 600 - 300$$

$$\therefore \quad 12x = 300$$

$$\therefore \quad x = 25.$$

Hence, $x = 25$.

5. The Price Index Number for year 2004, with respect to year 2000 as base year, is known to be 130. Find the missing numbers in the following table if

$\sum p_0 = 320$

Commodity	A	B	C	D	E	F
Price (in Rs.) in 2000	40	50	30	x	60	100
Price (in Rs.) in 2005	50	70	30	85	y	115

Solution:

We first tabulate the given data as shown in the following table.

Table 5.5

Commodities	Price in 2000 (Base year) p_0	Price in 2005 (Current year) p_1
A	40	50
B	50	70
C	30	30
D	x	85
E	60	y
F	100	115

From the above table, we have

$$\sum p_0 = 280 + x, \quad \sum p_1 = 350 + y,$$

But it is given that $\sum p_0 = 320$, so that

$$280 + x = 320$$

$$\therefore \quad x = 40$$

Further, using the formula

$$P_{01} = \frac{\sum p_1}{\sum p_0} \times 100$$

We have

$$130 = \frac{350 + y}{320} \times 100$$

$$\therefore \quad 416 = 350 + y$$

$$\therefore \quad y = 66.$$

EXERCISE 5.1

Find the Price Index Number using Simple Aggregate Method in each of the following examples.

1. Use 1995 as base year in the following problem.

Commodity	P	Q	R	S	T
Price (in Rs.) in 1995	15	20	24	23	28
Price (in Rs.) in 2000	27	38	32	40	45

2. Use 1995 as base year in the following problem.

Commodity	A	B	C	D	E
Price (in Rs.) in 1995	42	30	58	70	120
Price (in Rs.) in 2005	60	55	75	110	140

3.

Commodity	Unit	Base Year Price (in Rs.)	Current Year Price (in Rs.)
Wheat	kg	28	36
Rice	kg	40	56
Milk	litre	32	45
Clothing	meter	82	104
Fuel	litre	58	72

4. Use 2000 as base year in the following problem.

Commodity	Price (in Rs.) for year 2000	Price (in Rs.)for year 2006
Watch	900	1475
Shoes	1800	2300
Sunglasses	600	1040
Mobile	4500	8500

5. Use 1990 as base year in the following problem.

Commodity	Unit	Price (in Rs.) for 1990	Price (in Rs.) for 1997
Butter	kg	21	33
Cheese	kg	30	36
Milk	litre	25	29
Bread	loaf	10	14
Eggs	doz	24	36
Ghee	tin	250	320

6. Assume 2000 to be base year in the following problem.

Fruit	Unit	Price (in Rs.) in 2000	Price (in Rs.) in 2007
Mango	doz	250	300
Banana	doz	12	24
Apple	kg	80	110
Peach	kg	75	90
Orange	doz	33	65
Sweet Lime	doz	30	45

7. Use 2005 as base year in the following problem.

Vegetable	Unit	Price (in Rs.) in 2005	Price (in Rs.) in 2012
Ladies Finger	kg	32	38
Capsicum	kg	30	36
Brinjal	kg	40	60
Tomato	kg	40	62
Potato	kg	18	28

Find the Quantity Index Number using Simple Aggregate Method in each of the following examples.

8.

Commodity	I	II	III	IV	V
Base Year Quantities	140	120	100	200	220
Current Year Quantities	100	80	70	150	185

9.

Commodity	A	B	C	D	E
Base Year Quantities	360	280	340	160	260
Current Year Quantities	440	320	470	210	300

Find the Value Index Number using Simple Aggregate Method in each of the following examples.

10.

Commodity	Base Year		Current Year	
	Price	Quantity	Price	Quantity
A	30	22	40	18
B	40	15	60	12
C	10	38	15	24
D	50	12	60	16
E	20	28	25	36

11.

Commodity	Base Year		Current Year	
	Price	Quantity	Price	Quantity
A	50	22	70	14
B	70	16	90	22
C	60	19	105	14
D	120	12	140	15
E	100	22	155	28

12. Find x if the Price Index Number by Simple Aggregate Method is 125.

Commodity	P	Q	R	S	T
Base Year Price (in Rs.)	8	12	16	22	18
Current Year Price (in Rs.)	12	18	x	28	22

13. Find y if the Price Index Number by Simple Aggregate Method is 120, taking 1995 as base year

Commodity	A	B	C	D
Price (in Rs.) for 1995	95	y	80	35
Price (in Rs.) for 2003	116	74	92	42

5.4.2 Method 2: Weighted Aggregate Method

This method assigns suitable weights to different commodities before aggregating their prices, quantities, or values. These weights indicate relative importance of various commodities in the group. If w denotes the weight attached to a commodity, then the Price Index Number is given by

$$P_{01} = \frac{\sum p_1 w}{\sum p_0 w} \times 100$$

Weights are usually defined in terms of quantities in the weighted aggregate method. Index numbers constructed by the weighted aggregate method are known by names of the developers of these index numbers. Following are most popular price index numbers constructed by the weighted aggregate method.

(a) Laspeyre's Price Index Number

$$P_{01}(L) = \frac{\sum p_1 q_0}{\sum p_0 q_0} \times 100$$

Note: This construction uses base year quantities as weights.

(b) Paasche's Price Index Number

$$P_{01}(P) = \frac{\sum p_1 q_1}{\sum p_0 q_1} \times 100$$

Note: This construction uses current year quantities as weights.

