12

INDEX NUMBERS

Historically, it was Carli, an Italian Statistician, who constructed the first index number as early as 1764, to compare the prices of year 1750 with that of year 1500.

12.2 MEANING OF INDEX NUMBERS

An index number is a statistical device for measuring changes in the magnitude of a group of related variables.

- Index numbers measure the changes with respect to time, geographical location or some other characteristics. The comparison may be between categories such as persons, schools, hospitals etc.
- It also measures the changes in the value of variables like prices of specified list of commodities, volume of production in different sectors of an industry, production of various agricultural crops, cost of living etc.

Index numbers are known as 'Barometer of Economic Activity' as they are used to feel the pulse of the economy.

Definitions of Index Numbers

In the words of Edgeworth, "Index number shows by its variation the changes in a magnitude which is not susceptible either of accurate measurement in itself or of direct valuation in practice."

In the words of Tuttle, "An index number is a single ratio (usually in percentage) which measures the combined (i.e., averaged) change of several variables between two different times, places or situations".

In the words of Croxton and Cowden, "Index numbers are devices for measuring differences in the magnitude of a group of related variables".

In the words of Spiegal, "An index number is a statistical measure designed to show changes in variable or a group of related variables with respect to time, geographical location or other characteristic".

Features / Characteristics of Index Numbers

The various features of Index Numbers are:

1. Index numbers are specialised averages: Averages like mean, median or mode can be used to compare two or more series. However, if the units in which two or more series are expressed are different or if the series are composed of different types of items, then averages cannot be used to compare them. In such cases, index numbers help us in comparing change in series.

2. Index numbers are expressed in percentages: The changes in magnitude of a group are expressed in terms of percentages which are independent of the units of measurement. This facilitates the comparisons of two or more index numbers in different situations. *However, percentage sign (%) is never used.*

3. Index numbers measure the effect of changes in relation to time or place: Index numbers are used to compare changes which take place over periods of time, between locations, and in categories.

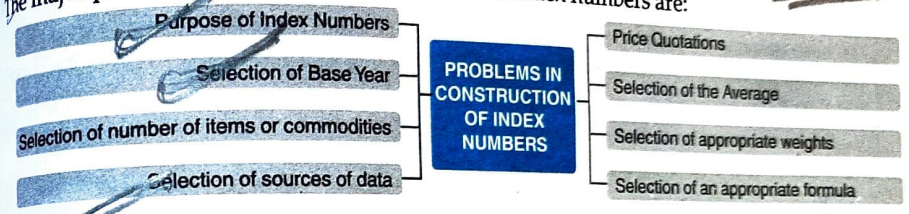
For example, cost of living may be different at two different places at the same time or cost of living in one city can be compared across two periods of time.

4. Index Numbers measure the change not capable of direct measurement: Index numbers are meant to study the changes in the effects of such factors which cannot be measured directly.

For example, cost of living cannot be measured in quantitative terms directly. We can only study relative changes in it by studying the variations in certain other factors connected to it.

12.3 PROBLEMS IN CONSTRUCTION OF INDEX NUMBERS

The major problems involved in construction of index numbers are:



1. Purpose of Index Numbers: *There is no 'All Purpose Index'.* Every index has a limited and specific use or purpose.
   - So, first step in the construction of index numbers is to carefully define and decide the purpose of its construction.
   - If we fail to decide the purpose of the index, then it would lead to confusion, wastage of time and money.
   - *For example,* if we want to measure the changes in prices and we have collected data of quantity consumption, then it is of no use.

2. Selection of Base Year: *The base period associated with an index number is a period of time that is used as a basis for comparing changes in prices or quantities in a given period.*
   - No matter what period of time is used as base period, the value of the index number for this period is always taken as 100.
   - The determination of base period primarily depends on the objective of index number.
   - ***Guidelines for selecting a Base Period:*** The following points may guide in selecting the base period:
     (i) *The base period should be a normal one:* The base period should be free from all sorts of abnormalities and irregular fluctuations like, wars, floods famines, earthquakes, economic booms and depressions, lockouts, labour strikes, etc.
     (ii) *The difference between base year and current year should not be too large:* Since index numbers are helpful in decision making and economic policies are often a matter of short period, we should not select a base period that is too distant in the past.

(iii) *Fixed Base or Chain Base:* The selection of 'fixed base method' or 'chain base method' depends on the purpose of construction of index number.

- In fixed base method, the period of comparison is kept fixed for all current years.
- In chain base method, the changes in prices for any given year are compared with the prices in the preceding year, not with fixed year.

However, the chain base method gives a better picture as compared to fixed base method.

Explore More: What is a Base Period?

A base period is the reference date from which an index number is calculated. Presently, 2011–12 is taken as the base year in India.

The base year may be changed to reflect any changes over time in the composition of items making up the index. If base period is taken as 2011–12 and index number in 2015–16 is 250, then it suggests that:

- Prices increased by 150% on an average between 2011–12 and 2015–16; or
- Same basket of goods in 2015–16 costs 1.5 times as much as in 2011–12.

3. **Selection of number of items or commodities:** The number of items to be included in an index number should be determined by the purpose for which the index is constructed. Every item cannot be included in the construction of index number. The following points may be helpful in the selection of commodities:

(i) The *commodities selected should be representative* of the tastes, habits and customs of the people for whom the index is meant.

(ii) *The total number of items should be neither too small nor too large.*

- If the number of items is too small, then the index number will not be representative; and
- If it is too large, the index will be more representative, but it will involve greater cost and time.

(iii) *The standardized or graded commodities should be selected* to arrive at meaningful and valid comparisons.

4. **Selection of sources of data:** The data is scattered over a large area, so there are chances for its being misleading. Therefore, it is necessary that the data used should be reliable, accurate, adequate, comparable and representative.

5. **Price Quotations:** Prices of many commodities vary from place to place. So, it is not practically possible to collect price quotations from all places.

- The places which are well known for trading of that particular commodity, can be selected for obtaining price quotation. *Price quotations should be taken from the reliable sources.*

- After selecting the source of price quotations, persons should be appointed who can supply *unbiased* price quotations, as and when required.
- *Methods of Price Quotations:* There are two methods, in which price can be quoted:
  (i) *Money prices:* In this, prices are quoted per unit of commodity. *For example,* sugar @ ₹ 40 per kg.
  (ii) *Quantity prices:* Quantity prices are quoted per unit of money. *For example,* 25 grams of sugar for one rupee.
- A decision must also be made as to whether the *wholesale prices* or *retail prices* are required. The choice would depend upon the purpose of the index.
- If the prices of certain commodities are controlled by the government, then these administered prices should be taken (not the black market prices, which may be much higher).

6. **Selection of the Average:** Different types of averages such as arithmetic mean, mode, median, geometric mean, etc., can be used in preparing index numbers.

- From the practical point of view, median and mode are not suitable because of their erratic limitations.
- Basically, a choice has to be made between arithmetic mean and geometric mean:
  - *Arithmetic mean* is the most simple of all averages. But, it is affected by the extreme items.
  - Theoretically speaking, *Geometric mean* is the best average as it attaches more importance to smaller units and less importance to larger items. So, it is not unduly affected by extreme values in the observations.

