INDEX NUMBERS

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Index numbers.

Is a number which indicates the level of certain phenomenon at any given date in comparison with the level of the same phenomenon at some standard date.

Provides the opportunity to measure the relative change of a variable where measurements of its actual change are impossible.

Are a series of numbers/values by which changes in the magnitude of a phenomenon are measured from place to place and time to time e.g., one may use the index number to study the change in prices of sugar of a given community or the changes of cost of living for a citizen.

There are different types of index numbers;

1. Price index numbers
2. Consumer (cost of living) index numbers
3. Stock exchange index numbers
4. Quantity index numbers
5. Wholesale/producer index numbers

The above types of indices fall under 3 broad categories;

1. Simple index numbers
2. General index numbers
3. Weighted index numbers

Factors to consider when constructing an index number.

a) Purpose of the index number.
   - → It is essential that the purpose of index number be determined before the construction otherwise the index number may be useless.
   - → The true results can be determined from proper construction method e.g. to compare the price of a commodity over time, simple indices are better than general indices.

b) Selection of the commodity/phenomenon.
   - → Once the purpose is known, selection of that commodity(s) for that purpose becomes easier and accurate.
   - → Great care and skills is used, e.g. to compare the price of household goods over a period of time, select the commodities that are commonly used in that household, whose prices easily fluctuate so as to obtain true results.

c) Price quotations
   - → It is impossible to collect price of the selected commodities from all the places in a region where they are marketed. A sample of markets will therefore be selected.
   - → The criterion of the sample, will be those places where given commodities are marketed in large commodities, and it is possible that a sample may serve the purpose of many commodities rather than one.

d) Choice of the base period (standard date)
   - → A base period is usually collected against which all the prices of other years are compared.
   - → Prices/quantities in these years are usually represented by 100%.
   - → The base year should be fairly normal. It should neither be high nor low.

e) Choice of the average to be used.
   - → When studying indices, averages are used.
   - → It must therefore be decided which average should be used since there are different measures of tendencies.

f) Choice of the proper weights.
   - → It is important to give weights according to the importance of the given commodities keeping in mind the purpose of the index number.
   - → Weighting is the process of assigning a number to different commodities in consideration of their importance to the given community.

1. Price index number

They show fluctuation in the value of money (either the value of the money is appreciating or depreciating as the index number prices increase or decrease over a period of time)

There are 3 categories of these.

a. **Simple price index number**
   - → Are constructed for a single commodity.
   - → There are two methods for constructing them.

   i. **Fixed based method**

   Here the base period is fixed and the prices of the subsequent years are expressed as relatives of the prices of the base year.

   Is calculated as follows; $P.R = \frac{p_1}{p_0} * 100$

   Example

   From the following data compute price indices taking 1991 as the standard year.

Year	1991	1992	1993	1994	195	1996	1997
Price of 1kg of sugar (KSH)	8	10	12.5	18	22	25	30.5

Year	prices	P.R
1991	8	100
1992	10	125
1993	12.5	156.25
1994	18	225
1995	22	275
1996	25	312.5
1997	30.5	381.25

ii. **Chain based method**

here the base is no fixed. Prices of the previous period is taken as the base period. Shows weather the rate of change is raising or falling.

Example

Construct chain-based indices for the following data.

Year	2000	201	2002	2003	2004	2005	2006	2007
Prices	120	125	140	150	135	160	200	300

year	prices	P.R
2000	120	100
2001	125	104.1667
2002	140	112
2003	150	107.1429
2004	135	90
2005	160	118.5185
2006	200	125
2007	300	150

The rate of change rose to 2003 where it dropped, and began to rise again steadily to 2007.

b. **General price index number**

Is constructed when indexing involves more than one commodity. Index number of each commodity is first computed for each commodity and then averaged for the rest of each year.

Example; construct the general prize indices form the following data taking 1993 as the base year.

