Index Numbers

BS Unit 3

Introduction

Many of you must also be aware of the Stock Exchange Share Price Index –commonly referred to as BSE SENSEX or, more recently, NSE SENSEX. In fact, these various types of index series have come to be used in many activities such as industrial production, export, prices, etc. In this Unit, you will study and understand the meaning and uses of index numbers, various problems resulting from the incorrect use of index numbers, methods for construction of various index numbers, and their limitations.

An index number may be defined as a special average which helps in comparison of the level of magnitude of a group of related variables under two or more situations.

Index numbers are a series of numbers devised to measure changes over a specified time period (the time period may be daily, weekly, monthly, yearly, or any other regular time interval), or compare with reference to one variable or a group of related variables. Thus, each number in a series of specified index number is:

a) A pure number i.e., it does not have any unit.

b) Calculated according to a pre-determined formula.

c) Generated at regular time intervals, sometimes during the same time interval at different places.

d) The regular generation of numbers form a chronological series.

e) With reference to some specified period and number known as base period and base number, the latter is always 100. For example, if the consumer price index, with base year 1996 is calculated to be 180 for the year 2003, it means that consumer prices have increased by 80 per cent in 2003 as compared to the prices prevalent in 1996.

ISSUES IN CONSTRUCTION OF INDEXNUMBERS

There are three major issues which may be faced in the construction of index numbers. They are: 1) Collection of Data; 2) Selection of Base Year and 3)Selection of Appropriate Index. Let us discuss them in detail:

1) Collection of Data: Data collection through a sample method is one of the issues in the construction of index numbers. The data has to be as reliable, adequate, accurate, comparable, and representative, as possible. Here a large number of questions need to be answered. The answers ultimately depend on the purpose and individual judgment. For example, one needs to decide the following:

i) **Identification of Commodities to be Included**: How many and which category of commodities to include? A large number of items may be present. It is not possible to include all of them, only those items deserve to be included in the construction of an index number as would make it more representative.

ii) **Sources of Data**: From where to collect data? It is an important and difficult issue. The source depends on the information requirement. Thus, based on a representative sample survey, sources should be from where accurate, adequate, and timely data can be available.

iii) **Timings of Data Collection**: It is also equally important to collect the data at an appropriate time. Referring to the example of consumer price index, prices are likely to vary on different days of the month.

2) **Selection of Base Year**: A base period is the reference period for comparing and analyzing the changes in prices or quantities in a given period. For many index number series, value of a particular time period, usually a year, is taken as reference period against which all subsequent index numbers in the series are calculated and compared. In some other cases, especially when cost of living needs to be compared across the cities, the value of cost of living prevailing in a selected city is taken as a base against which cost of living in other cities is compared.

3) **Selection of an Appropriate Index:** Different methods of indices give different results, when applied to the same data. Utmost care must be taken in selection of a formula which is the most suitable for the purpose. Whether to use an un weighted or weighted index is a difficult question to answer. It depends on the purpose for which the index number is required to be used. For example, if we are interested in an index for the purpose of negotiating wages or compensating for price rise, only a weighted index would be worthwhile to use.

CLASSIFICATION OF INDEX NUMBERS

There are three principal types of indices: price indices, quantity indices, and value indices.

Price Indices: This type of indices is the most frequently used. Price indices consider prices of a commodity or a group of commodities and compare changes of prices from one period to another period and also compare the difference in price from one place to another. For example, the familiar Consumer Price Index measuring overall price changes of consumer commodities and services is used to define the cost of living.

Quantity Indices: The major focus of consideration and comparison in these indices are the quantities either of a single commodity or a group of commodities. For example, the focus may be to understand the changes in the quantity of paddy production in India over different time periods. For this purpose, a single commodity's quantity index will have to be constructed. Alternatively, the focus may be to understand the changes in food grain production in India, in this case all commodities which are categorized under food grains will be considered while constructing the quantity index.