7. **Selection of appropriate weights:** *The term 'weight' refers to the relative importance of different items.*

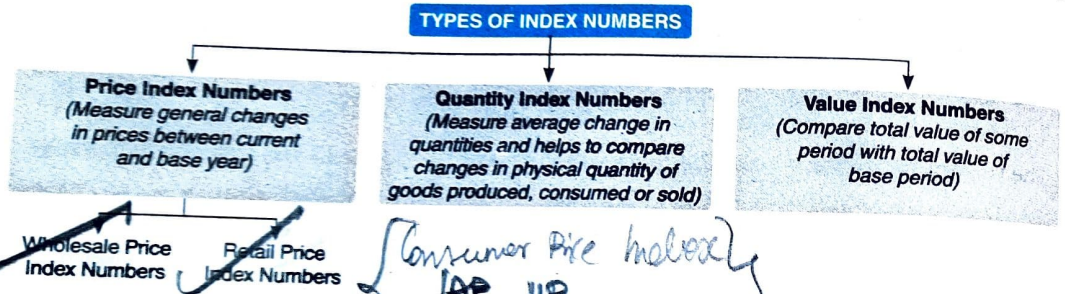
- The weights to be assigned to different commodities cannot be scientifically determined as importance of a commodity varies from consumer to consumer.
- The weights can be either quantity weights or value weights:
  - *Quantity weights* are appropriate when various commodities are attached importance according to the amount of their quantities used, purchased or consumed.
  - *Value weights* are appropriate when various commodities are attached importance according to the expenditure incurred on them.
- There are two methods of assigning weights:
  1. *Implicit weights:* If commodities are selected so as to include several varieties, then weights are said to be implicit.
  2. *Explicit weights:* In case of explicit weights, some outward evidence or importance of various items in the index is given.

- The weights must be periodically revised in order to reflect the current behaviour of fluctuations in price.
- When all items are equally important, an unweighted index number is constructed.

8. Selection of an appropriate formula: Various formulae or methods have been devised by the statisticians for constructing the index numbers like Laspeyre's method, Paasche's method, Bowley's method, Fisher's method, etc.
   - However, no single formula can be said to be appropriate for all types of index numbers.
   - The choice of formula would depend not only on the purpose of the index but also on the data available.

12.4 TYPES OF INDEX NUMBERS

There are various kinds of index numbers. These can be broadly classified into three categories:



1. Price Index Numbers: *The price index numbers measure the general changes in prices between the current year and the base year.*
   - General Price Index is used to measure the value of money.
   - Of all the index numbers, the price index numbers are the most important and are commonly employed in various economic and business contexts.
   - When percentage changes in prices are different for different commodities, then price index helps in representing these changes by a single numerical measure.
   - A price index may be a 'Wholesale Price Index' or a 'Retail Price Index', depending on the type of prices used.
     (i) *Wholesale Price Index Numbers: It reflects the general price level for a group of items taken as a whole.* In India, it is the most popular price index used in the business industry and policy market. It acts as an indicator of the rate of inflation. (It is discussed in detail later in the chapter).
     (ii) *Retail Price Index Numbers: It reflects the general changes in the retail prices of various items including food, housing, clothing and so on.* The "Consumer Price Index" is a special type of retail price index, which is a primary measure of the cost of living in a country. (Consumer Price Index Numbers are discussed later in the chapter)

2. Quantity Index Numbers: *The quantity or volume index numbers measure average change in quantities and enable us to compare changes in physical quantity of goods produced, consumed or sold.*
   - The level of physical output in an economy can be easily studied by this type of index number.
   - They can be constructed by using both simple as well as weighted method. So, Quantity Index Number can be easily derived from Price Index Numbers by interchanging p's to q's.
   - The indices of Agricultural production, Industrial Production, Exports, Imports, etc. are all Quantity Index Numbers.

3. Value Index Numbers: *Value index numbers compare the total value of some period with the total value of the base period.*
   - The study of changes in the total value (price × quantity) of production such as indices of retail sales or profits or inventories, can be made by value index numbers.

12.5 METHODS OF CONSTRUCTING PRICE INDEX NUMBERS

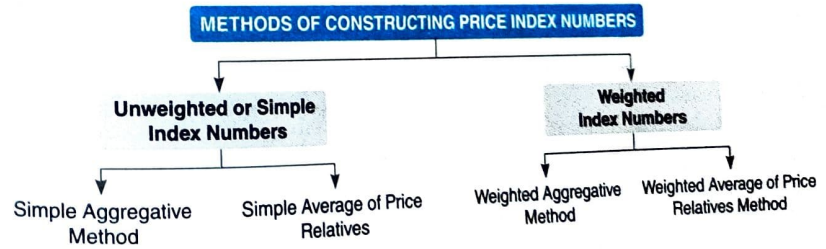
The various methods of constructing price index numbers can be grouped under two heads:

1. Unweighted or Simple Index Numbers;
2. Weighted Index Numbers.

Both of these methods of constructing index numbers are further classified as:

(i) Simple Aggregative Method;
(ii) Simple Average of Price Relatives Method.

The different methods of constructing the index numbers can be shown by following chart:



12.6 UNWEIGHTED INDEX NUMBERS

In the unweighted index numbers, each item is supposed to have the same weight as no weight is expressly assigned to any item. Such index numbers can be constructed by the following techniques:

(i) Simple Aggregative Method;
(ii) Simple Average of Price Relatives Method.

Let us discuss each technique one by one.

Simple Aggregative Method

This is the simplest method of constructing index numbers. In this method, aggregate prices of all the selected commodities in the current year are expressed as a percentage of the aggregate prices in the base year.

The steps in the construction of such an index are:

(i) Add up the current year prices of various commodities and denote by Σp_1.

(ii) Add up the base year prices of various commodities Σp_0.

(iii) Use the following formula:

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

Where,

P_{01} = Index number of the current year.

Σp_1 = Total of the current year's price of all commodities.

Σp_0 = Total of the base year's price of all commodities.

Examples 1, 2 and 3 will illustrate the application of the above steps.

Example 1. Construct index numbers for 2016-17 taking 2011-12 as the base year from the following data by Simple Aggregate Method:

Commodity	Price in 2011-12	Price in 2016-17
Wheat	₹ 20/kg	₹ 25/kg
Rice	₹ 30/kg	₹ 40/kg
Pulses	₹ 60/kg	₹ 80/kg
Sugar	₹ 30/kg	₹ 40/kg

Solution:

Construction of Price Index

Year 2011-12 as the base year

Commodity	Price in 2011-12 (₹) (p_0)	Price in 2016-17 (₹) (p_1)
Wheat	20	25
Rice	30	40
Pulses	60	80
Sugar	30	40
	$\Sigma p_0 = 140$	**$\Sigma p_1 = 185$**

Price Index for year 2016-17 with year 2011-12 as base

$$P_{01} = \frac{\Sigma p_1}{\Sigma p_0} \times 100 = \frac{185}{140} \times 100 = 132.14$$

The price index number (132.14) reveals that there is a net increase of 32.14% in prices in the year 2016-17, compared to the prices in the year 2011-12.

Ans. Price Index Number = 132.14

Example 2. The following are two sets of retail prices of a typical family's shopping basket. The data pertain to retail prices during 2001 and 2007.

