1. Introduction

Welcome to the series of E-learning modules on Index Numbers. In this session, we will focus on the concepts, meaning and uses of index numbers, selection of items to be included and the choice of the base year.

By the end of this session, you will be able to:

- Explain index numbers
- Explain the uses of index numbers
- Explain the selection of items to be included
- Explain the choice of the base year

The first index number was constructed in 1764 to compare the Italian price index in 1750 with the price level in 1500.

Though the index numbers were developed to measure the effect of change in prices, it has become one of the most widely used statistical devices and there is hardly any field where they are not used.

In business, managers are often concerned with the way in which values changes over time. It is necessary in business to understand and manipulate the different published index series, and to construct your own index series.

- Prices paid for raw materials
- Number of employees and customers
- Annual income and profits, etc.

In business, different groups of variables in the measurement of which index number techniques are commonly used are:

- i. Price
- ii. Quantity
- iii. Value and
- iv. Business activity

Thus, we have index of wholesale prices, index of consumer prices, index of industrial output, index of value of exports and index of business activity, etc.

In newspaper's headlines, index numbers are used to indicate facts like:

- Prices are going up or down
- Industrial production is rising or falling
- Imports are increasing or decreasing
- Crimes are rising in a particular period compare to the previous period, etc.

In economics, index numbers are:

- Defined as the barometer of the economic activity
- Used to feel the pulse of the economy
- Used as indicators for inflationary and deflationary tendencies of the economy

• Index numbers of industrial production, agricultural production, business activity, etc. helps in understanding the happenings of the economy

What are index numbers?

Index numbers are a way of presenting proportionate changes in a common format. Their most common use is looking at changes over time. However, they are not restricted to this and can be used to compare differences between local areas, groups of the population etc.

Index numbers are used to describe changes often concerned with money or manpower.

Index numbers measure the changing value of a variable over time in relation to its value at some fixed point in time. The base period is given the value of 100.

Index numbers are meant to study the change in the effects of such factors, which cannot be measured directly.

2. Definitions

Definitions:

According to Bowley:

"Index numbers are used to measure the changes in some quantity which we cannot observe directly."

According to Croton & Cowden:

"Index numbers are devices for measuring differences in the magnitude of a group related variables."

According to Spiegel:

"Index numbers are statistical measures designed to show changes in a variable or group of related variables with respect to time, geographic location or other characteristics such as income, profession, etc."

According to Morris Hamburg:

"In its simplest form, an index number is nothing more than a relative number or a 'relative' which express the relationship between two figures, where one of the figures is used as a base."

Characteristics of Index numbers:

Following are some of the important characteristics of index numbers :

- Index numbers are expressed in terms of percentages to show the extent of relative change
- Index numbers measure relative changes. They measure the relative change in the value of a variable or a group of related variables over a period of time or between places
- Index numbers measures the changes, which are not directly measurable
- The cost of living, the price level or the business activity in a country are not directly measurable. It is possible to study relative changes in these activities by measuring the changes in the values of variables or factors which effect these activities

The following points when considered, gives us a detailed understanding of the term Index number:

- Index numbers are specialized averages
- Index numbers measure the net change in a group related variables
- Index number measures the effect of changes over a period of time

Index numbers are specialized averages: An average is a single figure representing a group of figures. To obtain an average the items must be comparable, the unit of measurement must be the same for all items. However, in case of the index number, they are used for purposes of comparison in situations where two or more series are expressed in different units or the series are composed of different types of items and hence, are known as specialized averages.

For example: While constructing the consumer price index, we consider various items like

food, clothing, fuel & lighting, house rent and miscellaneous. If we observe, these items are expressed in different units under the head food. We include wheat, rice, ghee etc, which are expressed in quintals and kilograms. Under clothing, we use the unit's meter, but we obtain an average for all these items using the technique of index number.

Index number measure the net change in a group of related variables: Index numbers are averages, which help in understanding the net changes, that is, the increase or decrease in a group of related variables. It needs to be noted that even when an index is showing a net increase, it may include some items, which have actually decreased in value, and some items that are constant.

For example: If the consumer price index for the working class people in Bangalore has gone up to 113 in February 2011 compared to February 2010, it means there is a net increase of 13 percent in the prices of the commodities included in the index.

Index number measures the effect of changes over a period of time: Index numbers are most widely used for measuring the changes over a period of time and also helps in comparing the economic conditions of different locations, industries, cities or countries.

For example: The net change in agricultural prices from the beginning of the first five year plan to the end of the ninth five year plan can be compared. Similarly, we can compare the agricultural production, imports, exports, etc.

3. Classification of Index Number

Now, let us discuss about the classification of index number.

Based on the variables we can classify the index numbers as simple index number and composite index number.

Simple Index Number:

A simple index number is a number that measures a relative change in a single variable with respect to a base.

Composite Index Number:

A composite index number is a number that measures an average relative changes in a group of relative variables with respect to a base.

There are three more types of index number:

Price Index Numbers:

Price index numbers measure and compare the relative changes in prices of commodities between two periods. Prices can be either retail or wholesale.

Quantity Index Numbers:

Quantity index numbers are considered to measure changes in the physical quantity of goods produced, consumed or sold of an item or a group of items.

Cost of living Index number:

Cost of living index numbers are intended to study the effect of change in the price level of the cost of living of different classes of people.

