DEPARTMENT OF COMMERCE
D.B. COLLEGE, JAYNAGAR
BY: DR. SHAILESH KR. SINGH
(GUEST TEACHER)
LALIT NARAYANA MITHILA UNIVERSITY, DARBHANGA (BIHAR)

Ref. No.: ……. **Date:** 09- May, 2020

B.Com. I

CORE CONCEPT OF

BUSINESS MATHMATICS & STATISTICS

1. Illustrate the Index Number.
2. Briefly describe the characteristics of index number.
3. What do you mean by purpose of index number?

INDEX NUMBER

Index number is a specialized average through which charges in relative to time or comparative form.

Definition-

1) Index number are used to measure the changes in some quantity which we cannot observe directly.- A. L. Bowley
2) Index numbers are a series of numbers by which changes in the magnitude from time to time or from place to place.- Secrist
3) Index number is a single ratio which measure the combined change of several variables between two different time, place, situation.- A. M. Tuttle

Characteristics of Index Numbers-

1) Relative or comparative measures
2) Specialized average
3) Measurement of common characteristics of a group of items.
4) Measurement of changes not capable of direct measurement.
5) Comparison on the basis on time or place.
6) Universal use.

Points to be considered in the construction of Index Number-

1) Purpose of Index Number
2) Selection of base year
3) Selection of representative items of commodities.

4) Selection of representative price
5) Problem of weighting
6) Choice of suitable average
7) Selection of appropriate formula

Method of base year-

A) Single year fixed base
B) Multi year average base

Single year fixed base- In this method any normal year is selected as base year. The price of base year is denoted as P_0 and the price of other year as P_1 and index number or price relative (PR).

Index Number or (PR) = P_0/ P_1

Multi year average base- When there is difficulty in selecting a particular year as a base year, the average price of a few year is taken as base price and this average price expressed as P_0.

Chain base method- In this method price relative for every current year is calculated on the basis of price of the immediately preceding year.

Method of constructing Index Number

A) Unweighted index number- It is also known as simple aggregative method. In this method all commodities in base year and current year are added separately and they are denoted as ΣP_0 and ΣP_1

Index Number= $\left[\frac{\Sigma P1}{\Sigma Po} * 100\right]$

B) **Weighted index number-** In this method appropriate weights are be assigned to various commodities to reflect their relative importance. If these weights are base on the actual quantity, the symbol q is used for it. The formula for the construction of the index number.

Index Number= $\left[\frac{\Sigma P1q0}{\Sigma Poq0} * 100\right]$

There are some of the important methods to constructed Index number-

1) **Laspeyre's Method:** In this method, weights are assigned by the quantities (q_0) in the base year. The formula is:

Index Number (P_{01}) = $\left[\frac{\Sigma P1q0}{\Sigma Poq0} * 100\right]$

2) **Paasche's Method:** In this method, weights are assigned by the quantities (q_1) in the current year. The formula is:

Index Number (P_{01}) = $\left[\frac{\Sigma P1q1}{\Sigma Poq1} * 100\right]$

3) **Marshall-Edge worth's Method:** In this formula, weights are given on the basis of average of quantity of base year and that of current year. The formula is:
Index Number (P_{01}) = $\left[\frac{\Sigma P1q0+\Sigma p1q1}{\Sigma Poq0+\Sigma P0q1} * 100\right]$

4) **Dorbish Bowley's Method-** This method is a combination of Laspeyre's and Paasche's Method and we find out the arithmetic average of both these index numbers. The formula is:
Index Number (P_{01}) = $\left[\frac{\Sigma P1q0}{\Sigma Poq0} + \frac{\Sigma P1q1}{\Sigma Poq1}\right] * 100/2$

5) **Kelly's Method:** This formula, named after **Truman L. Kelly,** requires the weights to be fixed for all periods and is also sometimes known as aggregative index with fixed weights. These weights may be assigned on the basis of quantities of base year or current year or average of both these years or of any other year assumed as standardized year. The formula is :
Index Number (P_{01}) = $\left[\frac{\Sigma P1q}{\Sigma Poq} * 100\right]$

6) **Fisher's Ideal Index Number:** It was developed by **Prof. Irvin Fisher.** It is a geometric mean of the Laspeyre's and Paasche's method. The formula is :
Index Number (P_{01}) = $\sqrt{\frac{\Sigma P1q0}{\Sigma Poq0} * \frac{\Sigma P1q1}{\Sigma Poq1}} * 100$

Reversibility Tests- For an ideal index number it is necessary that it should satisfy reversal test, which are as follows:

1) **Time Reversibility test**- Time reversal test provides that if the index number of current year (P_{01}) is constructed on the basis of base year and then the index number of base year (P_{10}) on the basis of current year, both should be reciprocal to each other.

$$P_{01} * P_{10} = 1$$

Fisher's ideal index number satisfies this test as explained below:

(P_{01}) = $\sqrt{\frac{\Sigma P1q0}{\Sigma Poq0} * \frac{\Sigma P1q1}{\Sigma Poq1}} * 100$ or **(P_{10}) =** $\sqrt{\frac{\Sigma P0q0}{\Sigma P1q0} * \frac{\Sigma P0q1}{\Sigma P1q1}} * 100$

Thus, $P_{01} \times P_{10} = \sqrt{\frac{\Sigma P1q0}{\Sigma Poq0} * \frac{\Sigma P1q1}{\Sigma Poq1} * \frac{\Sigma P0q0}{\Sigma P1q0} * \frac{\Sigma P0q1}{\Sigma P1q1}}$

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

2) **Factor Reversibility Test-** It is provides that if quantity index number (Q_{01}) is constructed by substituting 'quantity' in place of 'price' and 'price' in place of 'quantity' and index number is multiplied by current year's price index number, product should be in ratio of total expenditure of current year (Σp_1q_1) and total expenditure of base year (Σp_0q_0).
$P_{01} * Q_{01} = \frac{\Sigma P1q1}{\Sigma Poq0}$

Fisher's formula satisfies also this test as explained below:

(P_{01}) = $\sqrt{\frac{\Sigma P1q0}{\Sigma Poq0} * \frac{\Sigma P1q1}{\Sigma Poq1}} * 100$ $Q_{01} = \sqrt{\frac{\Sigma q1p0}{\Sigma qop0} * \frac{\Sigma q1p1}{\Sigma qop1}} * 100$

$$P_{01}*Q_{01} = \sqrt{\frac{\Sigma P1q0}{\Sigma Poq0} * \frac{\Sigma P1q1}{\Sigma Poq1} * \frac{\Sigma q1p0}{\Sigma q0p0} * \frac{\Sigma q1p1}{\Sigma q0p1}}$$

$$P_{01}*Q_{01} = \frac{\boldsymbol{\Sigma P1q1}}{\boldsymbol{\Sigma Poq0}}$$