Value Indices: Value indices actually measure the combined effects of price and quantity changes. For many situations either a price index or quantity index may not be enough for the purpose of a comparison. For example, an index may be needed to compare cost of living for a specific group of persons in a city or a region. Here comparsion of expenditure of a typical family of the group is more relevant. Since this involves comparing expenditure, it is the value index which will have to be constructed. These indices are useful in production decisions, because it avoids the effects of inflation.

The formula, therefore is:

$$\text{Value indices} = \frac{\Sigma p_1 q_1}{\Sigma p_1 q_1} \times 100$$

METHODS OF CONSTRUCTING INDEXNUMBERS

Different formulae have been introduced by statisticians for constructing composite index numbers. They may be categorized into two broad groups as given below:

I. Unweighted Indices; and

II. Weighted Indices

The formula and its use in constructing each category of indices, listed above, are discussed in the following sections. Let us first acquaint ourselves with the symbols used in construction of index numbers. They are as follows:

P_0 denotes price per unit of a commodity in the base period.

P_1 denotes price per unit of the same commodity in the current period (current period is one in which the index number is calculated with reference to the base period).

Similar measurements are assigned to Q_0, Q_1 and V_0, V_1.

12.6.1 Unweighted Index Numbers

This type of indices are also referred to as simple index numbers. In this method of constructing indices, weights are not expressly assigned. These are further classified under two categories:

1) Simple Aggregative Index

2) Simple Average of Relatives Index

Let us study the construction of indices under these two heads:

1) **Simple Aggregative Index:** This is the simplest and least satisfactory method of constructing indices. In the case of price indices, through this method, the total of unit cost of each commodity in the current year is divided by the total of unit cost of the same commodity in the base year and the quotient is multiplied by 100. Symbolically,

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

Similarly, the quantity index may be expressed as:

$$Q_{01} = \left(\frac{\Sigma q_1}{\Sigma q_0} \right) \times 100$$

Example

Table 12.1 Computation of Index by Single Assergative Method

Item	Year 1990		Year 2000	
	Price (Rs.)	Quantity	Price (Rs.)	Quantity
Wheat	700	4 qts	950	3.5 qts
Clothing	200	30 mts	300	35 mts
Gas	150	4 cylinder	220	6 cylinders
Electricity	0.80	800 units	1.10	1,000 units
House Rent	400	1 dwelling	800	1 dwelling
	1450.80 ΣP_0	839 Σq_0	2271.1 Σp_1	1045.5 Σq_1

The price index for the year 2000 with reference to base year 1990 the simple aggregative method is

$$P_{01} = \left(\frac{\Sigma P_1}{\Sigma P_0}\right) \times 100 = \frac{2271.1}{1450.8} \times 100 = 156.54$$

Thus, the prices in respect of commodities considered in the index have shown an increase of 56.54 per cent in 2000 as compared to 1990.

Analogously, the Quantity Index by the simple aggregate method is:

$$Q_{01} = \left(\frac{\Sigma q_1}{\Sigma q_0}\right) \times 100$$

Consider the illustration 1 for quantity index

$$Q_{01} = \frac{1045.5}{839} \times 100 = 124.61$$

Here, you should note that the 'P' in the formulae of price index will be replaced by 'q' in constructing index. This expression is applicable to the formulae of different methods.

2) Simple Average of Relatives Index

In this method of constructing price index, first of all price relatives have to be computed for the different items included in the index then the average of these is calculated simbolically,

$$P_{01} = \frac{\Sigma\left(\frac{P_1}{P_0} \times 100\right)}{N} \text{ or } \frac{\text{Sum of the Price Relatives}}{\text{No. of items}}$$

Using the same data by considering only prices given in the illustration-1, the computation of price index as simple average of price relatives is as follows:

Table 12.2: Computation of Index by Simple Average of Relatives Method

Items	Units	Year 1990 Prices (Rs.)	Year 2000 Prices (Rs.)	Price relatives $\frac{P_1}{P_0} \times 100$
Wheat	qts	700	950	$(950/700) \times 100 = 135.7$
Clothing	mts	200	300	$(300/200) \times 100 = 150.0$
Gas	cylinder	150	220	$(220/150) \times 100 = 140.7$
Electricity	units	0.80	1.10	$(1.10/0.8) \times 100 = 137.5$
Housing	dwelling	400	800	$(800/400) \times 100 = 200$
	N = 5			$\Sigma\left(\frac{P_1}{P_0} \times 100\right) = 763.9$

$$P_{01} = \frac{\Sigma\left(\frac{P_1}{P_0} \times 100\right)}{N} = \frac{763.9}{5} = 152.78$$

Thus, the index of simple average of price relatives shows 52.78 per cent increase in price.

