INDEX NUMBERS

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| CONCEPT  Index number is a single pure number which represents the percentage change in the prices(or quanties)  of the group of consumer goods in the current year with respect to the base year. |

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| DEFINITIONS |

Spiegel--

*An index number is a statistical measure designed to show changes in a variable or a group of related variables with respect to time, geographical location or other characteristics.*

Croxton and Cowden--

*Index numbers are devices for measuring differences in the magnitude of a group of related variables.*

Wesell and Willett--

*Index numbers is a special type of average which provides* a measurement of relative changes from time to time or from place to place.

Thus an index number may be described as a measure of the average change of a group of related variables over two different situations.

The group of variable may be –

i. Prices of a specified group of commodities

Group I--Rice,sugar,onion, potato etc

Group II—nail police,lipstick,bodylotion, etc.

ii. Volumes of production

iii. The cost of living of a particular group of people

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| USES OF INDEX NUMBERS— |

i. To study trend or tendencies-

exports,imports,BOP,price,NI,industrial production

ii. Framing Policies

with the help of cost of living index numbers is used to fix DA.

iii. Calculation of purchasing power of money

iv. Deflating—

transformation of nominal wages into real wages

v. Act as economic barometer

As a barometer measures up and down of weather, similarly IN measures ups and down in the general economic condition of a country. The indices of prices(whole sale and retail), output, Volume of trade, imports, exports, industrial and agricultural production, RBI deposits, foreign exchange etc., throw light on the nature of variation in the general economic and business activity of a country. These indices may be combined into a composite index which could act as an economic barometer.

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| PROBLEMS IN THE CONSTRUCTION OF INDEX NUMBER |
| 2018 OR STEPS REQUIRED TO CONSTRUCT AN INDEX NUMBER |

1. PURPOSE
2. SELECTION OF COMMODITIES
3. COLLECTION OF DATA
4. SELECTION OF BASE PERIOD 2015-2016-2017-2018-2019-2020-2021-chain base index
5. CHOICE OF AVERAGE
6. SELECTION OF WEIGHTS
7. SELECTION OF APPROPRIATE FORMULLA

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| SOME USEFUL NOTATIONS |

1. 0 –denote base year
2. 1-denote current year
3. P0- the price of the base year
4. P1-the price of current year
5. q0- the quantity of the base year
6. q1- the quantity of the current year
7. P01- the price index number of the current year with respect to the base year
8. q01 - the quantity index number of the current year with respect to the base year
9. w-the weights assigned to commodities according to relative importance

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| PRICE RELATIVES |

The ratio of the price of a commodity at the current year to its price at the base year expressed as percentage.

Price Relatives= x100 2015 potato price rs 15 per kg

2020 Potato price rs 20 per kg

x100= 133.33 means 33.33

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| CLASSIFICATIO OF INDEX NUMBER |

1. Price Index Number
2. Quantity Index Number
3. Value Index Number=

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| PRICE INDEX NUMBER |

Price Index Number measures the change in the prices of commodities produced or consumed in the current period with respect to the base period.

They are of three types

1. Wholesale Price Index Number
2. Retail Price Index Number
3. Consumer or Cost of living Price Index Number

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| METHODS OF CONSTRUCTING PRICE INDEX NUMBERS |

1. Simple or Unweighted Index Number
2. Weighted Index Number

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| SIMPLE OR UNWEIGHTED INDEX NUMBER |

It assumes that all the commodities have equal importance. It can be calculated by two methods.

1. Simple Aggregative Method
2. Simple Average of Relative Method

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| 1. SIMPLE AGGREGATIVE METHOD |

In this method, the sum of prices of different commodities in the current year is divided by the sum of prices of different commodities in the base year and is multiplied by 100. Symbolically

P01= X100

Merits

Method is very simple and easy to calculate.

Demerits

1. Very much affected by the magnitude of prices of commodities
2. Relative importance of commodities is ignored.

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| SIMPLE AVERAGE OF RELATIVE METHOD |

In this method,firstly price relatives of various items are calculated and then the average of these price relatives is obtained either by applying arithmetic mean or geometric mean.

If arithmetic mean is applied, the formula is-

P01 =

Merits

Not influenced by units.

Not influenced by absolute values of prices as prices are converted to price relatives.

Extreme items do not influence the index.

Demerits

Equal importance is given on all items.

Choice of average is a problem.