Commodity	Price (in ₹) 2001	Price (in ₹) 2007
Milk (1 litre)	18	20
Banana (1 dozen)	15	15
Butter (1 kg)	120	150
Bread (400 gm)	9	14

Calculate the simple aggregate price index for 2007 using 2001 as the base year.

Solution:

Calculation of Simple Aggregate Price Index

Commodity	Price (₹) 2001 (p_0)	Price (₹) 2007 (p_1)
Milk (1 litre)	18	20
Banana (1 dozen)	15	15
Butter (1 kg)	120	150
Bread (400 gm)	9	14
	$\Sigma p_0 = 162$	**$\Sigma p_1 = 199$**

Price Index for year 2007 with year 2001 as base

$$P_{01} = \frac{\Sigma p_1}{\Sigma p_0} \times 100 = \frac{199}{162} \times 100 = 122.83$$

The price index number (122.83) reveals that there is a net increase of 22.83 % in prices in the year 2007, compared to the prices in the year 2001.

Ans. Price Index Number = 122.83

Example 3. Calculate the price index by first taking 2010 as base year and then 2012 as base year:

Year	Price (₹)
2010	40
2011	50
2012	60
2013	70
2014	80
2015	90
2016	95

2010	40	$\frac{40}{40} \times 100 = 100$	$\frac{40}{60} \times 100 = 66.66$
2011	50	$\frac{50}{40} \times 100 = 125$	$\frac{50}{60} \times 100 = 83.33$
2012	60	$\frac{60}{40} \times 100 = 150$	$\frac{60}{60} \times 100 = 100.00$
2013	70	$\frac{70}{40} \times 100 = 175$	$\frac{70}{60} \times 100 = 116.67$
2014	80	$\frac{80}{40} \times 100 = 200$	$\frac{80}{60} \times 100 = 133.33$
2015	90	$\frac{90}{40} \times 100 = 225$	$\frac{90}{60} \times 100 = 150.00$
2016	95	$\frac{95}{40} \times 100 = 237.5$	$\frac{95}{60} \times 100 = 158.33$

Limitations of Simple Aggregative Method

1. It is ***influenced by the magnitude of the prices.*** It means, higher the price of a commodity, greater is its influence on the index number.
   - So, high priced commodities receive greater weightage than low priced commodities.
   - *For example,* if rice prices are relatively higher than those of wheat, then rice prices tend to influence this index relatively more than the prices of wheat.
2. ***Equal weights are assigned to every item*** in construction of this index. The relative importance of various commodities is not taken into account.
   - *For example,* items like pencil and milk are assigned equal importance in the construction of this index.
   - This limitation renders the index of no practical utility.
3. ***Prices of various commodities may be quoted in different units*** like rupees per quintal, rupees per litre or rupees per metre and so on.
   - Thus, the index is influenced very much by the units in which commodities are quoted and accordingly some of the commodities may get more importance because they are quoted in a particular unit.

$\left(\frac{P_1}{P_0} \times 100\right)$, i.e. divide the price of each commodity in the current year by the price in the base year.

(ii) Obtain the sum total of price relatives, i.e. $\Sigma\left(\frac{P_1}{P_0} \times 100\right)$.

(iii) Divide the sum total of the price relatives of all commodities by the number of commodities.

(iv) Apply the formula: $P_{01} = \frac{\Sigma\left(\frac{P_1}{P_0} \times 100\right)}{N}$

Examples 4 and 5 will illustrate the application of the above steps.

Example 4. Construct an index for 2016-17 taking 2011-12 as the base by the simple average of price relatives method:

Commodities	A	B	C	D
Prices (2011-12)	10	20	30	40
Prices (2016-17)	13	17	60	70

Solution:

Calculation of Price Index Number

Commodities	Prices in 2011-12 (₹) (p_0)	Prices in 2016-17 (₹) (p_1)	Price Relatives $\frac{P_1}{P_0} \times 100$
A	10	13	$\frac{13}{10} \times 100 = 130$
B	20	17	$\frac{17}{20} \times 100 = 85$
C	30	60	$\frac{60}{30} \times 100 = 200$
D	40	70	$\frac{70}{40} \times 100 = 175$
N = 4			$\Sigma\left(\frac{P_1}{P_0} \times 100\right) = 590$

$$P_{01} = \frac{\Sigma\left(\frac{P_1}{P_0} \times 100\right)}{N} = \frac{590}{4} = 147.50$$

The price index number of 147.50 shows the increase of 47.5% in prices in the year 2016-17 as compare to year 2011-12.

Ans. Price Index Number = 147.50

Example 5. From the following data, construct an index for 2016 taking 2011 as base by th simple average of relatives method.

Commodities	A	B	C	D	E
Prices (2011)	50	40	80	100	20
Prices (2016)	70	60	100	120	20

Solution:

Price Index Number by Simple Average of Relatives Method

Commodities	Prices in 2011 (₹) p_0	Prices in 2016 (₹) p_1	Price Relatives $\frac{P_1}{P_0} \times 100$
A	50	70	$\frac{70}{50} \times 100 = 140$
B	40	60	$\frac{60}{40} \times 100 = 150$
C	80	100	$\frac{100}{80} \times 100 = 125$
D	100	120	$\frac{120}{100} \times 100 = 120$
E	20	20	$\frac{20}{20} \times 100 = 100$
N = 5			$\Sigma\left(\frac{P_1}{P_0} \times 100\right) = 635$

$$P_{01} = \frac{\Sigma\left(\frac{P_1}{P_0} \times 100\right)}{N} = \frac{635}{5} = 127$$

The price index number of 127 shows the increase of 27% in prices in the year 2016 as compared to year 2011.

Ans. Price Index Number = 127.

Laspeyre's Method

Mr. Laspeyres in 1871 gave an weighted aggregated index, in which weights are represented by the quantities of the commodities in the base year.

- It helps in answering the question that, if the expenditure in the base year on a basket of commodities was ₹ 100, then, how much should be the expenditure in the current period on the same basket of commodities.
- ***Formula:***

$$P_{01} = \frac{\Sigma p_1 q_0}{\Sigma p_0 q_0} \times 100$$

- ***Steps:*** The various steps involved are:
  1. Multiply the current year prices (p_1) by base year quantity weights (q_0) and total all such products to get $\Sigma p_1 q_0$.
  2. Similarly, multiply the base year prices (p_0) by base year quantity weights (q_0) and obtain the total to get $\Sigma p_0 q_0$.
  3. Divide $\Sigma p_1 q_0$ by $\Sigma p_0 q_0$ and multiply the quotient by 100. This will be the index number of the current year.

Paasche's Method

The German statistician Paasche in 1874 constructed an index number, in which weights are determined by quantities in the given year.

- It helps in answering the question that, if the current period basket of commodities was consumed in the base period and if we were spending ₹ 100 on it, how much should be the expenditure in current period on the same basket of commodities.
- ***Formula:***

$$P_{01} = \frac{\Sigma p_1 q_1}{\Sigma p_0 q_1} 100$$

- ***Steps:*** The various steps involved are:
  1. Multiply the current year prices (p_1) by current year quantities (q_1) and total all such products to get $\Sigma p_1 q_1$.
  2. Similarly, multiply the base year prices (p_0) by current year quantities (q_1) and obtain the total to get $\Sigma p_0 q_1$.
  3. Divide $\Sigma p_1 q_1$ by $\Sigma p_0 q_1$ and multiply the quotient by 100. This will be the index number of the current year.