1) Weighted Aggregates Index

In this group, we shall study three specific methods commonly used in business research. They are: (a) Laspeyre's index, (b) Paasche's index, and (c) Fisher's index. After understanding the concepts of the three indices we will take up an illustration for construction of these indices.

a) **Laspeyre's Index:** In this method, weights assigned to each commodity are the quantities consumed in the base year for price indices. For quantity index weights used are the prices of commodities in the base year. Thus, according to Laspeyre:

Price Index $(P_{01}^{La}) = \left(\frac{\Sigma P_1 q_0}{\Sigma P_0 q_0}\right) \times 100$, and

Quantity Index $= (Q_{01}^{La}) = \left(\frac{\Sigma q_1 P_0}{\Sigma q_0 P_0}\right) \times 100$

b) **Paasche's Index:** In this method, quantities consumed in the current year are used as weights in construction of price indices, where as in construction of quantity index, weights used are the prices of items in the current year. Thus according to Paasche:

$$\text{Price Index } (P_{01}^{Pa}) = \left(\frac{\Sigma P_1 q_1}{\Sigma P_0 q_1}\right) \times 100$$

$$\text{Quantity Index } (Q_{01}^{Pa}) = \left(\frac{\Sigma q_1 P_1}{\Sigma q_0 P_1}\right) \times 100$$

c) **Fisher's Ideal Index:** Irving Fisher used geometric mean of the Laspeyre's and Paache's indices to overcome the shortcomings of both. Thus,

$$\text{Fisher's Price Index } (P_{01}^{F}) = \sqrt{\left(\frac{\Sigma P_1 q_0}{\Sigma P_0 q_0}\right)\left(\frac{\Sigma P_1 q_1}{\Sigma P_0 q_1}\right)} \times 100$$

Analogously, Fisher's quantity index is:

$$Q^{F}{}_{01} = \sqrt{\left(\frac{\Sigma q_1 P_0}{\Sigma q_0 P_0}\right)\left(\frac{\Sigma q_1 P_1}{\Sigma q_0 P_1}\right)} \times 100$$

Fisher's index is superior because it uses geometric mean (which is best applicable for average of ratios and percentages) of Laspeyre's and Paache's indices. Also, because it is comparatively free from bias of over estimation and under estimation. Fisher's index satisfies the requirement of time reversal test and factor reversal test. This index is, therefore, called ideal index. So far we have discussed the three different indices of weighted aggregates method. For

Table 12.3: Computation of Weighted Aggregates Index

Commodities	Year 1995 (base year)		Year 2000 (current year)		P_0q_0	P_1q_0	P_0q_1	P_1q_1
	Prices (P_0)	Qty. (q_0)	Prices (P_1)	Qty. (q_1)				
Wheat	800	6	950	8	4800	5700	6400	7600
Rice	600	3	800	4	1800	2400	2400	3200
Oilseeds	400	5	425	4	2000	2125	1600	1700
Sugar	250	2	300	2	500	600	500	600
					ΣP_0q_0 =9100	ΣP_1q_0 =10824	ΣP_0q_1 =10900	ΣP_1q_1 =13100

i) **Laspeyre's Price Index or** P_{01}^{La} $= \dfrac{\Sigma P_1 q_0}{\Sigma P_0 q_0} \times 100$

$$= \frac{10824}{9100} \times 100 = 118.94$$

This shows that prices for the group (sample commodities) have increased by 18.94 per cent in 2000 as compared to those prevailing in 1995.

$$Q_{01}^{La} = \frac{10900}{9100} \times 100 = 119.78$$

This shows a 19.78 per cent increase in aggregate quantity consumption for this group in 2000 as compared to 1995.

ii) **Paache's Price Index or P_{01}^{La} -** $\frac{\Sigma P_1 q_1}{\Sigma P_0 q_1} \times 100$

$$= \frac{13100}{10900} \times 100 = 120.18$$

Thus, according to the Paache's Index the price index reveals an increase of 20.18 per cent in prices in 2000 as against 1995.

