TYPES OF INDEX NUMBERS AND METHOD OF INDEX NUMBERS

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Abstract: In this paper we are deals that various type of index numbers and measured value an index number is a statistical value that measures the change in a variable with respect to time. Index numbers are meant to study changes in the effects of factors which cannot be measured directly

Keywords: Price Index , Quantity Index numbers , WPI, RPI, weight

Introduction:

An index number is a statistical value that measures the change in a variable with respect to time. Index numbers are meant to study changes in the effects of factors which cannot be measured directly . Two variables that are often considered in this analysis are price and quantity. With the aid of index numbers, the average price of several articles in one year may be compound with the average price of the same quantity of the same articles in a number of different years. These are several sources of 'official' statistics that contain index numbers for quantities such as food prices. Clothing prices housing, wages and so on

BASIC DEFINITION

Definition : 1.1

An index number is a statistical measure designed to show changes in a variable or a group or related variable with respect to time, geographic location or other characteristics such as income. Profession etc.

Definition : 1.2

Measure changes in price over a specified period at time it is basically the ratio of the price of a certain number of commodities at the present years again base year.

Definition : 1.3

As the name suggest, these indices pertain to measuring changes in volumes of commodities like goods produced or good consumed etc.

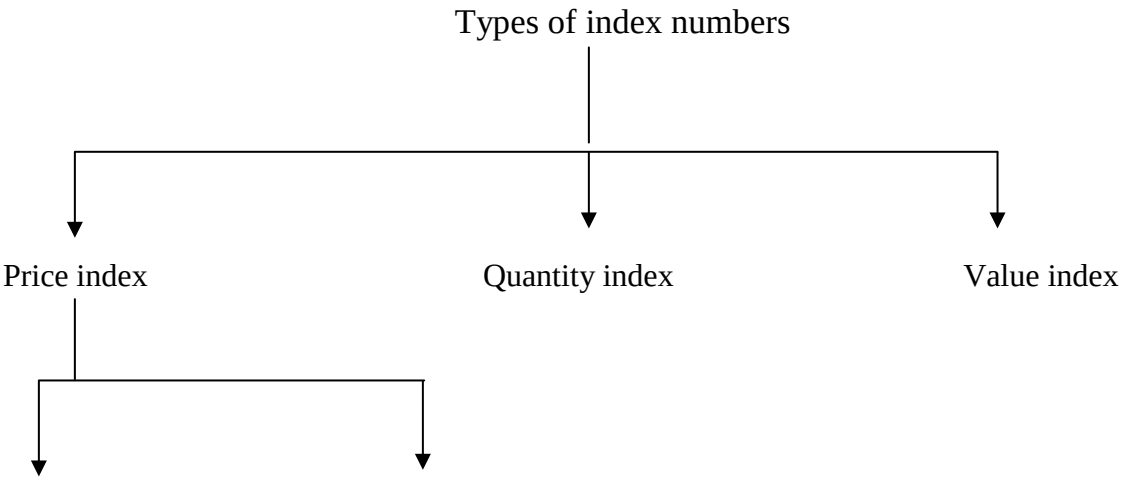
Definition : 1.4

These pertain to compare change in the monetary value of imports, exports, production or consumption of commodities.

Definition : 1.5

In the fixed base, a particular year is chosen as base year and numbers are expressed as relative of that year.

Types of index number : 2.1



Wholesale price Index (WPI)	Retail Price index (RPI)

Price Index : 2.2

For measuring the value of money, the general price index is used. It is an index number which compares the prices for a group of commodities at a certain time rate place with prices of a base period.

a) Whole sale price Index (WPI)

The wholesale price index reveals the changes in the general price level of a country.

b) Retail price Index (RPI)

Retail price index reveals the changes in the retail prices of commodities, such as consumption goods, bank, deposits, bonds etc.

Quantity Index numbers : 2.3

Quantity index numbers study the changes in the volume of goods produced or consumed for instance, industrial production, agricultural production import, export, etc. They are useful and helpful to study the output in an economy.