Fisher's Method

Prof. Irving Fisher has given a number of formulae for constructing index numbers and of these, he calls one as the 'ideal' index. The Fisher's Ideal Index is given by the following formula:

$$P_{01} = \sqrt{\frac{\Sigma p_1 q_0}{\Sigma p_0 q_0} \times \frac{\Sigma p_1 q_1}{\Sigma p_0 q_1}} \times 100$$

From the above formula, it is clear that Fisher's Ideal Index is the geometric mean of the Laspeyre and Paasche indices.

Why Fisher's method is an ideal method?

1. The formula is based on geometric mean, which is considered to be the best average for constructing index numbers;
2. It considers both base year and current year quantities as weights. So, it avoids the bias associated with the Laspeyre's and Paasche's indexes.
3. It satisfies time reversal test and factor reversal test.

Example 6. From the following data, calculate price index numbers for 2016 with 2011 as base by: (i) Laspeyre's Method, (ii) Paasche's Method, (iii) Fisher's Method.

Commodity	Base Year (2011)		Current Year (2016)	
	Price (₹) p_0	Quantity q_0	Price (₹) p_1	Quantity q_1
A	20	8	40	6
B	50	10	60	5
C	40	15	50	15
D	20	20	20	25

Solution:

Construction of Price Index Numbers

Commodity	Base Year (2011)		Current Year (2016)					
	Price (₹) p_0	Quantity q_0	Price (₹) p_1	Quantity q_1	p_0q_0	p_0q_1	p_1q_0	p_1q_1
A	20	8	40	6	160	120	320	240
B	50	10	60	5	500	250	600	300
C	40	15	50	15	600	600	750	750
D	20	20	20	25	400	500	400	500
					Σp_0q_0 = 1,660	Σp_0q_1 = 1,470	Σp_1q_0 = 2,070	Σp_1q_1 = 1,790

(i) Laspeyre's Method

$$P_{01} = \frac{\Sigma p_1 q_0}{\Sigma p_0 q_0} \times 100 = \frac{2,070}{1,660} \times 100 = 124.69$$

(ii) Paasche's Method

$$P_{01} = \frac{\Sigma p_1 q_1}{\Sigma p_0 q_1} \times 100 = \frac{1,790}{1,470} \times 100 = 121.77$$

(iii) Fisher's Method

$$P_{01} = \sqrt{\frac{\Sigma p_1 q_0}{\Sigma p_0 q_0} \times \frac{\Sigma p_1 q_1}{\Sigma p_0 q_1}} \times 100$$

$$= \sqrt{\frac{2,070}{1,660} \times \frac{1,790}{1,470}} \times 100 = \sqrt{1.51835} \times 100 = 1.2322 \times 100 = 123.22$$

Ans. (i) Laspeyre's = 124.69; (ii) Paasche's = 121.77; (iii) Fisher's = 123.22.

Example 7. For the data given in the following table, compute index numbers by: (i) Laspeyre's method, (ii) Paasche's method, (iii) Fisher's ideal method:

Commodity	Base year		Current year	
	Price (₹) p_0	Quantity q_0	Price (₹) p_1	Quantity q_1
A	10	30	12	50
B	8	15	10	25
C	6	20	6	30
D	4	10	6	20

Solution:

Construction of Price Index Numbers

Commodity	Base year		Current year					
	Price (₹) p_0	Quantity q_0	Price (₹) p_1	Quantity q_1	p_0q_0	p_0q_1	p_1q_0	p_1q_1
A	10	30	12	50	300	500	360	600
B	8	15	10	25	120	200	150	250
C	6	20	6	30	120	180	120	180
D	4	10	6	20	40	80	60	120
					Σp_0q_0 = 580	**Σp_0q_1 = 960**	**Σp_1q_0 = 690**	**Σp_1q_1 = 1,150**

(i) Laspeyre's Method

$$P_{01} = \frac{\Sigma p_1 q_0}{\Sigma p_0 q_0} \times 100 = \frac{690}{580} \times 100 = 118.965$$

(ii) Paasche's Method

$$P_{01} = \frac{\Sigma p_1 q_1}{\Sigma p_0 q_1} \times 100 = \frac{1,150}{960} \times 100 = 119.79$$

(iii) Fisher's Method

$$P_{01} = \sqrt{\frac{\Sigma p_1 q_0}{\Sigma p_0 q_0} \times \frac{\Sigma p_1 q_1}{\Sigma p_0 q_1}} \times 100$$

$$= \sqrt{\frac{690}{580} \times \frac{1,150}{960}} \times 100 = \sqrt{1.4250} \times 100 = 1.1937 \times 100 = 119.37$$

Ans. (i) Laspeyre's = 118.965; (ii) Paasche's = 119.79; (iii) Fisher's = 119.37.

Example 8. Calculate the price index number by: (i) Laspeyre's method, (ii) Paasche's method, (iii) Fisher's ideal method:

Commodity	Base Year (2011-12)		Current Year (2016-17)	
	Price (₹)	Value (Total Expenditure)	Price (₹)	Value (Total Expenditure)
A	2	200	3	300
B	8	72	10	100
C	12	60	15	90
D	7	49	10	80

Solution:

In case of both the years, total value is given. So, we will have to first calculate the quantity by applying the following formula: Quantity $= \frac{\text{Value}}{\text{Price}}$

Construction of Price Index Numbers

Commodity	Base Year (2011-12)		Current Year (2016-17)					
	Price (₹) p_0	Quantity q_0	Price (₹) p_1	Quantity q_1	p_0q_0	p_0q_1	p_1q_0	p_1q_1
A	2	100	3	100	200	200	300	300
B	8	9	10	10	72	80	90	100
C	12	5	15	6	60	72	75	90
D	7	7	10	8	49	56	70	80
					Σp_0q_0 = 381	**Σp_0q_1 = 408**	**Σp_1q_0 = 535**	**Σp_1q_1 = 570**

(i) Laspeyre's Method

$$P_{01} = \frac{\Sigma p_1 q_0}{\Sigma p_0 q_0} \times 100 = \frac{535}{381} \times 100 = 140.42$$

(ii) Paasche's Method

$$P_{01} = \frac{\Sigma p_1 q_1}{\Sigma p_0 q_1} \times 100 = \frac{570}{408} \times 100 = 139.70$$

(iii) Fisher's Method

$$P_{01} = \sqrt{\frac{\Sigma p_1 q_0}{\Sigma p_0 q_0} \times \frac{\Sigma p_1 q_1}{\Sigma p_0 q_1}} \times 100 = \sqrt{\frac{535}{381} \times \frac{570}{408}} \times 100 = 140.05$$

Ans. (i) Laspeyre's = 140.42; (ii) Paasche's = 139.70; (iii) Fisher's = 140.05.