Analogously, Paasche's quantity index is

$$Q_{01}^{Pa} = \frac{\Sigma q_1 P_1}{\Sigma q_0 P_1} \times 100$$

The values of $\Sigma q_1 P_1$ and $\Sigma q_0 P_1$ in the Table 12.3, as they are equivalent to $\Sigma P_1 q_1$ and $\Sigma P_1 q_0$, respectively. Thus,

$$Q_{01}^{Pa} = \frac{13100}{10824} \times 100 = 121.03$$

It shows a 21.03 per cent increase in quantity consumption for this group in 2000 as compared to 1995.

iii) **Fisher's Index or** P_{01}^{F} $= \sqrt{\left(\frac{\Sigma P_1 q_0}{\Sigma P_0 q_0}\right)\left(\frac{\Sigma P_1 q_1}{\Sigma P_0 q_1}\right)}\ 100$

$$P_{01}^{F} = \sqrt{\left(\frac{10824}{9100}\right)\left(\frac{13100}{10900}\right)}\ 100$$

$$= \sqrt{1.43} \times 100 = 119.55$$

Therefore, Fisher index value is comparatively free from bias of underestimation and overestimation as in Laspeyre's and Paachre's indices. However, it is more complicated to construct.

Fisher's Quantity Index or Q_{01}^{F} $= \sqrt{\left(\frac{\Sigma q_1 P_0}{\Sigma q_0 P_0}\right)\left(\frac{\Sigma q_1 P_1}{\Sigma q_0 P_1}\right)}\ \ 100$

Table 10.1:
Illustrative calculations of Laspeyres', Paasche's, Edgeworth-Marshall's and Fisher's indices

Item	Base Year (1970)		Current Year (1980)					
	Price (p_0)	Quantity (q_0)	Price (p_n)	Quantity (q_n)	p_0q_0	p_nq_0	p_0q_n	p_nq_n
A	20	7	25	9	140	175	180	225
B	42	6	40	8	252	240	336	320
C	30	17	25	4	510	425	120	100
D	8	15	14	10	120	210	80	140
E	10	8	13	5	80	104	50	65
Total					**1102**	**1154**	**766**	**850**

1) Laspeyres' price index $= \frac{\sum p_n q_0}{\sum p_n q_0} \times 100 = \frac{1154}{1102} \times 100 = 104.72 = 105$

2) Paasche's price index $= \frac{\sum p_n q_n}{p_0 q_n} \times 100 = \frac{850}{766} \times 100 = 110.97 = 111$

3) Edgeworth-Marshall's index

$$= \frac{\sum p_n q_0 + \sum p_n q_n}{\sum p_0 q_0 + \sum p_0 q_n} \times 100$$

$$= \frac{1154 + 850}{1102 + 766} \times 100$$

$$= \frac{2004}{1868} \times 100 = 107.28 = 107$$

4) Fisher's ideal index

$$= \sqrt{\frac{\sum p_n q_0}{\sum p_0 q_0} \frac{\sum p_n q_n}{\sum p_0 q_n}} \times 100$$

$$= \sqrt{[(L) \times (P)]} = \sqrt{(104.72 \times 110.97)}$$

$$= 107.8 = 108$$

TESTS FOR INDEX NUMBERS

A perfect index number, which measures the change in the level of a phenomenon from one period to another, should satisfy certain tests. There are three major tests of index numbers: (1) Time reversal test, (2) Factor reversal test, and (3) Circular test.

10.5.1 The Time Reversal Test

According to this test, if we reverse the time subscripts (such as 0 and n) of a price (or quantity) index the result should be the reciprocal of the original index.