(c) Dorbish-Bowley's Price Index Number

$$P_{01}(D-B) = \frac{\frac{\sum p_1 q_0}{\sum p_0 q_0} + \frac{\sum p_1 q_1}{\sum p_0 q_1}}{2} \times 100$$

(d) Fisher's Ideal Price Index Number

$$P_{01}(F) = \sqrt{\frac{\sum p_1 q_0}{\sum p_0 q_0} \times \frac{\sum p_1 q_1}{\sum p_0 q_1}} \times 100$$

Question:

Can you find any relation among Laspeyre's, Paasche's, Dorbish-Bowley's and Fisher's Price Index Number?

(e) Marshall-Edgeworth's Price Index Number

$$P_{01}(M-E) = \frac{\sum p_1 (q_0 + q_1)}{\sum p_0 (q_0 + q_1)} \times 100$$

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

(f) Walsh's Price Index Number

$$P_{01}(W) = \frac{\sum p_1 \sqrt{q_0 q_1}}{\sum p_0 \sqrt{q_0 q_1}} \times 100$$

SOLVED EXAMPLES

1. Calculate (a) Laspeyre's, (b) Paasche's, (c) Dorbish-Bowley's and Marshall-Edgeworth's Price Index Number for the following data.

Commodity	Base Year		Current Year	
	Price	Quantity	Price	Quantity
p	12	20	18	24
Q	14	12	21	16
R	8	10	12	18
S	16	15	20	25

Solution:

Let us first prepare the following table.

Table 5.6

Commodity	Base Year		Current Year		$p_0 q_0$	$p_1 q_0$	$p_0 q_1$	$p_1 q_1$
	p_0	q_0	p_1	q_1				
P	12	20	18	24	240	360	288	432
Q	14	12	21	16	168	252	224	336
R	8	10	12	18	80	120	144	216
S	16	15	20	25	240	300	400	500
Total					728	1032	1056	1484

From the above table, we have

$\sum p_0 q_0 = 728$, $\sum p_1 q_0 = 1032$

$\sum p_0 q_1 = 1056$ $\sum p_1 q_1 = 1484$

(a) Laspeyre's Price Index Number is then

$$P_{01}(L) = \frac{\sum p_1 q_0}{\sum p_0 q_0} \times 100$$

$$= \frac{1032}{728} \times 100$$

$$\therefore P_{01}(L) = 141.76$$

(b) Paasche's Price Index Number is given by

$$P_{01}(P) = \frac{\sum p_1 q_1}{\sum p_0 q_1} \times 100$$

$$= \frac{1484}{1056} \times 100$$

$$\therefore \; P_{01}(P) = 140.53$$

(c) Dorbish-Bowley's Price Index Number is given by

$$P_{01}(D-B) = \frac{P_{01}(L)+P_{01}(P)}{2}$$

$$= \frac{141.76+140.53}{2}$$

$$= 141.15$$

(d) Marshall-Edgeworth's Price Index Number is given by

$$P_{01}(M-E) = \frac{\left(\sum p_1 q_0 + \sum p_1 q_1\right)}{\left(\sum p_0 q_0 + \sum p_0 q_1\right)} \times 100$$

$$= \frac{(1032+1484)}{(728+1056)} \times 100$$

$$= \frac{2516}{1784} \times 100 = 141.03$$

$$\therefore \; P_{01}(M-E) = 141.03$$

2. Calculate Walsh's Price Index Number for the following data.

Commodity	Base Year		Current Year	
	Price	Quantity	Price	Quantity
A	20	9	30	4
B	10	5	50	5
C	40	8	10	2
D	30	4	20	1

Solution: Let us prepare the following table.

Table 5.7

Comm-odity	Base Year		Current Year		$\sqrt{q_0 q_1}$	$p_0\sqrt{q_0 q_1}$	$p_1\sqrt{q_0 q_1}$
	p_0	q_0	p_1	q_1			
A	20	9	30	4	6	120	180
B	10	5	50	5	5	50	250
C	40	8	10	2	4	160	40
D	30	4	20	1	2	60	40
Total						390	510

From the above table, we get

$$\sum p_0\sqrt{q_0 q_1} = 390$$

$$\sum p_1\sqrt{q_0 q_1} = 510$$

Walsh's Price Index Number is given by

$$P_{01}(W) = \frac{\sum p_1\sqrt{q_0 q_1}}{\sum p_0\sqrt{q_0 q_1}} \times 100$$

$$= \frac{510}{390} \times 100$$

$$= \frac{5100}{39}$$

$$\therefore \; P_{01}(W) = 130.77$$

3. If $P_{01}(L) = 225, P_{01}(P) = 144$, then calculate $P_{01}(F)$ and $P_{01}(D-B)$

Solution :

Given $P_{01}(L) = 225, P_{01}(P) = 144$, we obtain

$$P_{01}(F) = \sqrt{P_{01}(L) \times P_{01}(P)}$$

$$= \sqrt{225 \times 144}$$

$$= 15 \times 12$$

$$\therefore \; P_{01}(F) = 180$$

Next,

$$P_{01}(D-B) = \frac{P_{01}(L)+P_{01}(P)}{2}$$

$$= \frac{225+144}{2}$$

$$\therefore \; P_{01}(D-B) = 184.50$$

Example 4:

Find the missing price in the following table if Laspeyre's and Paasche's Price Index Numbers are the same.

Commodity	Base Year		Current Year	
	Price	Quantity	Price	Quantity
A	1	10	2	5
B	1	5	-	2

Solution:

Let us denote the missing value by x, and reconstruct the table as follows.