Example 9. On the basis of the following information, calculate Fisher's index number:

Commodity	Base Year		Current Year	
	Price (₹) (p_0)	Quantity (q_0)	Price (₹) (p_1)	Quantity (q_1)
A	6	50	10	56
B	2	100	2	120
C	4	60	6	60
D	10	30	12	24
E	8	40	12	36

Solution:

Construction of Price Index Numbers

Commodity	Base Year		Current Year					
	Price (₹) p_0	Quantity q_0	Price (₹) p_1	Quantity q_1	p_0q_0	p_0q_1	p_1q_0	p_1q_1
A	6	50	10	56	300	336	500	560
B	2	100	2	120	200	240	200	240
C	4	60	6	60	240	240	360	360
D	10	30	12	24	300	240	360	288
E	8	40	12	36	320	288	480	432
					Σp_0q_0 = 1,360	Σp_0q_1 = 1,344	Σp_1q_0 = 1,900	Σp_1q_1 = 1,880

Fisher's Index Number

$$P_{01} = \sqrt{\frac{\Sigma p_1q_0}{\Sigma p_0q_0} \times \frac{\Sigma p_1q_1}{\Sigma p_0q_1}} \times 100$$

$$= \sqrt{\frac{1,900}{1,360} \times \frac{1,880}{1,344}} \times 100 = \sqrt{1.953} \times 100 = 1.3974 \times 100 = 139.74$$

Ans. Fisher's Index Number = 139.74

Value Index Numbers

Value index numbers are very easy to calculate. Value is the product of price and quantity. A simple value ratio is equal to the value of the current year divided by the value of the base year. If this ratio is multiplied by 100, we get the value index number.

Symbolically: $V = \frac{\Sigma p_1q_1}{\Sigma p_0q_0} \times 100$; Where, V is the value index number.

Such index numbers are not weighted as they do not consider both the price and quantity. These index numbers are however not very popular, because the situation revealed by price and quantities are not fully revealed by the values.

Weighted Average of Price Relatives Method

In this method, the price relatives for the current year are calculated on the basis of the base year prices. These price relatives are multiplied by the respective weights of the items. These products are added up and divided by the sum of weights.

Steps:

1. Calculate price relatives for the current year $\left(\frac{P_1}{P_0} \times 100\right)$ and denote it by R;
2. Multiply the price in the base year (p_0) with weights (q_0) to get value weights and denote it by W;
3. Multiply the price relatives (R) with value weights (W) of each commodity and obtain its total to get ΣRW;
4. Obtain the sum total of value weights to get ΣW;
5. Apply the formula: $P_{01} = \frac{\Sigma RW}{\Sigma W}$

Example 10. Calculate the index number by weighted relatives method from the following data for the year 2016 with 2011 as the base year.

Commodity	Quantity in 2011 (Units)	Price in 2011 (₹)	Price in 2016 (₹)
A	80	5	8
B	65	8	14
C	42	12	18
D	37	4	5
E	31	4	5
F	15	2	4

Solution:

Construction of Weighted Index Numbers

Commodity	Weights q_0	Price (₹) 2011 p_0	Price (₹) 2016 p_1	Value Weights (p_0q_0) W	$\frac{P_1}{P_0} \times 100$ R	RW
A	80	5	8	400	160	64,000
B	65	8	14	520	175	91,000
C	42	12	18	504	150	75,600
D	37	4	5	148	125	18,500
E	31	4	5	124	125	15,500
F	15	2	4	30	200	6,000
				ΣW = 1,726		ΣRW = 2,70,600

Weighted Average of Price Relatives

$$P_{01} = \frac{\Sigma RW}{\Sigma W} = \frac{2,70,600}{1,726} = 156.77$$

The index number of 156.77 shows the increase of 56.77 % in prices in the year 2016 as compared to year 2011.

Quantity or Volume Index Numbers

As discussed earlier, quantity index number measures the average change in quantities and enable us to compare changes in the physical quantity of goods produced, consumed, or distributed. We can construct the following quantity index numbers analogous to the price index numbers.

	Price Index Numbers	Quantity Index Numbers
Simple Aggregative Method	$P_{01} = \frac{\Sigma p_1}{\Sigma p_0} \times 100$	$q_{01} = \frac{\Sigma q_1}{\Sigma q_0} \times 100$
Laspeyre's Method	$P_{01} = \frac{\Sigma p_1 q_0}{\Sigma p_0 q_0} \times 100$	$q_{01} = \frac{\Sigma q_1 p_0}{\Sigma q_0 p_0} \times 100$
Paasche's Method	$P_{01} = \frac{\Sigma p_1 q_1}{\Sigma p_0 q_1} \times 100$	$q_{01} = \frac{\Sigma q_1 p_1}{\Sigma q_0 p_1} \times 100$
Fisher's Method	$P_{01} = \sqrt{\frac{\Sigma p_1 q_0}{\Sigma p_0 q_0} \times \frac{\Sigma p_1 q_1}{\Sigma p_0 q_1}} \times 100$	$q_{01} = \sqrt{\frac{\Sigma q_1 p_0}{\Sigma q_0 p_0} \times \frac{\Sigma q_1 p_1}{\Sigma q_0 p_1}} \times 100$

12.8 CONSUMER PRICE INDEX (CPI)

Meaning

Consumer Price Index reflects the average increase in the cost of the commodities consumed by a class of people so that they can maintain the same standard of living in the current year as in the base year.

- They are designed to measure effects of change in prices of a basket of goods and services on purchasing power of a particular section of the society during any given (current) period with respect to some fixed (base) period.

The consumer price index numbers are also known as:

(i) Cost of Living Index Numbers;

(ii) Retail Price Index Numbers; or

(iii) Price of Living Index Numbers.

Need for Consumer Price Index

The need for constructing consumer price index numbers arises because general index numbers do not highlight the effect of rise or fall in prices of various commodities consumed by different classes of people on their cost of living.

Moreover, different classes of people consume different types of commodities and even the same type of commodities are not consumed in the same proportion by different classes of people.

So, consumer price index numbers are constructed separately for different classes of people to study the effect of rise or fall in prices of different types of commodities.

Different CPI for different categories of people

The consumption pattern of rich, poor and middle class people varies widely. Also, the consumption habits of the people of the same class differ from place to place. For example, the pattern of expenditure of a peon living in Delhi may differ widely from that of another peon living in, say, Kerala. The consumer price index helps us in determining the effect of rise and fall in prices on different classes of consumers living in different areas.

Construction of Consumer Price Index

The steps involved in construction of consumer price index are:

1. Determining the scope and coverage of the Index: The first step is to decide the particular class of people, for whom the index numbers is intended, such as industrial workers, government employees, low income or middle income class people, etc.
   - In addition to the class of people, the coverage should also be clearly earmarked, i.e. the geographical area – rural or urban, city or town, etc.
   - It is necessary that the selected class should form a homogenous group of people from the point of view of income and habits.
2. Family Budget Enquiry: The next step is to conduct a family budget enquiry by randomly selecting a sample of adequate number of representative families from the class of people, for whom the index is designed.
   - The enquiry should be conducted in a normal period of economic stability.
   - Family budget enquiry helps in finding out how much an average family of this group spends on different items of consumption.
   - Commodities are broadly classified into following 5 major groups: (i) Food, (ii) Clothing, (iii) Fuel and Lighting, (iv) House Rent, and (v) Miscellaneous.
   - Each of these major groups are further sub-divided into smaller groups termed as sub-groups. For instance, the group 'Food' may be sub-divided into cereals, pulses, milk and milk products, fruits, vegetables, etc.