4. Uses of Index Number

Uses of Index Number:

The main uses of index numbers are given below:

- Index numbers are used in the fields of commerce, meteorology, labour, industrial, etc.
- The index numbers measure fluctuations during intervals of time, group differences of geographical position of degree etc.
- They are used to compare the total variations in the prices of different commodities in which the unit of measurements differs with time and price etc.
- They measure the purchasing power of money
- They are used in studying difference between the comparable categories of animals, persons or items
- Index numbers of industrial production are used to measure the changes in the level of industrial production in the country
- Index numbers of import prices and export prices are used to measure the changes in the trade of a country
- The index numbers are used to measure seasonal variations and cyclical variations in a time series
- Index numbers can be used for a number of purposes: Index numbers are used not merely to measure changes in the price level or changes in the value of money. They can be used to measure any quantitative change. Thus, we can prepare an index number of wages, imports, exports, industrial production, unemployment, profit, area under cultivation, enrolment in a college, etc.
- Such quantitative changes are measured by index numbers can indicate social and economic trends and help in framing policies with respect to them. For instance, an index number of cost of living can guide us in the adjustment of wages to changing prices
- We can also compare, with the help of index numbers, economic conditions of a class of people at two different periods
- Index numbers can be used as basis for equitable discharge of contracts relating to borrowing and lending. We know when prices rise, creditors lose. It may perhaps be considered more just to ensure that the creditor gets back the same purchasing power. Hence, when prices rise, the debtor may be asked to pay a correspondingly higher sum to discharge a debt
- Index number can be used a s a barometer to take the pulse of the economy and used as indicators of inflationary or deflationary tendencies
- Index numbers are used by management personnel as an indispensable tool for business planning and formulation of executive decisions
- Index numbers of price, output, bank deposits, foreign exchange and reserves gives a picture of the variations in the general economic and business activity of the country
- Index numbers gives the common man a fairly good appraisal of the general trade, economic development and business activity of the country
- Index number helps in studying the trends and tendencies of production and business activities due to the components of time series

- Index number as a measure of average change in extensive group can be used to forecast the future events
- Index numbers like the population indices, IQ's indices are used by sociologists, psychologists, health and educational authorities for formulating and revising their policies time to time
- Consumer price indices are useful for measuring the purchasing power of money, deflation of income and wage negotiations and wage contracts

5. Limitations of Index Numbers

Limitations of Index numbers:

Although index numbers are indispensable tools in economics, business management, etc., they have their limitations. Proper care should be taken in using and interpreting them. Some of their limitations are enumerated below:

- Since index numbers are calculated from sample data, all the errors inherent in any sampling procedure creep in construction. Hence, the index numbers reflects only approximate changes in the relative level of a phenomenon
- At each stage of the construction of the index numbers, starting from selection of commodities to the choice of formulae there is a likelihood of the error being introduced. An attempt should be made to minimize these errors as far as possible
- Due to rapid advancements in science and technology these days, there is a rapid change in the tastes, customs, fashions and pattern of consumption of various commodities by the people of the society. Hence, index numbers may not be a true representative as it will not be able to keep pace with the change in the nature and quality of the commodities consumed at two periods
- None of the formulae for the construction of the index numbers is exact and contains the so called formula error
- Index numbers are special type of averages. Since the various averages have their relative limitations, their discriminate use may also introduce some error
- By subjective selection of base year, commodities, price and quantity quotations, index numbers are liable to be manipulated by selfish persons to obtain the desired results
- International comparisons are difficult on account of the different bases, different sets of commodities or difference in their quality or quantity
- Index numbers measure only changes in the sectional price levels. An index number that helps us to study the economic conditions of mill hands or railway coolies will be useless for a study of the conditions of college lecturers. An entirely different set of commodities will have to be selected. Different people use different things and hold different assets. Therefore, different classes of people are affected differently by a given change in the price level. Hence, the same index number cannot throw light on the effects of price changes on all sections of society

We can conclude saying that though there are a lot of limitations, the index numbers if properly constructed with caution are extremely useful devices.

Selection of items to be included:

The items to be included in an index should be determined by the purpose for which the index is constructed. Not every item can be included while constructing an index number and hence, only representative commodities should be selected keeping in view the purpose and type of the index number.

For example: While constructing a price index it is impossible to include each and every item. Hence, it is necessary to decide what commodities to be included. That is, if we are calculating the consumer price index for the working class we should not include the items like the scooter, refrigerators, cosmetics, etc.

In selecting items, the following points are to be kept in mind:

- a) The items should be representative of the tastes, habits and customs of the people for whom the index is meant
- b) Items should be recognizable
- c) Items should be stable in quantity and quality over two different periods and places
- d) The economic and social importance of various items should be considered
- e) The items should be fairly large in number, keeping in mind the purpose of the index
- f) All those varieties of a commodity which are in common use and are stable in character should be considered

Choice of a Base period

Whenever index numbers are constructed a reference is made to some base period. The base period of an index number (also called as the reference period) is the period against which comparisons are made. It may be a year, a month or a day.

The index for base period is always taken as 100. Though the selection of the base period would primarily depend upon the object of the index, the following points need careful consideration for base period:

- The base period should be a normal one
- The base period should not be too distant in the past
- Fixed base or chain base

Here's a summary of our learning in this session, where we have understood the:

- Definition and meaning of index numbers
- Uses of index numbers
- Selection of items to be included and
- The choice of the base year