Table 5.8

Comm-odity	Base Year		Current Year		p_0q_0	p_1q_0	p_1q_1	p_0q_1
	p_0	q_0	p_1	q_1				
A	1	10	2	5	10	20	10	5
B	1	5	x	2	5	$5x$	$2x$	2
Total					15	20+5x	10+2x	7

The above table gives

$\sum p_0q_0 = 15$, $\quad \sum p_1q_0 = 20+5x$

$\sum p_0q_1 = 7$ $\quad \sum p_1q_1 = 10+2x$

It is given that

$$P_{01}(L) = P_{01}(P)$$

$$\frac{\sum p_1q_0}{\sum p_0q_0} \times 100 = \frac{\sum p_1q_1}{\sum p_0q_1} \times 100$$

$$\therefore \quad \frac{5x+20}{15} = \frac{2x+10}{7}$$

$$\therefore \quad \frac{5(x+4)}{15} = \frac{2x+10}{7}$$

$$\therefore \quad 7(x+4) = 3(2x+10)$$

$$\therefore \quad 7x+28 = 6x+30$$

$$\therefore \quad x = 2.$$

The missing price is 2.

5. If $\sum p_0q_0 = 120$, $\sum p_0q_1 = 200$

$\sum p_1q_1 = 300$, and $P_{01}(L) = 150$, find

$P_{01}(M-E)$.

Solution: Note that

$$P_{01}(L) = \frac{\sum p_1q_0}{\sum p_0q_0} \times 100$$

$$\therefore \ 150 = \frac{\sum p_1q_0}{120} \times 100$$

$$\therefore \ \sum p_0q_1 = 15 \times 12$$

$$\therefore \ \sum p_0q_1 = 180.$$

Now,

$$P_{01}(M-E) = \frac{\left(\sum p_1q_0 + \sum p_1q_1\right)}{\left(\sum p_0q_0 + \sum p_0q_1\right)} \times 100$$

$$= \frac{180+300}{120+200} \times 100$$

$$= \frac{480}{320} \times 100$$

$$\therefore \ P_{01}(M-E) = 150.$$

6. If $\sum p_0q_0 = 180$, $\sum p_1q_0 = 200$

$\sum p_1q_1 = 280$, and $P_{01}(M-E) = 150$,

find $P_{01}(P)$.

Solution:

Let us denote $\sum p_0q_1$ by x. Then, using the fact that

$$P_{01}(M-E) = \frac{\left(\sum p_1q_0 + \sum p_1q_1\right)}{\left(\sum p_0q_0 + \sum p_0q_1\right)} \times 100$$

$$\therefore \quad 150 = \frac{200+280}{180+x} \times 100$$

$$\therefore \ 15(180+x) = 4800$$

$$\therefore\ 180 + x = \frac{4800}{15}$$

$$\therefore\ 180 + x = 320$$

$$\therefore\ x = 140$$

$$\therefore\ \sum p_0 q_1 = 140.$$

Now,

$$P_{01}(P) = \frac{\sum p_1 q_1}{\sum p_0 q_1} \times 100$$

$$= \frac{280}{140} \times 100$$

$$\therefore\ P_{01}(P) = 200$$

EXERCISE 5.2

Calculate Laspeyre's, Paasche's, Dorbish-Bowley's and Marshall-Edgeworth's Price Index Numbers in Problems 1 and 2

1.

Commodity	Base Year		Current Year	
	Price	Quantity	Price	Quantity
A	8	20	11	15
B	7	10	12	10
C	3	30	5	25
D	2	50	4	35

2.

Commodity	Base Year		Current Year	
	Price	Quantity	Price	Quantity
I	10	9	20	8
II	20	5	30	4
III	30	7	50	5
IV	40	8	60	6

Calculate Walsh's Price Index Number in Problem 3 and 4.

3.

Commodity	Base Year		Current Year	
	Price	Quantity	Price	Quantity
L	4	16	3	9
M	6	16	2	4
N	8	28	7	7

4.

Commodity	Base Year		Current Year	
	Price	Quantity	Price	Quantity
I	10	16	20	9
II	20	2	25	8
III	30	3	40	27
IV	60	9	75	36

5. If $P_{01}(L) = 90$, and $P_{01}(P) = 40$, find $P_{01}(D-B)$ and $P_{01}(F)$

6. If $\sum p_0 q_0 = 140, \sum p_0 q_1 = 200,$ $\sum p_1 q_0 = 350,\ \sum p_1 q_1 = 460,$ find Laspeyre's, Paasche's, Dorbish-Bowley's and Marshall-Edgeworth's Price Index Numbers.

7. Given that Laspeyre's and Dorbish-Bowley's Price Index Numbers are 160.32 and 164.18 respectively. Find Paasche's Price Index Number.

8. Given that $\sum p_0 q_0 = 220, \sum p_0 q_1 = 380,$ $\sum p_1 q_1 = 350$ and Marshall-Edgeworth's Price Index Number is 150, find Laspeyre's Price Index Number.

9. Find x in the following table if Laspeyre's and Paasche's Price Index Numbers are equal.

Commodity	Base Year		Current Year	
	Price	Quantity	Price	Quantity
A	2	10	2	5
B	2	5	x	2

10. If Laspeyre's Price Index Number is four times Paasche's Price Index Number, then find the relation between Dorbish-Bowley's and Fisher's Price Index Numbers.

11. If Dorbish-Bowley's and Fisher's Price Index Numbers are 5 and 4, respectively, then find

Laspeyre's and Paasche's Price Index Numbers.

5.5 Cost of Living Index Number

Cost of Living Index Number, also known as Consumer Price Index Number, is an index number of the cost of buying goods and services in day-to-day life for a specific consumer class. Different classes of consumers show different patterns of consumption of goods and services. As a result, a general index number cannot reflect changes in cost of living for a specific consumer class. For example, cost of living index numbers for rural population are different from cost of living index numbers for urban population. The goods and services consumed by members of different consumer classes can be different and therefore cost of living index numbers calculated for different consumer classes can be based on costs of different sets of goods and services.