- Usually, these sub-classes are divided still further, so that, the commodities included in each sub-group are individually mentioned. But, only those commodities, which a group generally consumes, are included in the index number.

3. Obtaining Price Quotations: The third and the last step is to collect retail prices.
   - It is a very important and difficult task. The reason is that retail prices vary from place to place, shop to shop and even customer to customer.
   - There cannot be one formula for collecting the prices, but still, the *following broad principles may be observed:*
     (i) The retail prices should relate to a fixed list of items and for each item, the quality should be prefixed by suitable specifications.
     (ii) Retail prices should be those actually charged from consumers.
     (iii) Discount for cash payment and interest rate for payment should be taken into account.
     (iv) In a period of rationing or price control, where illegal prices are charged openly, such prices should be taken into account along with the controlled prices.
   - Since prices form the most important component of cost of living indices, considerable attention has to be paid to the methods of price collection and to the price collection personnel.
   - In order to convert the prices into index numbers, the prices or their relatives must be weighted. *The need for weighting arises because relative importance of various items for different classes of people is not the same.* For this reason, the cost of living index is always a weighted index.

How the prices can be collected?

Prices are collected usually by special agents or through mailed questionnaire or in some cases through published price lists.

Special agents are more reliable as they visit the retail outlets and collect the prices from them. However, these agents should be properly selected and trained and should be given a manual of instructions as well as manual of specifications of items to be priced.

How the prices can be verified?

The prices can be verified by methods like *'check pricing'* or *'purchase checking'*.

- Under *'check pricing'*, price quotations are verified by means of duplicate prices obtained by different agents.
- In case of *'purchase checking'*, actual purchases of goods are made.

Difficulties in Construction of Consumer Price Index

1. Prices used in the construction of cost of living index are retail prices, which vary from shop to shop, place to place and consumer to consumer. Therefore, index numbers prepared on such prices cannot be used for different places or different classes of people.
2. It includes so many commodities of unstable quality, which will not be used at different point of time.
3. The ratio of expenditures on different commodities at different point of time and by various persons are not same, which creates difficulties in constructions of cost of living index numbers.

Thus, there will be variety of cost of living indices depending upon region, group, community etc.

Methods of Constructing CPI

The consumer price index numbers are constructed by the following two methods:

(i) Aggregate Expenditure Method or Weighted Aggregate Method;

(ii) Family Budget Method or Method of Weighted Average of Price Relatives.

Aggregate Expenditure Method

This method is similar to the Laspeyre's method of constructing weighted index. To apply this method, the quantities of commodities consumed by the particular group in the base year are estimated and these figures are used as weights. Then, the total expenditure on each commodity for each year (base and current) are calculated.

The **steps** involved in this method are:

1. Multiply prices of the base year (p_0) with quantities of the base year (q_0) and add it to get aggregate expenditure for the base year ($\Sigma p_0 q_0$);
2. Multiply prices of the current year (p_1) with quantities of the base year (q_0) and add it to obtain aggregate expenditure of the current year ($\Sigma p_1 q_0$);
3. Divide aggregate current year's expenditure ($\Sigma p_1 q_0$) by aggregate expenditure of base year ($\Sigma p_0 q_0$) and multiply it by 100 to get consumer price index number.
4. Apply the formula: Consumer Price Index $= \frac{\Sigma p_1 q_0}{\Sigma p_0 q_0} \times 100$

Family Budget Method

In this method, the family budgets of a large number of people, for whom the index is meant, are carefully studied. Then, the aggregate expenditure of an average family on various commodities is estimated. These values constitute the weights.

The **steps** involved in this method are:

1. Calculate price relatives for the current year $\left(\frac{P_1}{P_0} \times 100\right)$ and denote it by R;
2. Multiplying the price in the base year (p_0) with quantity in the base year (q_0) to calculate the weight of a commodity, i.e. to get W;

3. Multiply the price relatives (R) with weight (W) of each commodity and obtain its total to get ΣRW;
4. Obtain the sum total of weights to get ΣW;
5. Apply the formula: Consumer Price Index $= \frac{\Sigma RW}{\Sigma W}$

It should be noted that aforesaid both the methods of constructing consumer price index number would provide the same results.

Example 11. Calculate cost of living index, for the following data, using aggregate expenditure and family budget Method.

Commodity	Prices (in ₹)		Quantity in units
	2011	2016	2011
A	10	15	15
B	8	12	20
C	20	24	10
D	32	40	5
E	15	20	6
F	12	18	2
G	8	10	1

Solution

Aggregate Expenditure Method

Commodity	Prices (in ₹)		Quantity (units) (2011)	Aggregate Expenditure	
	2011 p_0	2016 p_1	q_0	p_0q_0	p_1q_0
A	10	15	15	150	225
B	8	12	20	160	240
C	20	24	10	200	240
D	32	40	5	160	200
E	15	20	6	90	120
F	12	18	2	24	36
G	8	10	1	8	10
				$\Sigma p_0q_0 = 792$	**$\Sigma p_1q_0 = 1,071$**

Consumer Price Index for the year 2016

$$= \frac{\Sigma p_1q_0}{\Sigma p_0q_0} \times 100 = \frac{1,071}{792} \times 100 = 135.22$$

Family Budget Method

Commodity	Prices (in ₹)		Price Relatives $\frac{P_1}{P_0} \times 100$ R	Quantity (2011) q_0	p_0q_0 W	RW
	2011 p_0	2016 p_1				
A	10	15	150	15	150	22,500
B	8	12	150	20	160	24,000
C	20	24	120	10	200	24,000
D	32	40	125	5	160	20,000
E	15	20	133.33	6	90	12,000
F	12	18	150	2	24	3,600
G	8	10	125	1	8	1,000
					ΣW = 792	**ΣRW = 1,07,100**

Consumer Price Index (CPI) for the year 2016

$$= \frac{\Sigma RW}{\Sigma W} = \frac{1,07,100}{792} = 135.22$$

It shows that there is an increase of 35.22% in prices in the year 2016 as compared to year 2011.

Ans. CPI by Aggregate Expenditure and Family Budget Method = 135.22

Example 12. Compute the index number using: (i) Aggregate Expenditure Method, (ii) Family Budget Method, for the year 2016 with 2011 as the base year, from the data given below:

Commodity	Quantity (in units) 2011	Price (₹) 2011	Price (₹) 2016
A	100	8	12
B	25	6	7.50
C	10	5	5.25
D	20	48	52
E	25	15	16.50
F	30	9	27

Solution:

Aggregate Expenditure Method

Commodity	Prices (₹)		Quantity (units) q_0	Aggregate Expenditure	
	2011 p_0	2016 p_1		p_0q_0	p_1q_0
A	8	12	100	800	1,200
B	6	7.50	25	150	187.50
C	5	5.25	10	50	52.50
D	48	52	20	960	1,040
E	15	16.50	25	375	412.50
F	9	27	30	270	810
				$\Sigma p_0q_0 = 2,605$	**$\Sigma p_1q_0 = 3,702.5$**

Consumer Price Index for the year 2016

$$= \frac{\Sigma p_1 q_0}{\Sigma p_0 q_0} \times 100 = \frac{3,702.50}{2,605} \times 100 = 1.4213 \times 100 = 142.13$$

Family Budget Method

Commodity	Prices (₹)		Price Relatives	Quantity		
	2011 p_0	2016 p_1	$R = \frac{P_1}{P_0} \times 100$ (R)	2011 q_0	p_0q_0 W	RW
A	8	12	150.00	100	800	1,20,000
B	6	7.50	125.00	25	150	18,750
C	5	5.25	105.00	10	50	5,250
D	48	52	108.33	20	960	1,03,996.80
E	15	16.50	110.00	25	375	41,250
F	9	27	300.00	30	270	81,000
					ΣW = 2,605	**ΣRW = 3,70,246.80**

Consumer Price Index for the year 2016 $= \frac{\Sigma RW}{\Sigma W} = \frac{3,70,246.80}{2,605} = 142.13$

The consumer price index number of 142.13 shows the increase of 42.13% in prices in the year 2016 as compared to year 2011.