Value Index Numbers 2.4

Value index numbers are easy to calculate. Here value in Product of Price and Quantity. The value index or V is the sum of the values of a given year divided by the sum of the values of the base year. The value index is a type not in wide use. The formula is

$$\text{Value index or } V = \frac{\sum p_1 q_1}{\sum p0q0} \times 100 \text{ or}$$

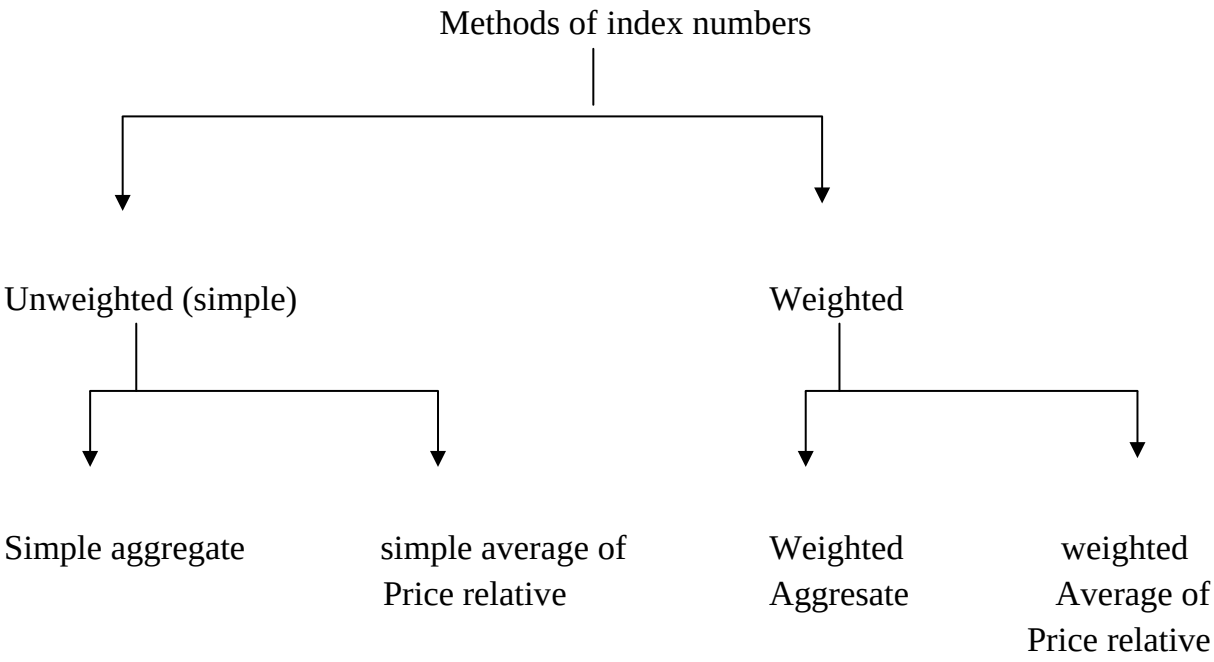
$$V = \frac{\sum V_1}{\sum V_0}$$

Where,

V_1 = Total values of all commodities in the given period.

V_0 = Total values of all commodities in the base period.

Methods of Index Numbers : 2.5



Unweighted 2.6

1.Simple aggregate method :

This is the simplest methodof constructing the index numbers. The prices of the different commodities of the current year are added and the total is divided by the sum of the prices of the base year commodity and multiplied by 100 :

symbolically,

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

P_{01} = Price index number for the current year with reference to the base year.

$\sum P_1$ =Aggregate of prices for the current year.

$\sum P_0$ =Aggregate of prices for the base year.

Example : 1

Commodity	Price in 1990	Price in 1991
A	**90**	**95**
B	**40**	**60**
C	**90**	**110**
D	**30**	**35**

Construct an index number for 1991 taking 1990 as base.

Commodity	Price in 1990	Price in 1991

Solution :

A	90	95
B	40	60
C	90	110
D	30	35
	$\sum P_0 = 250$	$\sum P_1 = 300$

Construction of price index

$P_{01} = \frac{\sum P_1}{\sum P_0} = \frac{300}{250} \times 100$

$= 120$

2. Simple average of price relative method

In this method, the price relative of each item is calculated separately and then averaged. A price relative is the price of the current year expressed as a percentage of the price of the base year symbolically

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

N = Number of items.