Steps in Construction of Cost of Living Index Numbers

Construction of cost of living index numbers involves the following steps:

1. Choice of Base Year:

The first step in preparing cost of living index numbers is choice of base year. Base years defined as that year with reference to which price changes in other years are compared and expressed as percentages. The base year should be a normal year. It should be free from abnormal conditions like wars, famines, floods, political instability, etc.

Base year can be chosen in two ways:

(a) Using fixed base method, where the base year remains fixed; and

(b) Using chain base method, where the base year goes on changing. For example, 1979 will be the base year for 1980, it will be 1978 for 1979, and so on.

2. Choice of Commodities:

The second step in construction of cost of living index numbers is choosing the commodities. Since all commodities cannot be included, only representative commodities should be chosen according to the purpose of the index number.

In choosing commodities, the following points must be kept in mind:

(a) The commodities must represent the tastes, habits and customs of the people.

(b) Commodities should be recognizable.

(c) Commodities should have the same quality over different periods and places.

(d) The economic and social importance of different commodities should be taken in consideration.

(e) The commodities should be sufficiently large in number,

(f) All varieties of a commodity should be included that are in common use and are stable in nature.

3. Collection of Prices:

After choosing the commodities, the next step is collection of their prices. The following points are important while collecting prices of commodities chosen for constructing cost of living index numbers.

(a) From where prices are to be collected.

(b) Whether to collect wholesale prices or retail prices.

(c) Whether to include taxes in prices.

Following points are to be noted while collecting prices:

(a) Prices must be collected from places where a particular commodity is traded in large quantities

(b) If published information on prices is available, it must be used,

(c) Care should be taken while collecting price quotations from individuals or institutions that they provide correct information.

(d) Choice of wholesale or retail prices depends on the purpose of preparing

index numbers. Wholesale prices are used in the construction of general price index, while retail prices are used in the construction of cost of living index.

(e) Prices must be averaged if collected from several sources.

4. Choice of Average:

Since the index numbers are a specialized average, it is important to choose a suitable average. Geometric mean is theoretically the best, but arithmetic mean is used in practice because it is easier to calculate.

5. Choice of Weights:

Generally, all the commodities included in the construction of index numbers are not equally important. Therefore, proper weights must be assigned to the commodities according to their relative importance. For example, cost of living index for teachers will assign higher weightage to prices of books than cost of living index for workers. Weights should be chosen rationally and not arbitrarily.

6. Purpose of Index Numbers:

The most important consideration in the construction of index numbers is their objective. All other steps are to be viewed in light of the purpose for which a particular index number is being prepared. Since every index number is prepared with a specific purpose, no single index number can be 'all purpose' index number. It is important to have a clear idea about the purpose of the index number before it is constructed.

Methods of constructing Cost of Living Index Numbers

5.5.1 Aggregative Expenditure Method (Weighted Aggregate Method)

This method uses quantities consumed in base year as weights, so that Cost of Living Index Number is defined as follows.

$$\text{CLI} = \frac{\text{Total expendutre in current year}}{\text{Total expendutre in base year}} \times 100$$

$$= \frac{\sum p_1 q_0}{\sum p_0 q_0} \times 100$$

The above formula is similar to that of a weighted Index Number. Do you recognize that Index Number?

5.5.2 Family Budget Method (Weighted Relative Method)

Cost of Living Index Number is defined as follows.

$$\text{CLI} = \frac{\sum IW}{\sum W}$$

where

$$I = \frac{p_1}{p_0} \times 100$$

= price relative for current year

and

$$W = p_0 q_0$$

= base year weightage.

Do you find the above two methods of calculating the Cost of Living Index Numbers to be same?

SOLVED EXAMPLES

1. Construct the Cost of Living Index Number for the following data.

Group	Base Year		Current Year
	Price	Quantity	Price
Food & Clothing	40	3	70
Fuel & Lighting	30	5	60
House Rent	50	2	50
Miscellaneous	60	3	90

Solution:

We shall begin by preparing the following table.

Group	Base Year		Current Year	p_1q_0	p_0q_0
	p_0	q_0	p_1		
Food & Clothing	40	3	70	210	120
Fuel & Lighting	30	5	60	300	150
House Rent	50	2	50	100	100
Miscellaneous	60	3	90	270	180
Total				880	550

We shall use Aggregative Expenditure Method since p_0, q_0 and p_1 are given.

$$\text{CLI} = \frac{\sum p_1q_0}{\sum p_0q_0} \times 100$$

$$= \frac{880}{550} \times 100$$

$$\therefore \text{CLI} = 160.$$

Interpretation. A person earning Rs 100 in the base year, should earn Rs 160 in the current year to maintain the same standard of living.

2. The following table gives the base year weightage (W) and current year price relative (I) for five commodities. Calculate the Cost of Living Index Number.

Group	Food	Cloth-ing	Fuel & Light-ing	House Rent	Misce-llane-ous
I	120	100	140	160	150
W	3	6	5	2	4

Solution:

We use Family Budget Method since I and W are given. For this, we prepare the following table.

Table 5.10

Group	I	W	IW
Food	120	3	360
Clothing	100	6	600
Fuel & Lighting	140	5	700
House Rent	160	2	320
Miscellaneous	150	4	600
Total	-	20	2580

The above table shows that $\sum W = 20$ and $\sum IW = 2580$, and

$$\therefore \text{CLI} = \frac{\sum IW}{\sum W}$$

$$= \frac{2580}{20}$$

$$\therefore \text{CLI} = 129.$$

3. Find x in the following table if the Cost of Living Index Number is 121.

Group	Food	Cloth-ing	Fuel & Light-ing	House Rent	Misce-llane-ous
I	100	125	174	x	90
W	13	12	10	8	7

Solution:

First, we prepare the following table.