Example

From the following data construct an index number for 2021 taking 2015 as base year by

1. The aggregative method
2. The average of relative method

|  |  |  |
| --- | --- | --- |
| Commodities | Price in 2015 | Price in 2021 |
| A | 50 | 70 |
| B | 40 | 60 |
| C | 80 | 90 |
| D | 110 | 120 |
| E | 20 | 20 |

Solution :-

|  |  |  |  |
| --- | --- | --- | --- |
| Commodities | Price in 2015(Base year)  P0 | Price in 2021(Current year)  P1 | Price Relatives = x100 |
| A | 50 | 70 | 140.00 |
| B | 40 | 60 | 150.00 |
| C | 80 | 90 | 112.50 |
| D | 110 | 120 | 109.09 |
| E | 20 | 20 | 100.00 |
|  | =300 | =360 |  |

Price index by aggregative method

P01= X100 = X100 = 120

It implies that the prices of commodities has increased by 20 percent in 2021 compared to 2015.

Price index by average of relative method

P01 ==122.32

It implies that the prices of commodities has increased by 22.32 in 2021 compared to 2015.

percent

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| II.WEIGHTED INDEX NUMBERS |

The importance of commodities that a consumer consumes are not same. When index number is constructed reflecting the importance of commodities it is called Weighted Index Numbers. It is of two types

1. Weighted Aggregative Index Numbers
2. Weighted Average of Relative Index Numbers

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| WEIGHTED AGGREGATIVE INDEX NUMBERS |

In this methods weights are assigned to various commodities to depict their relative importance. Usually the quantities of commodities consumed, sold or marketed in the base year or current year or some typical year are used as weights. The formula is—

P01= X100

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| Numerical example of Construction of Weighted index number |

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| --- | --- | --- | --- | --- | --- |
| Commodities | weights | Price in 2015 (p0) | p0 w | Price in 2021(P1) | P1w |
| A-rice | 8 | 50 | 400 | 70 | 560 |
| B- salt | 7 | 40 | 280 | 60 | 420 |
| C-sugar | 2 | 80 | 160 | 90 | 180 |
| D-dal | 5 | 110 | 550 | 120 | 600 |
| E-potato | 4 | 20 | 80 | 20 | 80 |
| F-tea | 1 | 200 | 200 | 250 | 250 |
| Total |  |  | 1670 |  | 2090 |

P01= X100 = X100 =125.15

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| **Assignment(22.7.2021) :**  **Collect information of prices of onion, potato, rice, dal, salt, mustered oil, tea and sugar in 2019 and 2021 and construct unweighted and weighted index number index number . Submit the same Saturday (24.7.2021).** |

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Commodity | WEIGHT  GIVEN BY YOU | Price 2019  P0 | Quantity PURCHSED PER MONTH 2019 | Price 2021  P1 | Quantity 2021 |  |  |
| Onion | 3 | 20 |  | 40 |  |  |  |
| POTATTO | 8 |  |  |  |  |  |  |
| RICE | 10 |  |  |  |  |  |  |
| MUGU DAL | 7 |  |  |  |  |  |  |
| SALT | 9 |  |  |  |  |  |  |
| M.OIL | 6 |  |  |  |  |  |  |
| TEA | 5 |  |  |  |  |  |  |
| SUGAR | 4 |  |  |  |  |  |  |
| TOTAL |  |  |  |  |  |  |  |

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| 1. LASPEYRE’S METHOD |

= LP01 = L= X100

In this methods base year quantities are taken weights. It was devised in 1871.

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| 1. PAASCHE’S METHOD |

= PP01 = X100

In this methods current year quantities are taken weights. It was devised in 1874.

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| 1. FISHER’S IDEAL INDEX NUMBERS |

It is geometric mean of Laspeyre’s and Paasche’s index number.

FP01=  =  x 100

It is called ideal index number because-

1. Based on GM which is best average for construction of index number.
2. It gives importance on both current year and base year prices and quantities.
3. Satisfies both time and factor reversal test.
4. Free from bias.

TIME REVERSAL TEST= P01 X P10 = 1

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| Numerical example |

From the following data construct the index number for 2020 with 2014 as base using Laspeyres’, Paasches’ and Fisher’s method.

|  |  |  |  |
| --- | --- | --- | --- |
|  | Commodity | | |
| Quantity (k.g.)  2014  2020 | A | B | C |
| 25  15 | 10  5 | 5  10 |
| Price(Price per kg)  2014  2020 | 10  20 | 100  150 | 200  180 |

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| Solution |

Construction of Laspeyres, Paasches and Fisher Index Number.

