CHAPTER 8

INDEX NUMBERS

- An **Index Number** is a statistical device used to measure changes in the related variables.

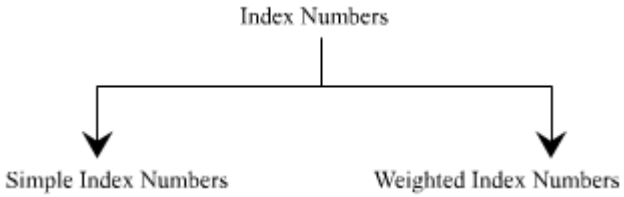
- **Features of Index Number**
  - It measures average changes in a variable with reference to base year.
  - It expresses relative change in the variable in absolute quantitative terms.
  - It expresses change in terms of percentage.

- **Importance/Uses/Advantages of Index Numbers**
  - To measure the changes in price level
  - To study the change in standard of living
  - To study the level of production
  - To help the government in framing policies
  - To help in planning and decision making

- **Difficulties in the Construction of Index Numbers**.
  - Purpose or objective of index number
  - Selection of base year
  - Selection of prices of goods and services
  - Selection of goods and services

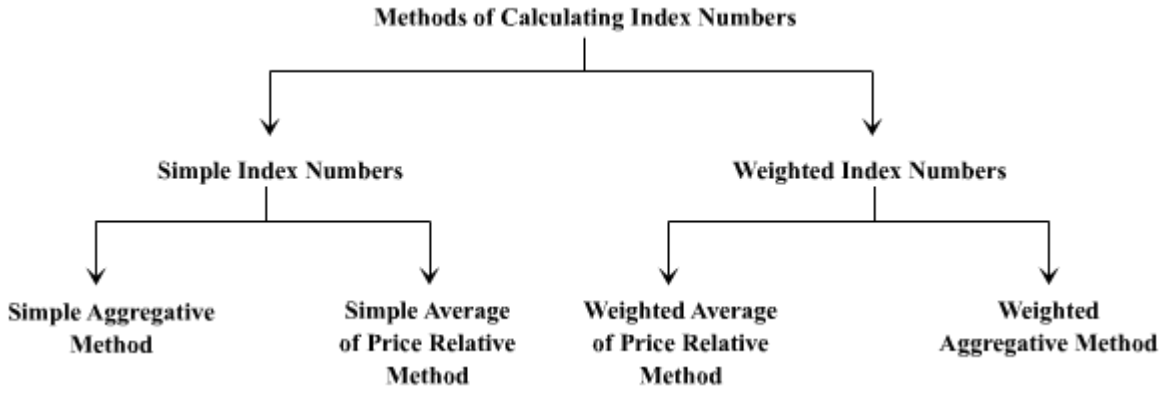
- **Limitations of Index Number**
  - Based on samples, and hence cannot be generalised thereby, not revealing a holistic view.
  - Acts merely as an approximation.
  - Fails to reveal the qualitative aspect of the variable under study.
  - More probable to give misleading and erroneous results, if wrong base year is selected.
  - It is objective specific. Index number constructed for one study cannot be used for another study.

- **Categories of Index Numbers**



  - ***Simple Index Numbers***-Those index numbers in which all items of the series are accorded equal weightage or importance are called simple index numbers.
  - ***Weighted Index Numbers***- Those index numbers in which different items of the series are accorded different weights depending on their relative importance are called weighted index numbers.

Methods of Calculating Index Numbers



Simple Index Numbers

- ***Simple Aggregative Method***

Price Index $\left(P_{01}\right) = \dfrac{\sum P_1}{\sum P_0} \times 100$

where,
P_{01} = Price index of current year
$\sum P_1$ = Sum of prices of commodities in current year
$\sum P_0$ = Sum of prices of commodities in base year

Quantity Index $\left(Q_{01}\right) = \dfrac{\sum Q_1}{\sum Q_0} \times 100$

where,
Q_{01} = Quantity index of current year
$\sum Q_1$ = Sum of quantities of commodities in current year
$\sum Q_0$ = Sum of quantities of commodities in base year

- ***Simple Average of Price Relative Method***

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

where,

$\sum\left(\dfrac{P_1}{P_0} \times 100\right)$ = Price Relatives

P_{01}= Index Number for current year
P_1 = Current year's price
P_0 = Base year's price
N = Number of goods

- **Weighted Average of Price Relative Method**

$$P_{01} = \frac{\sum RW}{\sum W} = \frac{\sum\left[\left(\frac{P_1}{P_0}\times 100\right)\left(P_0Q_0\right)\right]}{\sum P_0Q_0}\times 100$$

where,
P_{01}= Index Number for current year
W = Weight
R = Price relatives
P_0 = Base year's price
P_1 = Current year's price

- **Weighted Aggregative Method**
  - **Laspeyre's Method**

    For calculating price index, Laspeyre's method uses base year quantities (q_0) as weights of different items.

$$\textbf{Price Index } \left(P_{01}\right) = \frac{\sum p_1q_0}{\sum p_0q_0}\times 100$$

    For calculating quantity index, Laspeyre's method uses base year prices (p_0) as weights

$$\textbf{Quantity Index } \left(Q_{01}\right) = \frac{\sum q_1p_0}{\sum q_0p_0}\times 100$$

  - **Paasche's Method**

    For calculating price index, Paasche's method uses current year quantities (q_1) as weights of different items.

$$\textbf{Price Index } \left(P_{01}\right) = \frac{\sum p_1q_1}{\sum p_0q_1}\times 100$$

    For calculating quantity index, Paasche's method uses current year prices (p_1) as weights.

$$\textbf{Quantity Index } \left(Q_{01}\right) = \frac{\sum q_1p_1}{\sum q_0p_1}\times 100$$

  - **Fisher's Method**

    This method uses both base year as well as current year quantities as weights.

$$\textbf{Price Index } \left(P_{01}\right) = \sqrt{\text{Laspeyre's Price Index} \times \text{Paasche's Price Index}}$$

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

$$\textbf{Quantity Index } \left(Q_{01}\right) = \sqrt{\text{Laspeyre's Quantity Index} \times \text{Paasche's Quantity Index}}$$

$$Q_{01} = \sqrt{\frac{\sum q_1p_0}{\sum q_0p_0}\times\frac{\sum q_1p_1}{\sum q_0p_1}}\times 100$$

Why is Fisher's Index Number an Ideal Method?