Year	Price				
	Rice	Sugar	Bread	Cooking oil	Margarine
1993	40	16	5	50	35
1994	42	15	6	70	37
1995	45	20	4	100	42
1996	43	18	10	120	48
1997	50	22	15	130	53

Answer

year	Price											
	Rice	GPI	Sugar	GPI	Bread	GPI	Cooking oil	GPI	Margarine	GPI	Total	GPI average
1993	40	100	16	100	5	100	50	100	35	100	500	100
1994	42	105	15	93.75	6	120	70	140	37	105.7143	564.4643	112.8928571
1995	45	112.5	20	125	4	80	100	200	42	120	637.5	127.5
1996	43	107.5	18	112.5	10	200	120	240	48	137.1429	797.1429	159.4285714
1997	50	125	22	137.5	15	300	130	260	53	151.4286	973.9286	194.7857143

Where GPI represents the General price indexing.

<p style="text-align:center">limitations of general indexing</p>

- The units in which the price of commodities is given affect the price index. The price of batter can be given per Kg while the price of bread can be given per loaf.
- No consideration is given to the relative importance of the commodities to the community. Usually, some commodities e.g., sugar are considered more important than margarine in some communities.

<p style="text-align:center">Advantages of general indexing</p>

c. **Weighted price index number**

is a method of calculating price indices of several communities while taking into consideration the relative importance of every commodity?

This system is adopted because not all the selected commodities have equal importance to the consumers.

There are two main methods for calculating weighted price index. These are;

i) **The weighted aggregate method.**

An index number is called weighted aggregate when it is constructed for an aggregate of items that have been weighted in the same way.

Methods used in calculations are;

$$Laaspeyre's\ method: \frac{\sum p_1 q_o}{\sum p_o q_o} * 100$$

$$Paasche's\ method: \frac{\sum p_1 q_1}{\sum p_o q_1} * 100$$

$$Fisher's\ ideal\ formulae: \left(\sqrt{\frac{\sum p_1 q_0}{\sum p_0\ q_0} * \frac{\sum p_1 q_1}{\sum p_0\ q_1}} \right) * 100$$

$$Marshal\ Edgeworth's\ method: \frac{\sum p_1 q_0 + \sum p_1 q_1}{\sum p_0\ q_0 + \sum p_0\ q_1} * 100$$

<p style="text-align:center">Comparison between $laaspeyre's$ method and $paasche's$ method'</p>

→ The $laaspeyre's$ method is often preferred because it uses the base year quantities and does not change from one year to another.
→ The use of $paasche's$ indexing requires continuous new quantities as weights for each period considered and, in most case, the weights/quantities are difficult and expensive to obtain.

Example, use all the above given formulae to construct the index numbers for 1996 taking 1989 as the base year.

Commodity	1989		1996	
	Price (sh)	Commodity (bags)	Price (sh)	Commodity (bags)
Maize	65	20	135	30
Wheat	95	8	160	7
Beans	150	5	320	8

ii) **The weighted average of the price relative method.**

Here price relatives are weighted by their values (V).

The values are computed by multiplying the quantity consumed by their corresponding price per unit.

Is calculated using the formula; $\frac{\sum IV}{\sum V}$ where I is the price relatives given by $I = \frac{P_1}{P_0} * 100$ and V is the quantity of goods consumed and is given by $V = p_0 q_0$.

Example, compute the index number for 1996 from the following data.

Item	Price (Ksh) 1991	Price (Ksh) 1996	Quantities (units)
Fish	20	40	30
Meat	25	50	100
Eggs	20	30	50
Vegetables	10	18	100

$\frac{P_1}{P_0} * 100$	$p_0 q_0$	The product
200	600	120000
200	2500	500000
150	1000	150000
180	1000	180000
150	1500	225000
880	6600	1175000

fruits	30	45	50

$$= \frac{\sum IV}{\sum V} = \frac{1175000}{6600}$$

$$= 178.030303$$

Averagely price of commodities in the list went up by 78.03% weighting by values.

Merits of the weighted average of the price relative method.

- When different prices are constructed using this method, all of which have the same base, they can be combined to form a new base.