Meaning of Index Numbers

An **index number** is the measure of change in a variable (or group of variables) over time. ... **Index numbers** are one of the most used **statistical** tools in economics. **Index numbers** are not directly measurable, but represent general, relative changes. They are typically expressed as percent.

Uses of Index Numbers

Index numbers possess much practical importance in measuring changes in the cost of living, production trends, trade, income variations, etc.

1. Measuring Changes in the Value of Money:

Index numbers are used to measure changes in the value of money. A study of the rise or fall in the value of money is essential for determining the direction of production and employment to facilitate future payments and to know changes in the real income of different groups of people at different places and times. As pointed out by Crowther, "By using the technical device of an index number, it is thus possible to measure changes in different aspects of the value of money, each particular aspect being relevant to a different purpose."

2. Cost of Living:

Cost of living index numbers in the case of different groups of workers throw light on the rise or fall in the real income of workers. It is on the basis of the study of the cost of living index that money wages are determined and dearness and other allowances are granted to workers. The cost of living index is also the basis of wage negotiations and wage contracts.

3. Analysing Markets for Goods and Services:

Consumer price index numbers are used in analysing markets for particular kinds of goods and services. The weights assigned to different commodities like food, clothing, fuel, and lighting, house rent, etc., govern the market for such goods and services.

4. Measuring Changes in Industrial Production:

Index numbers of industrial production measure increase or decrease in industrial production in a given year as compared to the base year. We can know from such as index number the actual condition of different industries, whether production is increasing or decreasing in them, for an industrial index number measures changes in the quantity of production.

5. Internal Trade:

The study of indices of the wholesale prices of consumer and industrial goods and of industrial production helps commerce and industry in expanding or decreasing internal trade.

6. External Trade:

The foreign trade position of a country can be accessed on the basis of its export and import indices. These indices reveal whether the external trade of the country is increasing or decreasing.

7. Economic Policies:

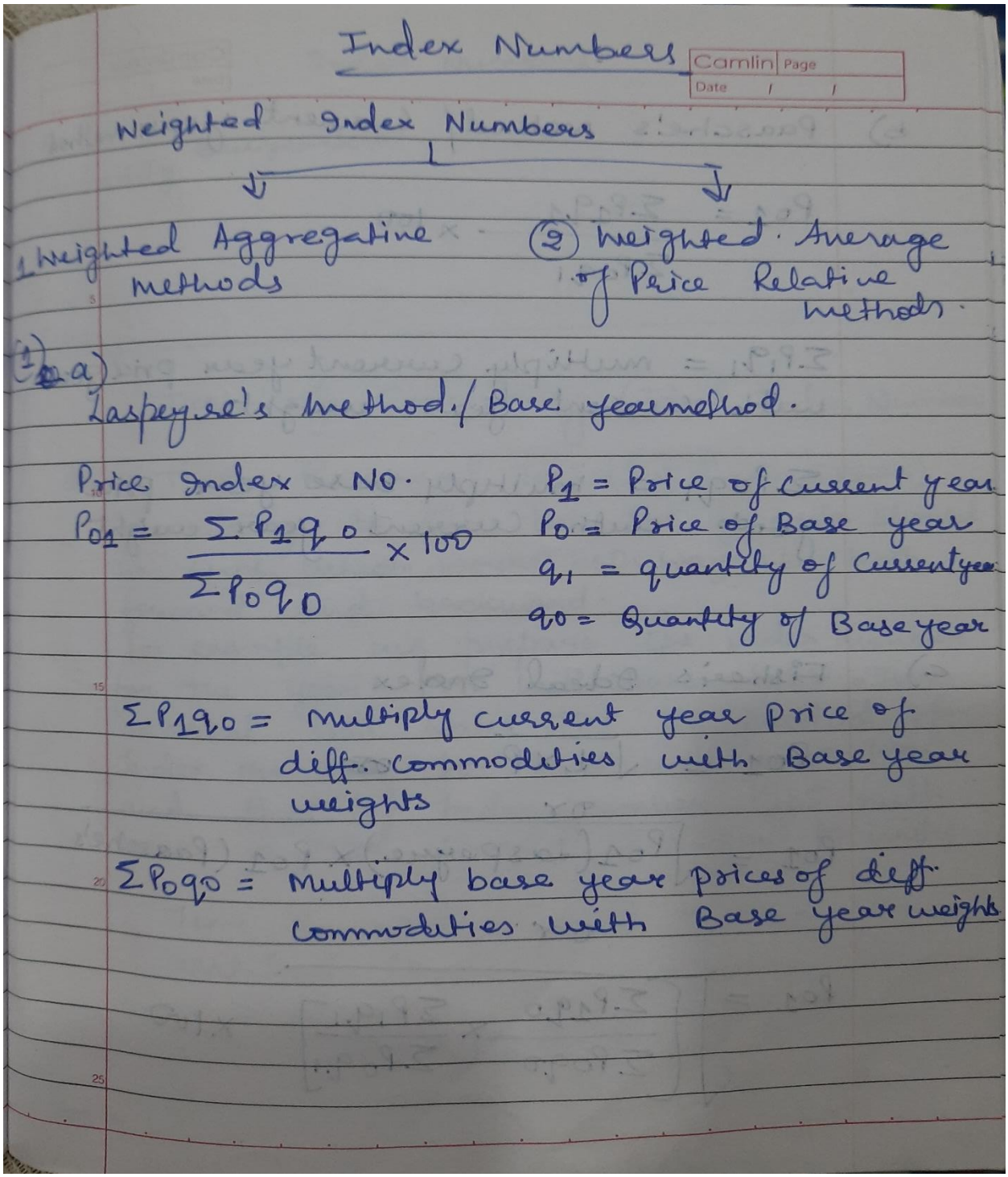
Index numbers are helpful to the state in formulating and adopting appropriate economic policies. Index numbers measure changes in such magnitudes as prices, incomes, wages, production, employment, products, exports, imports, etc. By comparing the index numbers of