- It is based on the geometric mean of Laspeyre's and Paasche's Index Numbers.
- It satisfies both the Factor Reversal Test as well as Time Reversal Test.
- Unlike Laspeyre's and Paasche's, Fisher's Method considers price and quantities of both the base year as well as of the current year.
- It overcomes the shortcomings of Laspeyre's and Paasche's Method.

Test of Adequacy

- **Time Reversal Test -** This method suggests that the product of both the ratios (i.e. the ratio of current year on the base year and the ratio of base year on the current year) should be one. Algebraically,

  $P_{01} \times P_{10} = 1$

  where,

  P_{01} represents index for current period on base period

  P_{10} represents index for base period on current period.

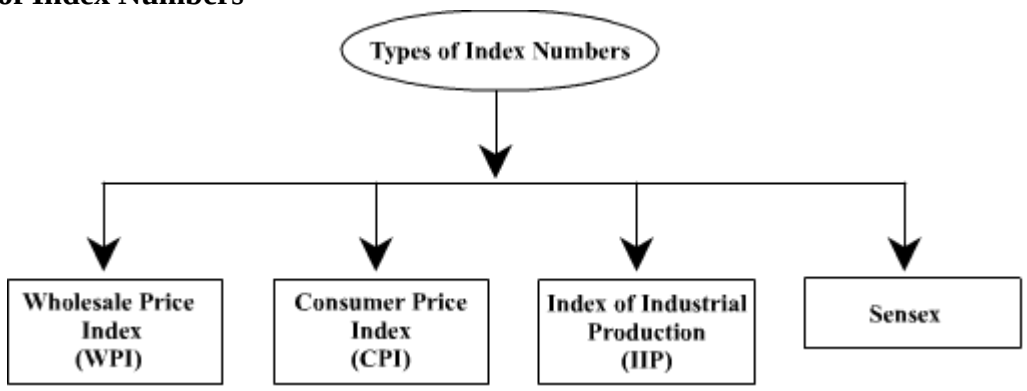
- **Factor Reversal Test -** This method suggests that the product of the price index (P_{01}) and the quantity index (Q_{01}) should equal their value index (V_{01}). Algebraically,

  $P_{01} \times Q_{01} = V_{01}$

  or, $P_{01} \times Q_{01} = \sqrt{\frac{\sum p_1 q_0}{\sum p_0 q_0} \times \frac{\sum p_1 q_1}{\sum p_0 q_1} \times \frac{\sum q_1 p_0}{\sum q_0 p_0} \times \frac{\sum q_1 p_1}{\sum q_0 p_1}}$

  or, $P_{01} \times Q_{01} = \frac{\sum p_1 q_1}{\sum p_0 q_0} = V_{01}$

Types of Index Numbers



- **Wholesale Price Index (WPI) -** It measures the relative changes in the prices of commodities traded in the wholesale markets. It indicates the change in the general (or overall) price level.

  $$\text{Rate of Inflation} = \left(\frac{\text{WPI of Current Year}}{\text{WPI of Previous Year}} \times 100 \right) - 100$$

  OR

$$\text{Rate of Inflation} = \frac{\text{WPI of Current Year} - \text{WPI of Previous Year}}{\text{WPI of Previous Year}} \times 100$$

$$\text{or, Rate of Inflation} = \frac{A_2 - A_1}{A_1} \times 100$$

where,

A_1 = Wholesale price index for week 1

A_2 = Wholesale price index for week 2

- **Consumer Price Index or Cost of Living Index (CPI) -** It is used to measure the changes in the cost of living in which the retail prices of consumer goods and services are obtained. It indicates the average change in the retail price level.
- ***Methods of Constructing CPI***
    1. ***Family Budget Method* (or *Weighted Relatives*)**

       $$CPI = \frac{\sum RW}{\sum W}$$

       where,

       R = Price Relatives = $\frac{P_1}{P_0} \times 100$

       W =Weights $\left(\text{i.e. } P_0Q_0\right)$
    2. ***Aggregative Expenditure Method* (or *Aggregative Method*)**

       $$CPI = \frac{\sum P_1Q_0}{\sum P_0Q_0} \times 100$$

- **Index of Industrial Production (IIP) -** It measures the relative change (increase or decrease) in the level of industrial output in the country in comparison to the level of production in the base year.
    - It measures the production of public sector as well as of the private sector.
    - Currently, IIP (for industries) is calculated on the monthly basis with 1993-94 as the base year.
    - Currently, index number of Agricultural Production is calculated on the base period of 1981-82.
    - *Formula*

$$\textbf{Index Number of Industrial Production}\left(IIP_{01}\right) = \frac{\sum\left(\frac{q_1}{q_0}\right)W}{\sum W} \times 100$$

- **Sensex -** It is an index depicting the fluctuation in the stock exchange market (or share market). The word is derived from Bombay Stock Exchange Sensitive Index. Currently, Sensex is calculated with the base year of 1978-79. A high Sensex depicts high economic activity (or boom) and vice-versa.