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| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Commodity | 2014 | | 2020 | | p0q0 | P1q0 | p0q1 | P1q1 |
| Price  (P0) | Quantity  (q0) | Price  (P1) | Quantity  (q1) |
| A | 10 | 25 | 20 | 15 | 250 | 500 | 150 | 300 |
| B | 100 | 10 | 150 | 5 | 1000 | 1500 | 500 | 750 |
| C | 200 | 5 | 180 | 10 | 1000 | 900 | 2000 | 1800 |
| Total |  |  |  |  | 2250 | 2900 | 2650 | 2850 |

Therefore ,

LP01 = X100= X100 = 128.89

PP01 = X100= X100 = 107.55

FxP01=  == 118

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| *CHAIN BASE INDEX NUMBER* |

In chain base method, the value of each period is related to that of the immediately preceding period (and not any fixed period). The cahin base is suitable for long run study. It is constructed with the help of [Link Relatives](file:///C:\Users\user\Desktop\INDEX%20NUMBERS%20binod%20goswami%20(2).dot) which are a series of index numbers for each year with preceding year as the base year. The link relatives can be calculated as follows---

Link Relatives= x 100

The link relative are represented as P01, P12 ,P23 , etc. The link relative can be chained as follows-

P01 = First link relative

P02 = P01x P12

P03 = P01x P12 x P23= P02x P23

P04 = P01x P12 x P23x P34 = P03x P34  and so on……

After finding link relatives, the Chain Base Index are obtained by the following formula:-

Chain Base Index (CBI) =

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| NUMERICAL EXAMPLE |

Compute the chain base index number with 2014 prices as base from the following table giving the average wholesale prices of the commodities A,B and C for the years 2014-2018.

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| --- | --- | --- | --- | --- | --- |
| Average wholesale price(in Rs) | | | | | |
| Commodity | 2014 | 2015 | 2016 | 2017 | 2018 |
| A | 20 | 16 | 28 | 35 | 21 |
| B | 25 | 30 | 24 | 36 | 45 |
| C | 20 | 25 | 30 | 24 | 30 |

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| Solution |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Commodity | Relatives based on previous year | | | | |
| 2014 | 2015 | 2016 | 2017 | 2018 |
| A | 100 | X100=80 | X100=175 | X100=125 | X100=60 |
| B | 100 | X100=120 | X100=80 | X100=150 | X100=125 |
| C | 100 | X100=125 | X100=120 | X100=80 | X100=125 |
| Total of link  relatives | 300 | 325 | 375 | 355 | 310 |
| Average of link  Relatives | 100 | 108.33 | 125 | 118.33 | 103.33 |
| Chain Index  (2013=100) | 100 | =108.33 | =135.41 | =160.23 | =165.57 |

Merits

1. Economic and business data becomes practically useful when it is compared with previous periods and not with any distant past.
2. This method permits inclusion of new commodities and deletion of old ones without recalculation of entire series. That is why it is used in the indices like consumer price index and wholesale price index.
3. Weights can be adjusted as frequently as possible.
4. It is free from seasonal variation.

Limitation

The main limitation of this method is that while the percentage of previous year figures give accurate comparisons of year to year changes, but long –range comparisons of chained percentage are not strictly valid.

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| DEFLATING OF INDEX NUMBERS |

Deflating is the statistical process of removing the effect of price changes from the current money value. It helps to find out the real value or purchasing power of money.

Purchasing Power of Money=

Deflated or Real Wage =Money Wage x x100

Or= x100

MW=300000 , P01=150 REAL WAGE = 30000 x x100=20000

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| COST OF LIVING INDEX NUMBER |

The cost of living index number is also called the consumer price index number or retail price index. It is used to measure the effect of rise and fall in prices of a basket of goods and services on the purchasing power of a particular group of people or a section of society during a given period. It is necessary to construct separate index number for different class of people because the consumption habit of people varies widely from class to class and even within the same class from region to region. The change in the level of prices affect different classes differently. The main steps of constructing the cost of living index are as follows—

1. Scope and coverage:-

The first step is to take decision about the group or the class of people for whom the cost of living index number is to be constructed. It also needs to specify the geographical area of that group of people.

1. Family Budget Enquiry:-

The second step is to conduct a family budget enquiry to find out how much an average family spends on different commodities of consumption. The enquiry is conducted by selection of families on the basis of random sample and during a normal period. Generally, a household spends their income on the following heads-

1. Food
2. Clothing
3. Fuel and Lighting
4. House rent
5. Education
6. Miscellaneous

Her it should be kept in mind that the items of consumption are selected in such a way that they represent that particular group of people and they also represent their taste, habit, and customs.

1. Collection of Price Quotations:-

For construction of cost of living index, retail prices of commodities are taken into consideration as household collects commodities in smaller quantities from retail shops. But the obtain accurate information of retail prices of commodities is a difficult task as retail price varies place to place and also time to time. The information of retail price should be collected from the market from where the selected group of people purchases their commodities.