these magnitudes for different periods, the government can know the present trend of economic activity and accordingly adopt price policy, foreign trade policy and general economic policies.

8. Determining the Foreign Exchange Rate

Index numbers of wholesale price of two countries are used to determine their rate of foreign exchange. They are the basis of the purchasing power parity theory which determines the exchange rate between two countries on inconvertible paper standard.

Types of Index Numbers



b) Paasche's Method / Current year Method

$$P_{01} = \frac{\Sigma P_1 q_1}{\Sigma P_0 q_1} \times 100$$

$\Sigma P_1 q_1$ = multiply current year price goods with current year weights

$\Sigma P_0 q_1$ = multiply base year price goods with current year weight

c) Fisher's Ideal Index

$$P_{01} = \sqrt{L \times P}$$

or

$$P_{01} = \sqrt{P_{01}(\text{Laspeyre}) \times P_{01}(\text{Paasche's}}$$

or

$$P_{01} = \sqrt{\left[\frac{\Sigma P_1 q_0}{\Sigma P_0 q_0} \times \frac{\Sigma P_1 q_1}{\Sigma P_0 q_1}\right]} \times 100$$

Tests of Consistency (Ideal Index Number)

1. Time Reversal Test (By Irvin Fisher)

According to this test the formula should be such which works both ways i.e. both forward and backward.

for example we prepare the index number for the year 1990 with base 1985. Time reversal test states that the product of Index Number for 1990 with base 1985 and that of Index Number 1985 with base 1990 should be equal to unity.

Time Reversal is said to be satisfied if

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

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Fisher's formula (Excluding 100)

$$P_{01} = \sqrt{\left(\frac{\Sigma P_1 q_0}{\Sigma P_0 q_0} \times \frac{\Sigma P_1 q_1}{\Sigma P_0 q_1}\right)}$$

by interchanging subscripts we get

$$P_{10} = \sqrt{\left(\frac{\Sigma P_0 q_1}{\Sigma P_1 q_1} \times \frac{\Sigma P_0 q_0}{\Sigma P_1 q_0}\right)}$$

Now multiply P_{01} & P_{10} ie

$$P_{01} \times P_{10} = \sqrt{\left(\frac{\Sigma P_1 q_0}{\Sigma P_0 q_0} \times \frac{\Sigma P_1 q_1}{\Sigma P_0 q_0} \times \frac{\Sigma P_0 q_1}{\Sigma P_1 q_1} \times \frac{\Sigma P_0 q_0}{\Sigma P_1 q_0}\right)}$$

$$= \sqrt{1} = 1$$

It means Time Reversal Test is satisfied

② Factor Reversal Test (FRT)

According to this test changes in the prices multiplied by the changes in the quantities should be equal to the total change in the values without using factor 100 each time it is has also been developed by Prof. Irvin Fisher.

This test is applicable if.

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

Fisher's formula:

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

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

Now multiply both :

$$P_{01} \times Q_{01} = \sqrt{\frac{\sum P_1 q_0}{\sum P_0 q_0} \times \frac{\sum P_1 q_1}{\sum P_0 q_1} \times \frac{\sum q_1 P_0}{\sum q_0 P_0} \times \frac{\sum q_1 P_1}{\sum q_0 P_1}}$$

$$= \sqrt{\left(\frac{\sum P_1 q_1}{\sum P_0 q_0}\right)^2} = \frac{\sum P_1 q_1}{\sum P_0 q_0}$$

Therefore Fisher's formula satisfied.
F R T.

Index Numbers

Consumer price Index Numbers / Cost of Living Index

Cost of Living Index is nothing but a comparision between the expenditure of particular section on the commodities in the current period with reference to the base period.

Methods to prepare Consumer price Index Numbers

1. Aggregate Expenditure Method
2. Family Budget Method

1 Aggregate Expenditure Method :

This formula is based upon Laspeyre's Method of constructing an Index No. By this method quantities consumed in the base period are taken as the weights.

we can say that:

Consumer Price Index Number $= \frac{\Sigma P_1 q_0}{\Sigma P_0 q_0} \times 100$

2. Family Budget Method.

a) By Arithmetic mean
Consumer price Index Number

$= \frac{\Sigma PV}{\Sigma V}$ where $P = \frac{P_1}{P_0} \times 100$

$V = P_0 q_0$

b) By Geometric Mean
Consumer price Index Number

$= \text{Antilog} \frac{\Sigma V . \log P}{\Sigma V}$

where $P = \frac{P_1}{P_0} \times 100$, $V = P_0 q_0$