Group	I	W	IW
Food	100	13	1300
Clothing	125	12	1500
Fuel & Lighting	174	10	1740
House Rent	x	8	$8x$
Miscellaneous	90	7	630
Total	-	50	$5170+8x$

It can be found from the above table that

$$\sum W = 50 \text{ and } \sum IW = 5170 + 8x$$

$$\therefore \quad \text{CLI} = \frac{\sum IW}{\sum W}$$

$$\therefore \quad 121 = \frac{5170 + 8x}{50}$$

$$\therefore \quad 6050 = 5170 + 8x$$

$$\therefore \quad x = 110.$$

4. Cost of Living Index Numbers for the years 2000 and 2005 are 120 and 200, respectively. If a person has monthly earnings of Rs 10800 in year 2000, what should be his monthly earnings in year 2005 in order to maintain same standard of living?

Solution:

For the year 2000, it is given that CLI = 120, and Income = Rs 10800. These two give us real income as follows.

$$\text{Real Income} = \frac{\text{Income}}{\text{CLI}} \times 100$$

$$= \frac{10800}{120} \times 100$$

$$\therefore \text{ Real Income} = 9000.$$

This shows that the real income is Rs 9000.

The CLI for year 2005 is 220.

$$\text{Real Income} = \frac{\text{Income}}{\text{CLI}} \times 100$$

$$\therefore \quad 9000 = \frac{\text{Income}}{220} \times 100$$

$$\therefore \quad \text{Income} = 19800.$$

This shows that the monthly income of the person should be Rs 19800 in year of 2005 in order to maintain the same standard of living as in year 2000

5. Calculate the Cost of Living Index Number for the year 1999 by Family Budget Method from the following data. Also, find the expenditure of a person in year 1999 if his expenditure in year 1995 was 800.

Group	Price in year 1995	Price in year 1999	W
Food	8	24	6
Clothing	18	36	12
Fuel & Lighting	20	40	8
House Rent	15	30	4
Miscellaneous	10	22	10

Solution:

Let us first prepare the following table.

Table 5.12

Group	Price in year 1995	Price in year 1999	$I = \frac{p_1}{p_0} \times 100$	W	IW
Food	8	24	300	6	1800
Clothing	18	36	200	12	2400
Fuel & Lighting	20	40	200	8	1600
House Rent	15	30	200	4	800
Miscellaneous	10	22	220	10	2200
Total	-	-	-	40	8800

By Family Budget Method,

$$\therefore \quad \text{CLI} = \frac{\sum IW}{\sum W}$$

$$= \frac{8800}{40}$$

$$\therefore \quad \text{CLI} = 220$$

Now, the expenditure in 1995 was Rs 800. In other words, the expenditure is Rs 800 when CLI is 100. The question is to find expenditure when CLI is 220 in 1999.

$$\therefore \text{ Expenditure in 1999} = \frac{220}{100} \times 800$$

$$= 1760$$

Thus, the expenditure in 1999 is Rs 1760.

EXERCISE 5.3

Calculate the cost of living index in problems 1 to 3.

1.

Group	Base Year		Current Year
	Price	Quantity	Price
Food	120	15	170
Clothing	150	20	190
Fuel & Lighting	130	30	220
House Rent	160	10	180
Miscellaneous	200	12	200

2.

Group	Base Year		Current Year
	Price	Quantity	Price
Food	40	15	45
Clothing	30	10	35
Fuel & Lighting	20	25	25
House Rent	60	20	70
Miscellaneous	70	20	80

3.

Group	Base Year		Current Year
	Price	Quantity	Price
Food	130	10	170
Clothing	150	12	160
Fuel & Lighting	162	20	180
House Rent	170	18	195
Miscellaneous	120	5	120

Base year weights (W) and current year price relatives (I) are given in Problems 4 to 8. Calculate the cost of living index in each case

4.

Group	Food	Cloth-ing	Fuel & Light-ing	House Rent	Misce-llane-ous
I	70	90	100	60	80
W	5	3	2	4	6

5.

Group	Food	Cloth-ing	Fuel & Light-ing	House Rent	Misce-llane-ous
I	400	300	150	120	100
W	3	3	4	5	2

6.

Group	Food	Cloth-ing	Fuel & Light-ing	House Rent	Misce-llane-ous
I	200	150	120	180	160
W	30	20	10	40	50

7. Find x if the cost of living index is 150.

Group	Food	Cloth-ing	Fuel & Light-ing	House Rent	Misce-llane-ous
I	180	120	300	100	160
W	4	5	6	x	3

8. Find y if the cost of living index is 200

Group	Food	Cloth-ing	Fuel & Light-ing	House Rent	Misce-llane-ous
I	180	120	160	300	200
W	4	5	3	y	2

9. The Cost of Living Index Number for years 1995 and 1999 are 140 and 200 respectively. A person earns Rs. 11,200 per month in the year 1995. What should be his monthly earnings in the year 1999 in order to maintain his standard of living as in the year 1995 ?

5.6 Uses of Cost of Living Index Number

1. Cost of Living Index Number is used to regulate the dearness allowance or the grant of bonus to employees in order to enable them bear the increased cost of living.
2. Cost of Living Index Number is used for settling dispute related to salaries and wages.
3. Cost of Living Index Number is used in calculating purchasing power of money.

   Purchasing power of money

   $$= \frac{1}{\text{Cost of Living Index Number}}$$
4. Cost of Living Index Number is used in determining real wages.

   $$= \frac{\text{Real Wages}}{\text{Money wages}} \times 100$$
   $$\text{Cost of Living Index Number}$$
5. Cost of Living Index Numbers are widely used in negotiations of wages in wage contracts.