When the geometric mean is employed instead of the arithmetic mean then the formula is

P_{01} = antilog $\frac{\sum log\left(\frac{P_1 x 100}{P_0}\right)}{N}$

= antilog $\frac{\sum logP}{N}$

Where P = $\frac{P_1 \, x \, 100}{P_0}$

Weighted index numbers :

1. **Weighted aggregate index numbers :**

According to this method, prices them selves are weighted by Quantities, ie, p x q. Thus physical Quantities are used as weights. There are various methods of assigning weights and thus various formulas have been formed for the construction of index numbers.

Some of the important formulae are given below :

1. Laspeyres method
2. Paasche's method
3. Bowley's method
4. Fisher's ideal method
5. Marshall – Edgeworth method
6. Kelly's method
7. Walsch's method.

A. Lasypeyre's method :

In this method the base year Quantities are taken as weights : symbolically

$$P_{01} \text{ (La)} = \frac{\sum P_1}{\sum P_0} \text{ x } 100$$

B. Paasche's method

In this method , the current year Quantities are taken as weights symbolically.

$$P_{01} \text{ (Pa)} = \frac{\sum P_1 q_1}{\sum P_0 q_1} \text{ x } 100$$

C. Bowley's method

This is an index number got by the arithmetic mean of Laspeyre's and Passche's method symbolically This method takes into account both the current and the base (Periods) symbolically.

$$P_{01}\ (B) = \frac{\frac{\sum P_1 q_0}{\sum P_0 q_0} + \frac{\sum P_1 q_1}{\sum P_0 q_1}}{2} \times 100 = \frac{L+P}{2}$$

L = Laspeyre's method

P = Paasche's method

D. Fisher's Ideal method :

Fisher's price index number is given by the geometric mean of Laspeyre's and Paasche's formula symbolically

$$P_{01}\ (B) = \sqrt{L \times P} = \sqrt{\frac{\sum P_1 q_0}{\sum P_0 q_0} \times \frac{\sum P_1 q_1}{\sum P_0 q_1}} \times 100$$

E. Marshall edge worth method :

In marshall – Edge worth's index number the arithmetic mean of base year – current year Quantities is taken as the weights.

$$P_{01}\ (Ma) = \frac{\sum p_1 (q_0 + q_1)}{\sum p_0 (q_0 + q_1)} \times 100$$

$$P_{01} = \frac{\sum p_1 q_0 + \sum p_1 q_1}{\sum p_0 q_0 + \sum p_0 q_1} \times 100$$

F. Kelly's method

Kelly's index number uses Quantities of some period as weights. This weight is kept constant for all periods. If we denote it by q, then kelly's index number is given by

$$P_{01}\ (K) = \frac{\sum P_1 q}{\sum P_0 q} \times 100$$

G. Walsch's method

Walsch's index number uses the geometric mean of the base year and current year Quantities as weight.

$$P_{01}\ (wa) = \frac{\sum P_1\sqrt{q_0 q_1}}{\sum P_0\sqrt{q_0 q_1}} \times 100$$

2. Weighted average of price relative

Price relative is not calculated by the weighted aggregate method. If we know the values consumed in the base year, then we can construct the weighted index number according to the weighted average of relative method.

$$P_{01} = \frac{\left(\frac{p_1}{q_0} x\ p_0 q_0\right)}{\sum p_0 q_0} \times 100 = \frac{\sum pv}{\sum v}$$

P = price relative $\left(\frac{p_1}{p_0}\ x\ 100\right)$,

V = Value weight $(p_0 q_0)$

Exmaple :

Compute the five different weighted index numbers for 1990 from the following data.

Commodity	Price		Quantity	
	1980	1990	1980	1990
A	2	4	8	6
B	5	6	10	5
C	4	5	14	10
D	2	2	19	13
E				

Solution :

Commodity	1980		1990		$P_0\ q_0$	$P_1\ q_0$	$P_0\ q_1$	$P_1\ q_1$
	P_0	q_0	P_1	q_1				
A	2	8	4	6	16	32	12	24
B	5	10	6	5	50	60	25	30
C	4	14	5	10	46	70	40	50
D	2	19	2	13	38	38	26	26
					160	200	103	130