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| Methods of constructing cost of living index number |

1. Aggregate Expenditure method
2. Family Budget Method

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| Aggregate Expenditure Method |

In this method the cost of living index number is obtained by dividing the total expenditure of the current year by the total expenditure on the same basket of goods in the base year multiuplied by 100. Here the base year quantities are used as weights. Thus it is nothing but the Laspeyre’s formula. Symbolically—

Cost of Living Index= X100

= X100

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| Family Budget Method |

In this method, weighted averages of price relatives are taken. The weights are obtained by multiplying the prices with the quantities in the base year i.e. p0 q0 .

Price Relative (P) = X100

Weights (w) = p0 q0

Thus, Cost of Living Index =

The cost of living index obtained through Family Budget Method is nothing but the Laspeyeres’ index, i.e.

X100

If IF, IC, IL, IH and IM stand for the indices of food,clothging, fuel and lighting,house rent and miscellaneous groups respectively and WF, WC, WL, WH, and WM denote the weights of these groups then –

Cost of Living Index=

=

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| Uses of Cost of Living Index |

1. It is used to adjust dearness allowance to the workers so as to enable them to meet the increased cost of living.
2. Widely used in wage negotiations and wage contract.
3. To study the purchasing power of money
4. To measure real wage and is calculated as—

Real wage= x100

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| Exercise(GU/BCOM/2008) |

THE FOLLOWING TABLE GIVES THE INDEX NUMBER FOR DIFFERENT GROUPS OF ITEMS WITH THEIR RESPECTIVE WEIGHTS FOR 2005 (Base year 2000)

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Group | Food | Clothing | Fuel | Rent | Others |
| Group Index Number | 525 | 325 | 240 | 180 | 200 |
| Group weight | 40 | 16 | 15 | 20 | 9 |

1. Calculate the overall cost of living index number.
2. Mr. X got a salary of Rs 8500 in 2000. Determine how much he should have to receive as salary in 2005 to maintain the same standard of living as in 2000.

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| Solution |

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| --- | --- | --- | --- |
| Groups | Group Index(I) | Weights (W) | IW |
| Food | 525 | 40 | 21000 |
| Clothing | 325 | 16 | 5200 |
| Fuel | 240 | 15 | 3600 |
| Rent | 180 | 20 | 3600 |
| Others | 200 | 9 | 1800 |
| Total |  | 100 | 35200 |

Therefore,

1. Cost of Living Index ==352
2. Money wage of Mr X = Rs 8500

Cost of Living index = 352

Therefore , he should receive =

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| Exercise |

Calculate the cost of living index number from the data given below-

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Groups | Base year | | Current year | |
| Price | Quantity | Price | Quantity |
| Food | 20 | 7 | 25 | 8 |
| Fuel and lighting | 7 | 4 | 10 | 5 |
| Clothing | 10 | 3 | 12 | 4 |
| House rent | 7 | 2 | 10 | 4 |
| Miscellaneous | 10 | 4 | 15 | 3 |

Computation of cost of living index number through Family Budget Method

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Groups | P0 | q0 | P1 | q1 | P = X100 | W=P0q0 | PW |
| Food | 20 | 7 | 25 | 8 | 125.00 | 140 | 17500 |
| Fuel and lighting | 7 | 4 | 10 | 5 | 142.86 | 28 | 4000 |
| Clothing | 10 | 3 | 12 | 4 | 120.00 | 30 | 3600 |
| House rent | 7 | 2 | 10 | 4 | 142.86 | 14 | 2000 |
| Miscellaneous | 10 | 4 | 15 | 3 | 150.00 | 40 | 6000 |
| Total |  |  |  |  |  | 252 | 33100 |

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| Solution |

Cost of Living Index = = = 131.35

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| WHOLESALE PRICE INDEX NUMBER |

Wholesale price index number is constructed on the basis of the wholesale prices of the commodities traded in wholesale market and it measures the relative changes in the general price level in a given period of time compared to some base period. In constructing this index number data about the whole sale prices of commodities marketed are selected.it is not possible to include all the commodities to construct this index number, therefore a sample of commodities represented a particular group are selected. The weights are assigned according to relative important of the commodities. Data for this purpose are collected from standard government agencies or from commercial centres. This index number is used to forecast demand and supply situation in the economy, estimation of monetary value and real value. It is an indicator of rate of inflation. In India, wholesale price index number is calculated on weekly basis. Following steps are required to construct the wholesale price index number.

1. PURPOSE
2. SELECTION OF COMMODITIES
3. COLLECTION OF DATA
4. SELECTION OF BASE PERIOD
5. CHOICE OF AVERAGE
6. SELECTION OF WEIGHTS
7. SELECTION OF APPROPRIATE FORMULLA