Let's Remember

- There are three types of index numbers.
  - (i) Price Index Number
  - (ii) Quantity Index Number
  - (iii) Value Index Number
- There are two methods of constructing index numbers.
  - (i) Simple Aggregate Method
  - (ii) Weighted Aggregate Method
- Price Index Number using Simple aggregate method is calculated by the following formula.

$$P_{01} = \frac{\sum p_1}{\sum p_0} \times 100$$

Where

P_{01} : Price index Number for the current year with respect to base year

P_1 : Price of the commodity in current year

P_0 : Price of the commodity in base year

- Price Index Number using Weighted Aggregate Method is calculated by the following formula.

$$P_{01} = \frac{\sum p_1 w}{\sum p_0 w} \times 100$$

Where

w : Weight assigned to a commodity

- **Laspeyre's Price Index Number**

$$P_{01}(L) = \frac{\sum p_1 q_0}{\sum p_0 q_0} \times 100$$

- **Paasche's Price Index Number**

$$P_{01}(P) = \frac{\sum p_1 q_1}{\sum p_0 q_1} \times 100$$

- **Dorbish-Bowley's Price Index Number**

$$P_{01}(D\text{–}B) = \frac{\frac{\sum p_1 q_0}{\sum p_0 q_0} + \frac{\sum p_1 q_1}{\sum p_0 q_1}}{2} \times 100$$

- **Fisher's Price Index Number**

$$P_{01}(F) = \sqrt{\frac{\sum p_1 q_0}{\sum p_0 q_0} \times \frac{\sum p_1 q_1}{\sum p_0 q_1}} \times 100$$

- **Marshall-Edgeworth's Price Index Number**

$$P_{01}(M-E) = \frac{\sum p_1 (q_0 + q_1)}{\sum p_0 (q_0 + q_1)} \times 100$$

- **Walsh's Price Index Number**

$$P_{01}(W) = \frac{\sum p_1 \sqrt{q_0 q_1}}{\sum p_0 \sqrt{q_0 q_1}} \times 100$$

- **Cost of Living Index Number using Aggregate Expenditure Method**

$$\text{CLI} = \frac{\sum p_1 q_0}{\sum p_0 q_0} \times 100$$

- **Cost of Living Index Number using Weighted Relative Method**

$$\text{CLI} = \frac{\sum IW}{\sum W}$$

where $I = \frac{p_1}{p_0} \times 100$

and $w = p_0 q_0$

MISCELLANEOUS EXERCISE - 5

I) Choose the correct alternative.

1. Price Index Number by Simple Aggregate Method is given by

(a) $\sum \frac{p_1}{p_0} \times 100$

(b) $\sum \frac{p_0}{p_1} \times 100$

(c) $\frac{\sum p_1}{\sum p_0} \times 100$

(d) $\frac{\sum p_0}{\sum p_1} \times 100$

2. Quantity Index Number by Simple Aggregate Method is given by

(a) $\sum \frac{q_1}{q_0} \times 100$

(b) $\sum \frac{q_0}{q_1} \times 100$

(c) $\frac{\sum q_1}{\sum q_0} \times 100$

(d) $\frac{\sum q_0}{\sum q_1} \times 100$

3. Value Index Number by Simple Aggregate Method is given by

(a) $\sum \frac{p_1 q_0}{p_0 q_1} \times 100$

(b) $\sum \frac{p_0 q_1}{p_0 q_0} \times 100$

(c) $\frac{\sum p_1 q_1}{\sum p_1 q_0} \times 100$

(d) $\frac{\sum p_1 q_1}{\sum p_0 q_0} \times 100$

4. Price Index Number by Weighted Aggregate Method is given by

(a) $\sum \frac{p_1 w}{p_0 w} \times 100$

(b) $\sum \frac{p_0 w}{p_1 w} \times 100$

(c) $\frac{\sum p_1 w}{\sum p_0 w} \times 100$

(d) $\frac{\sum p_0 w}{\sum p_1 w} \times 100$

5. Quantity Index Number by Weighted Aggregate Method is given by

(a) $\sum \frac{q_1 w}{q_0 w} \times 100$

(b) $\sum \frac{q_0 w}{q_1 w} \times 100$

(c) $\frac{\sum q_1 w}{\sum q_0 w} \times 100$

(d) $\frac{\sum q_0}{\sum q_1} \times 100$

6. Value Index Number by Weighted Aggregate Method is given by

(a) $\sum \frac{p_1 q_0 w}{p_0 q_0 w} \times 100$

(b) $\sum \frac{p_0 q_1 w}{p_0 q_0 w} \times 100$

(c) $\frac{\sum p_1 q_1 w}{\sum p_0 q_1 w} \times 100$

(d) $\frac{\sum p_1 q_1 w}{\sum p_0 q_0 w} \times 100$

7. Laspeyre's Price Index Number is given by

(a) $\frac{\sum p_0 q_0}{\sum p_1 q_0} \times 100$

(b) $\frac{\sum p_0 q_1}{\sum p_1 q_1} \times 100$

(c) $\frac{\sum p_1 q_0}{\sum p_0 q_0} \times 100$

(d) $\frac{\sum p_1 q_1}{\sum p_0 q_1} \times 100$

8. Paasche's Price Index Number is given by

(a) $\frac{\sum p_0 q_0}{\sum p_1 q_0} \times 100$

(b) $\frac{\sum p_0 q_1}{\sum p_1 q_1} \times 100$

(c) $\frac{\sum p_1 q_0}{\sum p_0 q_0} \times 100$

(d) $\frac{\sum p_1 q_1}{\sum p_0 q_1} \times 100$

9. Dorbish-Bowley's Price Index Number is given by

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

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

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

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

10. Fisher's Price Number is given by

(a) $\sqrt{\frac{\sum p_1 q_0}{\sum p_0 q_0} \times \frac{\sum p_1 q_1}{\sum p_0 q_1}} \times 100$