Ans. CPI by Aggregate Expenditure and Family Budget Method = 142.13.

Uses of Consumer Price Index (CPI) Number

The importance of the consumer price index can be seen from the following points:

1. Consumer price index numbers helps in wage negotiations, formulation of wage policy, price policy, rent control, taxation and general economic policy formulation.
2. The government and business units use the consumer price index numbers to regulate the Dearness allowance (D.A.) or grant of bonus to the employees in order to compensate them for increased cost of living due to price rise.
3. The CPI are used to measure purchasing power of the consumer in rupees. The purchasing power of the rupee is the value of a rupee in a given year as compared to a base year. The formula for calculating the purchasing power of the rupee is:

$$\text{Purchasing Power} = \frac{1}{\text{Consumer Price Index}} \times 100$$

It indicates that money purchasing power is the reciprocal of the price index. Accordingly, if the consumer price index for a given year is 140, then purchasing power of a rupee is

$\frac{1}{140} \times 100 = 0.71$. That is, the purchasing power of a rupee in the given year is 71 paise as compared to the base year.

4. With the increase in prices, the amount of goods and services which money wages can buy (or the real wages) goes on decreasing. Index numbers tell us the change in real wages. Real wages can also be determined, in the following manner:

$$\text{Real Wages} = \frac{\text{Money Wages}}{\text{Consumer Price Index}} \times 100$$

5. Consumer price index numbers are also used for analysing markets for particular kinds of goods and services.

Calculation of Real Wages

Example 13. During a certain period, the cost of living index goes up from 110 to 200 and the daily wages of a worker was also raised from ₹ 80 to ₹ 125. Has the worker really gained, and if so, by how much in real terms.

Solution:

With increase in cost of living index from 110 to 200, the daily wages of the worker should be increased to: $\frac{80 \times 200}{110} = ₹ 145.45$. However, the daily wages have gone up only to ₹ 125. Hence, the worker has not gained. In fact, his real wages have gone down. The real wage of the worker is $\frac{125 \times 110}{200} = ₹ 68.75$ as compared to ₹ 80 before the price rise.

All India Consumer Price Index Numbers

In India, three Consumer Price Index Numbers (CPI's) are constructed:

1. CPI for *Industrial Workers* with 1982 as base year. It is published by Labour Bureau, Shimla.
2. CPI for *urban non-manual employees* with 1984–85 as base year. It is also published by Labour Bureau, Shimla.
3. CPI for *agricultural labourers* with 1986–87 as base year. It is published by Central Statistical Organisation.

They are routinely calculated every month to analyse the impact of changes in the retail price on the cost of living of these three broad categories of consumers.

All India Consumer Price Index Numbers are given in Table 12.1:

Chemical Production	80	140	40	175	5,320
Electrical Products	170	272	10	160	7,000
Textile	220	308	15	140	1,600
			ΣW = 100		2,100
					16,020

$$\text{Index Number of Industrial Production} = \frac{\Sigma\left(\frac{q_1}{q_0} \times 100\right) W}{\Sigma W} = \frac{16,020}{100} = 160.20$$

Industrial production has increased by 60.20% in year 2016

Ans. Index of Industrial Production = 160.20

12.10 USES OF INDEX NUMBERS

Index numbers are being extensively used to record changes in output, income, employment, productivity, business activities, etc. Index numbers are applied to measure variations in almost all spheres of economic activities.

In the words of M.M. Blair, *"Index numbers are the signs and guide posts along the business highway that indicate to the businessman how he should drive or manage his affairs".*

The following are the uses of index numbers:

1. Helps in Policy Formulation: Index numbers are indispensable tools for the management of any government or non-government organisation.
   - They help in studying trends of various phenomena and these trends and tendencies are the bases on which many policy decisions are taken.
   - They are also used in planning and formulating various government and business policies.
2. Index numbers act as Economic Barometers: A barometer is an instrument that is used to measure atmospheric pressure. *They measure the pulse of an economy and act as a barometer to indicate fluctuations in general economic conditions of a country.*
3. Help in studying trends: Index numbers are very useful in studying the trend or tendency of a series spread over a period of time.
   - They help to find out the trend of exports, imports, industrial production, prices and a variety of other phenomena.

4. To measure and compare changes: Index numbers helps in comparative changes in two variables.
   - It is not possible to measure changes in absolute terms. But, index numbers provide a relative measure to changes in the magnitude of a group of variables.
   - The changes over time and geographic location can be easily compared.
5. Index numbers help to measure purchasing power: The value of money depends on its purchasing power and purchasing power of money depends on the prices of the commodities. The change in prices adversely affects the value of money.
   - When the price level goes up, the value or purchasing power of money falls. Sometimes, it is said that a rupee of today is worth only 20 paise as compared to its purchasing power in 1980.
   - Index numbers are helpful in finding out the intrinsic worth of money as contrasted with its nominal worth. *This helps in formulating the wage policy of the country.*

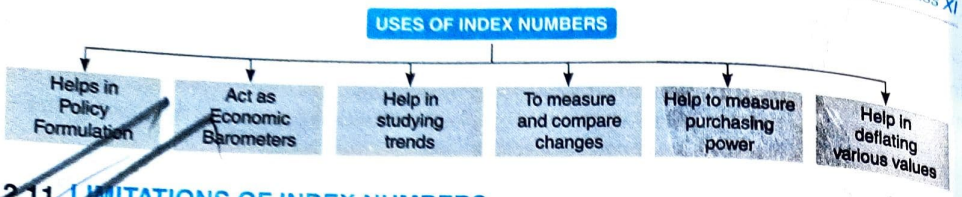
How Index numbers help in formulating the wage policy of the country?

Suppose, a person used to earn ₹ 10,000 per month in the year 2005. The cost of an item in that year was ₹ 1,000. It means, the person could purchase 10 units of the item with one month's earnings.

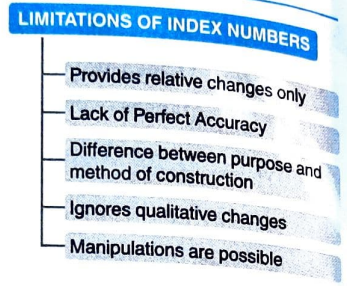
In the year 2016, the same person earns ₹ 20,000 per month and cost of the item is ₹ 2,500. Now, he could purchase only 8 units with one month's earnings. It means, the effect of monthly earnings relative to the particular item is less in year 2016 than in 2005 as lesser number of items can be purchased with current earnings.