Symbolically,

$$I_{0n} \times I_{n0} = 1$$

where I_{0n} = index number for period n with the base period 0

I_{n0} = index number for period 0 with the base period n.

$$\text{Fisher's ideal index } F = \sqrt{\frac{\sum p_n q_0}{\sum p_0 q_0} \times \frac{\sum p_n q_n}{\sum p_0 q_n}}$$

If time subscripts are reversed,

$$F' = \sqrt{\frac{\sum p_0 q_n}{\sum p_n q_n} \times \frac{\sum p_0 q_0}{\sum p_n q_0}}$$

Since $F \times F' = 1$, the test is satisfied.

10.5.2 The Factor Reversal Test

With the usual notations, a "value index" formula is given by

$$I_v = \frac{\sum p_n q_n}{\sum p_0 q_0}$$

Now, for example, Laspeyres' index for prices and quantities are given respectively by

$$I_p = \frac{\sum p_n q_0}{\sum p_0 q_0}$$

and $$I_q = \frac{\sum q_n p_0}{\sum q_0 p_0}$$

The factor reversal test desires that $I_p . I_q = I_v$

But for Laspeyres' index

$$Ip.Iq = \frac{\Sigma(p_n q_0)(\Sigma q_n p_0)}{\Sigma(p_0 q_0)^2} \neq I_v$$

On the other hand, Fisher's ideal index satisfies this test, as shown below.

$$I_p = \sqrt{\frac{\Sigma p_n q_0}{\Sigma p_n q_0} \times \frac{\Sigma p_n q_n}{\Sigma p_0 q_n}}$$

$$I_q = \sqrt{\frac{\Sigma q_n p_0}{\Sigma q_n p_0} \times \frac{\Sigma q_n p_n}{\Sigma q_0 p_n}}$$

$$I_p I_q = \sqrt{\frac{\Sigma p_n q_0}{\Sigma p_0 q_0} \times \frac{\Sigma p_n q_n}{\Sigma p_0 q_n} \times \frac{\Sigma q_n p_0}{\Sigma q_0 p_0} \times \frac{\Sigma q_n p_n}{\Sigma q_0 p_n}}$$

$$= \sqrt{\frac{\Sigma p_n q_n}{\Sigma p_0 q_0} \times \frac{\Sigma q_n p_n}{\Sigma q_0 p_0}} = \frac{\Sigma p_n q_n}{\Sigma p_0 q_0} = I_v$$

To understand this principle further, we take the following example.

10.5.3 Chain Index Number and Circular Test

Two types of base periods are used for the construction of index numbers, namely, (a) fixed base, (b) chain base. Most commonly used indices use fixed base method. This method cannot take into account any changes in price or quantity in any other year. It fails to include new commodities gaining importance at a later date or exclude commodities losing significance in course of time. These problems can be overcome by chain index numbers.

Using a suitable index number formula (say, Laspeyres' index), link indices, defined as follows, are first calculated: Link index = Index number with previous period as base. The chain index is obtained by multiplying link indices progressively. Thus, the chain index number I_{0n} for period n with base period 0 is given by

$$I_{01} = I_{01}$$
$$I_{02} = I_{01} \times I_{12}$$
$$I_{03} = I_{01} \times I_{12} \times I_{23} = I_{02} \times I_{23}$$

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Example 10.4: The calculation of chain index numbers is illustrated with reference to the following data:

Year	Link index	Chain index (Base 1970 = 100)
1970	100	100
1971	$I_{01} = 80$	$100 \times \frac{80}{100} = 80$
1972	$I_{12} = 120$	$80 \times \frac{120}{100} = 96$
1973	$I_{23} = 75$	$96 \times \frac{75}{100} = 72$

Thus, the chain index numbers for the years 1971 to 1973 with 1970 as the base are 80, 96 and 72 respectively.