(b) $\sqrt{\frac{\sum p_0 q_0}{\sum p_1 q_0} \times \frac{\sum p_0 q_1}{\sum p_1 q_1}} \times 100$

(c) $\sqrt{\frac{\sum p_0 q_1}{\sum p_0 q_0} \times \frac{\sum p_1 q_1}{\sum p_1 q_0}} \times 100$

(d) $\sqrt{\frac{\sum p_1 q_0}{\sum p_1 q_1} \times \frac{\sum p_0 q_0}{\sum p_0 q_1}} \times 100$

11. Marshall-Edgeworth's Price Index Number is given by

(a) $\frac{\sum p_1 (q_0 + q_1)}{\sum p_0 (q_0 + q_1)} \times 100$

(b) $\frac{\sum p_0 (q_0 + q_1)}{\sum p_1 (q_0 + q_1)} \times 100$

(c) $\frac{\sum q_1 (p_0 + p_1)}{\sum q_0 (p_0 + p_1)} \times 100$

(d) $\frac{\sum q_1 (p_0 + p_1)}{\sum q_0 (p_0 + p_1)} \times 100$

12. Walsh's Price Index Number is given by

(a) $\frac{\sum p_1 \sqrt{q_0 q_1}}{\sum p_0 \sqrt{q_0 q_1}} \times 100$

(b) $\frac{\sum p_0\sqrt{q_0q_1}}{\sum p_1\sqrt{q_0q_1}} \times 100$

(c) $\frac{\sum q_1\sqrt{p_0p_1}}{\sum q_0\sqrt{p_0p_1}} \times 100$

(d) $\frac{\sum q_0\sqrt{p_0p_1}}{\sum q_1\sqrt{p_0p_1}} \times 100$

13. The Cost of Living Index Number using Aggregate Expenditure Method is given by

(a) $\frac{\sum p_1q_0}{\sum p_0q_0} \times 100$

(b) $\sum \frac{p_1q_1}{p_0q_1} \times 100$

(c) $\frac{\sum p_1q_1}{\sum p_0q_1} \times 100$

(d) $\sum \frac{p_1q_0}{p_0q_0} \times 100$

14. The Cost of Living Index Number using Weighted Relative Method is given by

(a) $\frac{\sum IW}{\sum W}$

(b) $\sum \frac{W}{IW}$

(c) $\frac{\sum W}{\sum IW}$

(d) $\sum \frac{IW}{W}$

II) Fill in the blanks.

1. Price Index Number by Simple Aggregate Method is given by _____.
2. Quantity Index Number by Simple Aggregate Method is given by _____.
3. Value Index Number by Simple Aggregate Method is given by _____.
4. Price Index Number by Weighted Aggregate Method is given by _____.
5. Quantity Index Number by Weighted Aggregate Method is given by _____.
6. Value Index Number by Weighted Aggregate Method is given by _____.
7. Laspeyre's Price Index Number is given by _____.
8. Paasche's Price Index Number is given by _____.
9. Dorbish-Bowley's Price Index Number is given by _____.
10. Fisher's Price Index Number is given by _____.
11. Marshall-Edgeworth's Price Index Number is given by _____.
12. Walsh's Price Index Number is given by _____.

III) State whether each of the following is True or False.

1. $\frac{\sum p_1}{\sum p_0} \times 100$ is the Price Index Number by Simple Aggregate Method. .
2. $\frac{\sum q_0}{\sum q_1} \times 100$ is the Quantity Index Number by Simple Aggregate Method.
3. $\sum \frac{p_0q_0}{p_1q_1} \times 100$ is Value Index Number by Simple Aggregate Method.
4. $\sum \frac{p_1q_0}{p_0q_0} \times 100$ is Paasche's Price Index Number.
5. $\frac{\sum p_1q_1}{\sum p_0q_1} \times 100$ is Laspeyre's Price Index Number.

6. $\frac{\sum p_1q_0}{\sum p_0q_0} \times \frac{\sum p_1q_0}{\sum p_0q_0} \times 100$ is Dorbish-Bowley's Price Index Number.

7. $\frac{1}{2}\left[\sqrt{\frac{\sum p_1q_0}{\sum p_0q_0}} + \frac{\sqrt{p_1q_1}}{\sqrt{p_0q_1}}\right] \times 100$ is Fisher's Price Index Number.

8. $\frac{\sum p_0(q_0+q_1)}{\sum p_1(q_0+q_1)} \times 100$ is Marshall-Edgeworth's Price Index Number.

9. $\frac{\sum p_0\sqrt{q_0q_1}}{\sum p_1\sqrt{q_0q_1}} \times 100$ is Walsh's Price Index Number.

10. $\sqrt{\frac{p_1q_0}{\sum p_0q_0}} \times \sqrt{\frac{\sum p_1q_1}{\sum p_0q_1}} \times 100$ is Fisher's Price Index Number.

IV) Solve the following problems.