Thus, a person who was earning ₹ 10,000 in 2005, should earn ₹ 25,000 in 2016, to maintain the standard of 2005. This helps in formulating the wage policy of the country.

6. Index numbers help in deflating various values: The price index number helps to adjust monetary figures of various periods for changes in prices.
   - *For example,* the figure of national income of a country is computed on the basis of the prices of the year in question. However, national income at current year price does not reveal the real change in the level of production of goods and services.
   - In order to know the real change in national income, these figures must be adjusted for price changes in various years. Such adjustments are possible only by the use of price index numbers and the process of adjustment, in a situation of rising prices, is known as deflating.



12.11 LIMITATIONS OF INDEX NUMBERS



1. **Provides relative changes only:** Index numbers are only estimates of relative changes in various events. They cannot speak the truth as they are only the approximate indicators. They represent the generalised truth, which is obtained on the basis of average of all the items. Hence, it does not apply to individual units.
2. **Lack of Perfect Accuracy:** Quite often, index numbers are based on sample items, i.e., each and every item is not considered. If samples are inadequate or selected by erroneous method, index number is bound to give inaccurate result.
3. **Difference between purpose and method of construction:** When an index number is constructed for a special purpose by a specific method, then such index number will not be appropriate for all other purposes and situations. If they are used for other purposes, it is bound to give erroneous inferences.
4. **Ignores qualitative changes:** While constructing the price or production index numbers, no attention is paid to the changes in quality of the product. An increase in price may be due to improvement in the quality of the product. Such changes are not reflected in the index numbers.
5. **Manipulations are possible:** Index numbers can be constructed in such a manner so that the desired result can be obtained. Such a manipulation can be done by choosing a particular base year, a particular group of commodities, a specific set of prices, etc.

12.12 WHOLESALE PRICE INDEX NUMBERS

Wholesale price index numbers are those price index numbers which measure the general changes in the wholesale prices of goods in a country.

- This index is restricted to commodities which are mainly traded on a wholesale basis like wheat, rice, edible oils, minerals etc.
- Wholesale price index numbers also act as an indicator of changes in economy.

In India, the first wholesale price index number was compiled in 1947. The latest wholesale price index number in India is constructed with 2004–05 as the base year.

Groups of Commodities for Wholesale Price Index (WPI)

In India, the commodities traded on wholesale basis are broadly classified into following three major groups:

1. **Primary Articles:** It include those goods, which are obtained by exploiting natural resources like wheat, rice, pulses, fruits, vegetables, minerals, etc. The number of items in this category are 98 and the weights are 22.02%.
2. **Energy Articles:** In this category, goods like power, coal, petroleum products, electricity and fuel are included. The number of goods in this category is 19 with weightage of 14.23%.
3. **Manufactured Articles:** It includes manufactured goods like sugar, edible oil, textile, machinery and equipment, paper and paper products, leather and leather products, chemicals, fertilizers, etc.
   - The number of items of this group is 318 and weight given to them is 63.75%.
   - It means that manufactured products have nearly is two-third importance in WPI.

Weights to Different Categories

Primary Articles	22.02%
Energy Articles	14.23%
Manufactured Articles	63.75%
Total Weights	100%

Wholesale Price Index is the only price index in India, which is available on weekly basis with shortest time gap of two weeks. Due to this reason, it is widely used in business and industry and by the Government. It is generally taken as an indicator of inflation rate in the economy.

Utility of Wholesale Price Index Number

The utility or uses of wholesale price index number will become clear from the following points:

1. **Indicator of Inflation:** *Inflation is a persistent and appreciable rise in general level of prices.* In economics, wholesale price index is taken as an indicator of the rate of inflation.
   - An increase in WPI indicates the rate at which the purchasing power of money is decreasing.
   - WPI number helps in finding out the rate of inflation in the country, which can be calculated as:

   The *weekly inflation rate* is given by:

$$\text{Weekly Rate of Inflation} = \frac{X_t - X_{t-1}}{X_{t-1}} \times 100$$

   (Where, X_t and X_{t-1} refer to the WPI for the t^{th} and $(t-1)^{th}$ weeks)

   The *yearly inflation rate* is given by:

$$\text{Yearly Rate of Inflation} = \left[\frac{\text{WPI of Current Year}}{\text{WPI of Previous Year}} \times 100\right] - 100$$

2. Forecasting Demand and Supply: The wholesale price indices are helpful in forecast the demand and supply of the commodities in the economy.
   - An increase in wholesale price index indicates a situation of excess demand.
   - On the other hand, a decrease in wholesale price index shows a situation of exc supply over demand for goods.
3. Helps in determining real changes in aggregates: WPI is used to eliminate the effec changes in prices on aggregates such as national income, capital formation, etc.
   For example, an increase in the national income in a particular year may be because same output is sold at a higher price. This can be known only when we divide natio income by the wholesale price index.
   - If the resultant value is the same as the base year, it would imply that the real outp has remained the same, or that there has been no growth in the economy.
   - On the other hand, if the resultant value is greater than that of the base year, it mea that the economy is growing at that rate.
4. Useful in Cost Evaluation of various projects: Major projects like construction of an Airp or Shopping Malls are long term activity where huge sums have to be spent in future.
   - The original estimated cost of project will be increased as prices rise over the time.
   - To estimate the revised price, the inflation rate has to be considered, which is indicat by the wholesale price index.
   - Wholesale price indices are useful in computing the real cost of such projects.
   - *For example,* if WPI for a year is 105, this means that initial cost estimate of that year w need an upward adjustment by 5%.

12.13 INFLATION AND INDEX NUMBERS

Inflation is described as a situation characterised by a sustained increase in the general price level. small rise in prices or an irregular price rise cannot be called inflation. It is a persistent a appreciable rise in prices, which can be called inflation.

- The Wholesale Price Index (WPI) is the most widely used price index as an indicator the rate of inflation in the economy.
- It is the only general index capturing price movements in a comprehensive way a indicates movement in prices of commodities in all trade and transactions.
- WPI is available on a weekly basis with the shortest possible time lag of 2 weeks.

Due to all these attributes, WPI is the most commonly accepted measure of inflation.

Paasche's Method	$P_{01} = \frac{\Sigma p_1 q_1}{\Sigma p_0 q_1} \times 100$
Fisher's Method	$P_{01} = \sqrt{\frac{\Sigma p_1 q_0}{\Sigma p_0 q_0} \times \frac{\Sigma p_1 q_1}{\Sigma p_0 q_1}} \times 100$
2.2 Weighted Average of Price Relatives Method	$P_{01} = \frac{\Sigma RW}{\Sigma W}$
3. CONSUMER PRICE INDEX	
3.1 Aggregate Expenditure Method	$CPI = \frac{\Sigma p_1 q_0}{\Sigma p_0 q_0} \times 100$
3.2 Family Budget Method	$CPI = \frac{\Sigma RW}{\Sigma W}$
4. INDEX OF INDUSTRIAL PRODUCTION	
Index Number of Industrial Productions	$= \frac{\Sigma \left(\frac{P_1}{P_0} \times 100 \right) W}{\Sigma W}$