Circular test

Circular Test: The circular test is an extension of time reversal test over a number of years. It states that the chain index for the year 1973, calculated above, starting from the base year 1970 will be same as the index number directly calculated with fixed base period of 1970. In symbols,

$I_{01} \times I_{12} \times \ldots\ldots \times I_{(n-1)n} \times I_{n0} = 1$. (Notice that $I_{0n} = \frac{1}{1_{n0}}$)

Considering an aggregate index with fixed weights

$$\frac{\sum p_1 q}{\sum p_0 q}$$

we can illustrate the test as follows:

With base period 0, we can trace the above formula from 1 to 3 years:

$$\frac{\sum p_1 q}{\sum p_0 q} \times \frac{\sum p_2 q}{\sum p_1 q} \times \frac{\sum p_3 q}{\sum p_2 q} \times \frac{\sum p_0 q}{\sum p_3 q} = 1$$

Fisher's ideal index does not satisfy this test. It has been proved that no index satisfies both the factor reversal and the circular tests.

Example 10.3: We show with the following data that the Fisher's ideal index satisfies the factor reversal test:

Item	Price (Rs.)		No. of units		p_0q_0	p_nq_0	p_0q_n	p_nq_n
	1983 (p_0)	1989 (p_n)	1983 (q_0)	1989 (q_n)				
I	6	10	50	56	300	500	336	560
II	2	2	100	120	200	200	240	240
III	4	6	60	60	240	360	240	360
IV	10	12	30	24	300	360	240	288
V	8	12	40	36	320	480	288	432
Total					**1360**	**1900**	**1344**	**1880**

Price Ratio: $I_p = \sqrt{\frac{\sum p_n q_0}{\sum p_n q_0} \times \frac{\sum p_n q_n}{\sum p_0 q_n}} = \sqrt{\frac{1900}{1360} \times \frac{1880}{1344}}$

Quantity Ratio: $I_p = \sqrt{\frac{\sum q_n p_0}{\sum q_n p_0} \times \frac{\sum q_n p_n}{\sum q_0 p_n}} = \sqrt{\frac{1344}{1360} \times \frac{1880}{1900}}$

Value Ratio: $I_v = \frac{\sum p_n q_n}{\sum p_0 q_0} = \frac{1880}{1360}$

$$I_p.I_q = \sqrt{\frac{1900}{1360} \times \frac{1880}{1344} \times \frac{1344}{1360} \times \frac{1880}{1900}} = \sqrt{\frac{1880}{1360} \times \frac{1880}{1360}}$$

$$= \frac{1880}{1360}$$

$= I_v$ which shows that the test is satisfied.

COST OF LIVING INDEX NUMBER (CLI) OR CONSUMER PRICE INDEX NUMBER (CPI)

This is an index of changes in the prices of goods and services commonly consumed by a homogeneous group of people, such as families of industrial workers. The major items of consumption that are considered for the construction of CLI are:

1) Food
2) Fuel and Light
3) Clothing
4) House rent
5) Miscellaneous

The common method for obtaining the consumption basket is to conduct a family living survey among the population group for which the index is to be constructed. Prices of selected items are also collected from various retail markets used by consumers in question. It may be noted that each of the above broad groups contains several sub groups. Thus, 'food' includes cereals, pulses, oils, meat, fish, egg, spices, vegetables, fruits, non-alcoholic beverages, etc. 'Miscellaneous' includes such items as medical care, education, transport, recreation, gifts and many others.

Construction of Cost of living index

Item	Weight (Percentage Expenditure)	Index	Wt. × Index
Food	45	130	5850
Clothing	15	140	2100
Housing	20	170	3400
Fuel	5	110	550
Misc.	15	125	1875
Total	**100**		**13775**

$$\text{Cost of Living Index} = \frac{13,775}{100} = 137.75 = 138$$

Splicing of Index numbers

Splicing

Sometimes, a specific situation may arise for shifting the base period of an index number series to some recent period. For instance, in course of time a few commodities which are being considered for constructing indices may get replaced with new commodities, as a result their relative weightage may also change. In some cases, the weights may have become outdated and we may take into account the revised weights. Consequently, whatever be the reasons, index number series loses continuity and now we have two different index number series with different base periods which are not directly comparable. It is, therefore, essential to connect these two different series of indices into one continuous series. The statistical procedure involved in connecting these two series of indices to make continuity is termed as 'Splicing'. Thus, splicing means reducing two overlapping series of indices with different base periods into a continuous index number series. In equation form, we can say,

$$\text{Spliced Index Numbers} = \text{New Index No. of current period} \times \frac{\text{Old index No. of new base period}}{100}$$