1. Find the Price Index Number using Simple Aggregate Method. Consider 1980 as base year.

Commodity	Price in 1980 (in Rs.)	Price in 1985 (in Rs.)
I	22	46
II	38	36
III	20	28
IV	18	44
V	12	16

2. Find the Quantity Index Number using Simple Aggregate Method.

Commodity	Based year quantity	Current year quantity
A	100	130
B	170	200
C	210	250
D	90	110
E	50	150

3. Find the Value Index Number using Simple Aggregate Method.

Commodity	Base Year		Current Year	
	Price	Quantity	Price	Quantity
I	20	42	22	45
II	35	60	40	58
III	50	22	55	24
IV	60	56	70	62
V	25	40	30	41

4. Find x if the Price Index Number using Simple Aggregate Method is 200

Commodity	P	Q	R	S	T
Base Year Price	20	12	22	23	13
Current Year Price	30	x	38	51	19

5. Calculate Laspeyre's and Paasche's Price Index Number for the following data.

Commodity	Base Year		Current Year	
	Price p_0	Quantity q_0	Price p_1	Quantity q_1
A	20	18	30	5
B	25	8	28	4
C	32	5	40	5
D	12	10	18	20

6. Calculate Dorbish-Bowley's Price Index Number for the following data.

Commodity	Base Year		Current Year	
	Price p_0	Quantity q_0	Price p_1	Quantity q_1
I	8	25	12	28
II	9	20	12	24
III	10	12	30	16

7. Calculate Marshall-Edgeworth's Price Index Number for the following data.

Commodity	Base Year		Current Year	
	Price p_0	Quantity q_0	Price p_1	Quantity q_1
X	12	35	15	25
Y	29	50	30	70

8. Calculate Walsh's Price Index Number for the following data.

Commodity	Base Year		Current Year	
	Price p_0	Quantity q_0	Price p_1	Quantity q_1
I	8	9	12	25
II	10	4	20	16

9. Calculate Laspeyre';s and Paasche's Price Index Number for the following data.

Commodity	Base Year		Current Year	
	Price p_0	Quantity q_0	Price p_1	Quantity q_1
I	8	30	12	25
II	10	42	20	16

10. Find x if Laseyre's Price Index Number is same as Paasche's Price Index Number for the following data.

Commodity	Base Year		Current Year	
	Price p_0	Quantity q_0	Price p_1	Quantity q_1
A	3	x	2	5
B	4	6	3	5

11. If find x is Walsh's Price Index Number is 150 for the following data.

Commodity	Base Year		Current Year	
	Price p_0	Quantity q_0	Price p_1	Quantity q_1
A	5	3	10	3
B	x	4	16	9
C	15	5	23	5
D	10	2	26	8

12. Find x if Paasche's Price Index Number is 140 for the following data.

Commodity	Base Year		Current Year	
	Price p_0	Quantity q_0	Price p_1	Quantity q_1
A	20	8	40	7
B	50	10	60	10
C	40	15	60	x
D	12	15	15	15

13. Given that Laspeyre's and Paasche's Price Index Numbers are 25 and 16 respectively. Find Dorbish-Bowley's and Fisher's Price Index Number.

14. If Laspeyre's and Dorbish's Price Index Numbers are 150.2 and 152.8 respectively, find Paasche's Price Index Number.

15. If $\sum p_0q_0 = 120$, $\sum p_0q_1 = 160$, $\sum p_1q_1 = 140$, and $\sum p_1q_0 = 200$ find Laspeyre's, Paasche's, Dorbish-Bowley's, and Marshall-Edgeworth's Price Index Numbers.

16. Given that $\sum p_0q_0 = 130$, $\sum p_1q_1 = 140$, $\sum p_0q_1 = 160$, and $\sum p_1q_0 = 200$, find Laspeyre's, Paasche's, Dorbish-Bowley's, and Marshall-Edgeworth's Price Index Numbers.

17. Given that $\sum p_1q_1 = 300$, $\sum p_0q_1 = 320$, $\sum p_0q_0 = 120$, and Marshall-Edgeworth's Price Index Number is 120, find Laspeyre's Price Index Number.

18. Calculate the cost of living number for the following data.

Group	Base Year		Current Year
	Price p_0	Quantity q_0	Price p_1
Food	140	13	160
Clothing	120	18	150
Fuel & Lighting	140	10	190
House Rent	160	12	210
Miscellaneous	180	15	260

19. Find the cost living index number by the weighted aggregate method.

Group	Food	Cloth-ing	Fuel & Light-ing	House Rent	Misce-llane-ous
I	78	80	110	60	90
W	5	3	4	2	6

20. Find the cost of living index number by Family Budget Method for the following data. Also, find the expenditure of a person in the year 2008 if his expenditure in the year 2005 was Rs. 10,000.

Group	Base Year (2005) Price	Current Year (2005) Price	Weight
Food	12	60	25
Clothing	10	45	20
Fuel & Lighting	20	35	15
House Rent	25	20	30
Miscellaneous	16	48	10

21. Find x if the cost of living index number is 193 for the following data.

Group	Food	Cloth-ing	Fuel & Light-ing	House Rent	Misce-llane-ous
I	221	198	171	183	161
W	35	14	x	8	20

22. The cost of living index number for year 2000 and 2003 are 150 and 210 respectively. A person earns Rs. 13,500 per month in the year 2000. What should be his monthly earning in the year 2003 in order to maintain the same standard of living ?

Activities

Try each of the following activities for better understanding of index numbers.

1. Find weekly prices of any five vegetables for at least six months. Taking the first week of observation as the base period, find price index numbers for the remaining five months for every vegetable.
2. Note the SENSEX for six months. Talking the first mouth as the base period, find price index numbers for the remaining five months.
3. Note inflation rate for six months. Taking the first month as the base period. Find price index numbers for the remaining five months.
4. Note petrol prices for six months. Taking the first months as the base period, find price index numbers for the remaining five months.
5. Note gold prices for six months. Taking the first month as the base period, find price index numbers for the remaining five months.