**BUSINEES STATISTICS**

**UNIT 3 : INDEX NUMBERS**

**Unit 3: Index Numbers**

3.1 Need, meaning, and uses of index numbers, Applications of index numbers in share market, Price, quantity, and value index numbers.

3.2 Simple index numbers by simple aggregate method and simple average of relatives method (using A. M.), Numerical problems.

3.3 Weighted index numbers by Laspeyre’s, Paasche’s, and Fisher’s formulae, Numerical problems.

3.4 Problems involved in construction of index numbers.

**Introduction :**

We have seen that a series can be reduced to a single figure by calculating an average and two series can be compared by their averages. Burt also we know that an average is meaningful only when data are homogeneous i.e. of the same time. Now suppose we are given two series of the prices of essential commodities for two years. It is clear that we can’t compare the cost of living for the two years by comparing the simple averages of the commodities. For this purpose we need a special type of average called Index Numbers.

**Q.1 what is Index Numbers? Give the importance or utility of Index Numbers?**

 Ans.: **Index Numbers are specialized averages designed to measure the change in a group of related variables over a period of time**. Index numbers have today become one of the most widely used statistical devices and there is hardly any field where they are not used.

 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, geographic location or other characteristics such as income, profession etc.”**

**Importance of Index Numbers :**

**(i) Help in Framing Suitable Policies:** Index numbers provide guidance in administrative policy determination. For example in determining dearness allowance of the employee’s cost of living index are used.

**(ii) They Reveal Trends:** Index numbers are most widely used for determining the commercial and industrial trends. By examining the index numbers of industrial production of last few years, we can conclude about the trend of production.

 **(iii) Helps in Comparative Study**: Data which cannot be compared with the help of simple averages, index numbers can be used because they are in relative form.

 **(iv) Important in Forecasting**: Index numbers are often used in time series analysis, the historical study of long-term trend, seasonal variations etc.

**(v) Universal Application:** Index numbers are useful in economic, commercial, social and in every field such as agriculture etc.

**Important Definitions :**

**Price index numbers:**

A price index (PI) is a measure of how prices change over a period of time, or in other words, it is a way to measure [inflation](https://corporatefinanceinstitute.com/resources/knowledge/economics/inflation/) .

**Quantity index numbers:**

Quantity index numbers measure the change in the quantity of goods sold, consumed or produced during a given time period.

**Value index numbers:**

Value index numbers show the changes in the values of commodities in a given period with reference to base period.

**Construction of Index Number:**

**A number of formulae have been devised for constructing index numbers. They can be divided into two types**

**Diagram:**

**1) Price Index Numbers:**

Price Index Number show the changes in prices of commodities produced or consumed in a given period with reference to base period.

**(I) Unweighted Index Numbers:**

**(a) Simple Aggregative Method:**

This is a simplest method and the formula is

Where

 ∑P1 = Total of current year prices of various commodities.

 ∑P0 = Total of base year prices of various commodities

 **(b) Simple Average of Relative Method:**

This is also a simple method of constructing index numbers. In this method, the ratio of the price in current year to the price in the base year per cent is calculated. Symbolically



Where –

 P1 = Prices of current year.

 P0 =Prices of base year.

**(II) Weighted Index Numbers:**

**(a) Weighted Aggregative Method:**

There are three important methods of constructing index numbers by giving proper weightage to time and they are

 1) Laspeyre’s Index Number Method

2) Paasche’s Index Number Method

 3) Fisher’s Ideal Index Method

 **1) Laspeyre’s Index Number Method:**

****In this method, the base year quantities are taken as weights. The formula is

 Where –

 P1 = Price of current year

 P0 = Price of base year.

 q0 =Quantity of base year

**2) Paasche’s Index Number Method:**

In this method the current year quantities are taken as weights. The formula is

 Where –

 q1 **=** Quantity of current year

 P1 = Price of current year

 P0 = Price of base year.

**3) Fisher’s Ideal Index Method:**

Fisher defined the index number by the following formula

****

It is obvious that Fishers Index Number is the geometric mean between Laspeyre’s index and Paasche’s index

 Where

 q1 **=** Quantity of current year

 P1 = Price of current year

 P0 = Price of base year.

 q0 =Quantity of base year

**Quantity Index Numbers:**

The price index number measures the changes in the level of prices .The quantity index measures the changes in level of quantities. There are many formulae for quantity index as there are as price index. They are obtained simply by interchanging p and q.

**(a) Simple Aggregative Method:**

This is a simplest method and the formula is sum of current year quantities divided by sum of base year quantities into multiply by 100



Where

 ∑q1 = Total of current year quantities of various commodities.

 ∑q0 = Total of base year quantities of various commodities

**(b) Simple Average of Relative Method:**

This is also a simple method of constructing index numbers. In this method, the ratio of the quantity in current year to the quantity in the base year per cent is calculated. Symbolically



Where –

 q1 = quantity of current year.

 q0 =quantity of base year.

**1) Laspeyre’s Index Number Method:**

In this method, the base year prices are taken as weights. The formula is

 Where –

 q1 = quantity of current year

 q0 = quantity of base year.

 p0 =quantity of base year

**2) Paasche’s Index Number Method:**

In this method the current year prices are taken as weights. The formula is

 Where –

 q1 **=** Quantity of current year

 P1 = Price of current year

 q0 = quantity of base year.

**3) Fisher’s Ideal Index Method:**

Fisher defined the index number by the following formula



 Where

 q1 **=** Quantity of current year

 P1 = Price of current year

 P0 = Price of base year.

 q0 =Quantity of base year

**Value Index Number**

Value index numbers show the changes in the values of commodities in a given period with reference to base period. The simplest of them expresses the ratio of the total expenditure for the current year to that for the base year in percentage.



 Where

 q1 **=** Quantity of current year

 P1 = Price of current year s

 P0 = Price of base year.

 q0 =Quantity of base year