Table 12.5: Splicing the New Series of Indices with the Old Series of Indices

Year	Consumer Price Index (1990 = base) (Old Index No. series)	Consumer Price Index (1994 =base) (New Index No. series)	Spliced Consumer Index [New index (114/100)]
1990	100		100
1991	110		110
1992	108		108
1993	114	100	100 (114/100) = 114
1994		108	108 (114/100) = 123
1995		116	116 (114/100) = 132
1996		112	112 (114/100) = 128

In the above illustration, old series was discontinued in 1993 and in that year new series was started. As shown in Column No. 4, splicing took place at the base year 1993 of the new series.

Alternatively, splicing may be done to the old index number series with new index number series. It means instead of carrying old series forward, new series may be brought backwards. To do this, the formula looks like this:

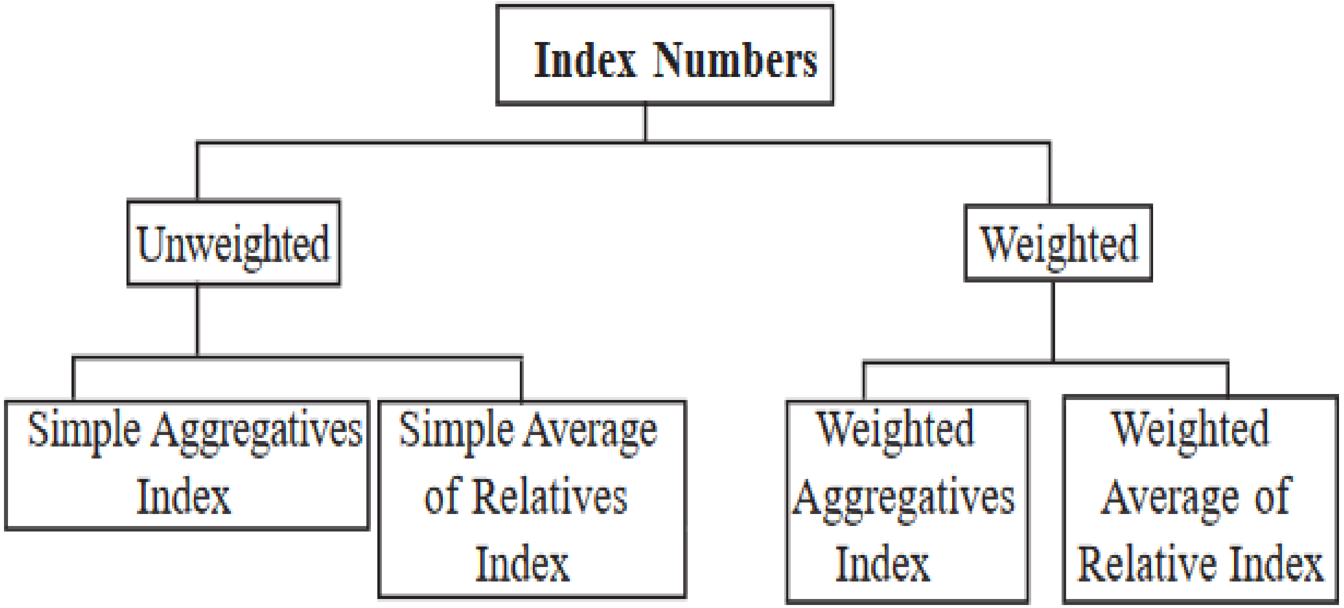
$$\text{Old Index No. of current period} \times \frac{100}{\text{Old index No. of new base period}}$$

Under this approach (Splicing the old series with the new series) the spliced indices are as follows:

Year	**1990**	**1991**	**1992**	**193**	**1994**	**1995**	**1996**	**1997**	**1998**
Spliced Index	88	96	97	95	100	108	116	112	120

Summary

There are different methods of constructing index numbers which is illustrated through the following chart:



Choice of an appropriate method depends upon the purpose of constructing indices.