1) Laspayre's index = $P_{01} = \frac{\sum p_1 q_0}{\sum p_0 q_0} \times 100$

$= \frac{200}{160} \times 100$

$= 125$

2) Paasche's index = $P_{01} = \frac{\sum p_1 q_1}{\sum p_0 q_1} \times 100$

$= \frac{130}{103} \times 100$

$= 126.21$

3) Fisher's ideal index

$P_{01} = \sqrt{\frac{\sum p_1 q_0 \ x \ \sum p_1 q_1}{\sum p_0 q_0 \ x \ \sum p_0 q_1}} \times 100$

$= \sqrt{\frac{200 \ x \ 130}{160 \ x \ 103}} \times 100$

$= \sqrt{125\ x\ 121.21}$

$= \sqrt{15776.25}$

= 125.6

4) Dorbish and Bowley's method

$P_{01} = \frac{L+P}{2}$

$= \frac{125+126.2}{2}$

= 125.6

$P_{01} = \frac{\frac{\sum p_1q_0+\sum p_1q_1}{\sum p_0q_0+\sum p_0q_1}}{2}$ x 100

$= \frac{\frac{200}{160}+\frac{130}{103}}{2}$ x 100

$= \frac{1.25+1.26}{2}$ x 100

= 125.6

1) Marshall – Edge worth index

$P_{01} = \frac{\sum p_1(q_0+q_1)}{\sum p_0(q_0+q_1)}$ x 100

$= \frac{\sum p_1q_0+p_1q_1}{\sum p_0q_0+p_0q_1}$ x 100

$= \frac{200+130}{160+103}$ x 100

$= \frac{330}{263}$ x 100

= 1.2547 x 100

= 125.5

Example :

Products	P_0	q_0	P_1	q_1
A	12	100	20	120
B	4	200	4	240
C	8	120	12	150
D	20	60	24	50

Fort the data given above, find the index number by Paasche's method and Laspeyre's method.

Commodity	P_0	q_0	P_1	q_1	$P_0\ q_0$	$P_0\ q_1$	$P_1\ q_0$	$P_1\ q_1$
A	12	100	20	120	1200	1440	2000	2400
B	4	200	4	240	800	960	800	960
C	8	120	12	150	960	1200	1440	1800
D	20	60	24	50	1200	1000	1440	1200
					$\sum p_0\ q_{0=}$	$\sum p_1\ q_{0=}$	$\sum p_0\ q_{1=}$	$\sum p_1\ q_{1=}$
					4160	4600	5680	6360

1) Laspayre's index = $P_{01} = \frac{\sum p_1 q_0}{\sum p_0 q_0} \times 100$

$$= \frac{5680}{4160} \text{ x } 100$$

$$= 136.54$$

2) Paasche's index = $P_{01} = \frac{\sum p_1 q_1}{\sum p_0 q_1} \text{ x } 100$

$$= \frac{5680}{4160} \text{ x } 100$$

$$= 136.54$$

Example :

Compute Laspeyre's, Paasche's and Fisher ideal index x numbers for the following data

Products	P_0	q_0	P_1	q_1
A	6	10	50	50
B	2	2	100	120
C	4	6	60	60
D	10	12	30	25

Commodity	P_0	q_0	P_1	q_1	$P_0\ q_0$	$P_0\ q_1$	$P_1\ q_0$	$P_1\ q_1$
A	6	10	50	50	300	300	500	500
B	2	2	100	120	200	240	200	240
C	4	6	60	60	240	240	360	360

D	10	12	30	25	300	250	360	300
					$\sum p_0 q_{0=}$ 1040	$\sum p_1 q_{0=}$ 1030	$\sum p_0 q_{1=}$ 1420	$\sum p_1 q_{1=}$ 1400

1) Laspayre's index = $P_{01} = \frac{\sum p_1 q_0}{\sum p_0 q_0}$ x 100

$= \frac{1420}{1040}$ x 100

= 136.54

2) Paasche's index = $P_{01} = \frac{\sum p_1 q_1}{\sum p_0 q_1}$ x 100

$= \frac{1400}{1030}$ x 100

= 135.92

Conclusion:

The index numbers are used to measures all types of Quantitative changes in the agricultural, industrial and commercial fields, as also in such economic magnitudes as income, employment, exports, imports, prices, etc.

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