The process of connecting the series of index numbers of old base period with the series of index numbers of new base period is called splicing. Splicing may be done in two ways: one is splicing the new series of indices with old series of indices. Another is splicing the old series of indices with new series of indices. Deflating means the process of finding out the real wage by applying appropriate price indices to the money wage so as to allow for the changes in the price level.

Key words

Index Number: A ratio for measuring differences in the magnitude of a group of related variables over time.

Cost of Living Index: Numbers represent the average change in the prices paid by the consumer on specified goods and services over a period of time, popularly known as "Consumer Price Index Number".

Base period: It is the reference period against which comparisons are made.

Price Index: A measure of how much the price variables change over a period of time.

Quality Index: A measure which studies the quantity of a variable changes from one period to another period.

Value Index: A measure for changes in total monetary worth over a time.

Splicing: It is a process of connecting two different index series of different base periods into a continuous series.

Key Words

Base Year	:	Preferably a normal year, in terms of variable concerned, base year index is invariably taken as 100. Current year index is expressed as a percentage of base year index.
Chain Index	:	Current year's index is expressed as a percentage of previous year's index.
Index Number	:	A pure number, expressed as a percentage to base year value. Index Number measures the relative changes over time in the variable concerned (price, quantity sales or say, exports) of a group of commodities. This is a special type of weighted average of prices (or any other attribute) of the commodities or items included.
Price Relative	:	In the construction of a an index number price relative for a commodity is the ratio of the current year price to base year price of that commodity.
Quantity Index Number	:	The variable considered is the quantity of commodities.

Exercise

Compute price index number by Weighted Aggregates method (Laspeyre's, Paache's and Fisher's) and weighted Average of Relatives method, from the following data (Price quoted in Rs. per kg. and production in qtls).

Commodity	1990		2000	
	Price	Production	Price	Production
Wheat	8	700	12	900
Rice	7	900	16	1,400
Sugar	12	300	19	500

A drug processing plant utilized four different materials in the manufacturing of a medicine. The following data indicates the final inventory levels (in tons) and prices (per kg). for these materials for the years 2000 and 2004.

Material	2000		2004	
	Inventory	**Price (Rs.)**	**Inventory**	**Price (Rs.)**
A	96	45	108	41
B	495	26	523	32
C	1,425	5	1,608	8
D	208	12	196	9

Find the price indices and quantity indices by using the methods of unweighted index numbers and comment on the results.

7) A department of Statistics has collected the following data describing the prices and quantities of harvested crops for the years 1990, 2000 and 2004 (Price in Qtls. and Production in tons).

Item	**1990**		**2000**		**2004**	
	Price	**Production**	**Price**	**Production**	**Price**	**Production**
Paddy	200	1,050	500	1,300	600	1,450
Wheat	250	940	550	1,220	700	1,450
Groundnut	350	400	800	500	1,000	480

Construct the price and quantity indices of Laspeyre's Index, Paache's Index and Fisher's Index in 2000 and 2004, using 1990 as the base period. Give your comments on the results.

Splicing Exercise

The index A was started in 1995 and continued upto 1998 in which year another index B was started. Splice the index B to index A so that a continuous series of index number from 1995 upto date may be available.

Year	**1995**	**1996**	**1997**	**1998**	**1999**	**2000**	**2001**
Index A	100	128	115	135	-	-	-
Index B	-	-	-	100	125	138	130

. Two price index series of cement are given below. Splice the old series with the new series. By what per cent did the price of cement rise between 1995 and 2000.

Year	Old series Base (1990)	New series Base (1998)
1995	156.6	-
1996	174.8	-
1997	162.3	-
1998	160.0	100.0
1999	-	106.4
2000	-	114.1
2001	-	112.2