6th SEMESTER

INDEX NUMBER

RITU MADAM

Time reversal test

Acc to this test the index number should work both ways forward as well as backward with respect to time. Thus if P_{01} = index number for the current year based on base year

P_{10} = index number for base year based on current year then

$$P_{01} \times P_{10} = 1 \dots\dots\dots\dots\dots\dots\dots\dots\dots(i)$$

An eqution which satisfies (i) is said to satisfy time reversal test

Fisher's Price Index Number is given by

$$P_{01}^{\ F} = \sqrt{\sum p_1 q_0 \times \sum p_1 q_1 / \sum p_0 q_0 \times \sum p_0 q_1}$$

Interchanging base year and current year

$$P_{10} = \sqrt{\sum p_0 q_1 \times \sum p_0 q_0 / \sum p_1 q_1 \times \sum p_1 q_0}$$

Now $P_{01} \times P_{10}$ $= \sqrt{\sum p_1 q_0 \times \sum p_1 q_1 / \sum p_0 q_0 \times \sum p_0 q_1 \times \sqrt{\sum p_0 q_1 \times \sum p_0 q_0 / \sum p_1 q_1 \times \sum p_1 q_0}}$

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

Factor Reversal Test

To this test the factor reversal test is satisfied if the change in price multiplied by the change in quantity is equal to the total change in value.

i.e $P_{01} \times q_{01} = \sum p_1 q_1 / \sum p_0 q_0$ (V_{01})..................(ii)

q_{01} = quantity change for the current year over the base year.

P_{01} = price change for the current year over the base year

Now

Fisher's price index number is given by

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

Interchanging price and quantity we get Fisher's Quantiy Index Number

$$Q_{01} = \sqrt{\sum q_1 p_0 \times \sum q_1 p_1 / \sum q_0 p_0 \times \sum q_0 p_1}$$

Now

Now

$$P_{01} \times Q_{01} = \sqrt{\sum p_1 q_0 \times \sum p_1 q_1 / \sum p_0 q_0 \times \sum p_0 q_1} \quad X \quad \sqrt{\sum q_1 p_0 \times \sum q_1 p_1 / \sum q_0 p_0 \times \sum q_0 p_1}$$

$$= \sqrt{\left(\sum p_1 q_1 / \sum p_0 q_0\right)^2}$$

$$= \sum p_1 q_1 / \sum p_0 q_0$$

$$= V_{01}$$

Hence

$$P_{01} \times Q_{01} = V_{01}$$

Hence Fisher's I.N. satisfies both time reversal and factor reversal test. That is why it is known as Ideal Index No.

Qno.1 Using the data given below show that Fisher's I.N. satisfies both time reversal and factor reversal test.

Commodity	Base year		Current year	
	Quantity	Price	Quantity	Price
A	12	10	15	12
B	15	7	20	5
C	24	5	20	9
D	5	10	5	4

CHAIN BASE INDEX NUMBERS

In various formula of I.N.base period is taken to be as fixed at some previous period .In chain base I.N. there is no fixed base. It consists in calculating a series of I.N for each year with the preceding year as the base year.

Qno.2 From the data given below construct an index number by chain base method.

Year	:	1985	1986	1987	1988	1989	1990
Price (in Rs) :		50	60	62	65	70	78

SOLUTION:

Construction of L.R and chain index

Year	Price	Link relatives	Chain index
1985	50	100	100
1986	60	60/50 x 100= 120	120x100/100=120
1987	62	62/60x100= 103.33	103.33x120/100=124
1988	65	65/62x100= 104.84	104.84 x124/100=130
1989	70		
1990	78		

Conversion of Chain Base Index Numbers to Fixed Base Index :

A chain base index number can be converted into a fixed base index number by the formula given below :

$$\text{Current year F.B.I.} = \frac{\text{Current year C.B.I.} \times \text{Previous year F.B.I.}}{100}$$

Where F.B.I. is Fixed Base Index and C.B.I. Chain Base Index.

Example 7 : From the chain base index numbers given below, obtain the fixed base index numbers.

Year	:	1981	1982	1983	1984	1985	1986
Chain Indices	:	105	75	71	105	95	90

Solution :

Conversion of C.B.I. to F.B.I.

Year	Chain Index Number	Fixed Base Index Number
1981	105	105
1982	75	$\frac{105 \times 75}{100} = 79$
1983	71	$\frac{79 \times 71}{100} = 56$
1984	105	$\frac{56 \times 105}{100} = 59$
1985	95	$\frac{59 \times 95}{100} = 56$
1986	90	$\frac{56 \times 90}{100} = 50$

Merits and Demerits of Chain Base Index :

The main advantage of Chain Base Index is that it help us to make comparisons of the current situation with the recent past situation. It is very helpful in business and economic problems. In this method it is easy to introduce new commodities and delete old one without involving recalculation of the whole series. Also these indices are free from cyclical and seasonal variations.

The main demerits of this method is that they are not useful for long comparisons in a time series. Also the process of finding link relatives is very cumbersome.

geographical area to be covered by the index.

(ii) **Family Budget Enquiry :** Having the decision regarding the class of people for whom the index is to be constructed, the next step is to conduct a family budget enquiry with a view to find out how much an average family of this group spends on different commodities of consumption. The enquiry is conducted on the basis of random sample and during a normal period *i.e.,* a period free from economic boom or depression. After selecting some families, their family budgets are scrutinized in details. The commodities of consumption on which money is spent can be classified into five groups given below :

(a) Food,

(b) Clothing,

(c) Fuel and Lighting,

(d) House Rent and

(e) Miscellaneous.

In this case we should include those commodities which are primarily used by the class of people for which cost of living index is to be constructed *i.e.,* the commodities should represent the tastes, habits and customs of the selected class of people.

(iii) **Collection of Retail Prices :** The collection of retail prices is the most important and also the most difficult task. The reason behind this is that retail prices very from place to place, shop to shop and even at one shop from customer to customer. Therefore, the price quotations should be obtained from the local market of the region where the specified class of people reside or from some representative shops or departmental stores from which people usually make their purchases.

Methods of Constructing Cost of Living Index Numbers : Cost of living index number is constructed by the following two methods :

(i) **Aggregate Expenditure Method :** In this method the quantities of commodities consumed by the specified group of people in the base year are used as weights. Thus, in this method 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 and services in the base year and the resulting figure is multiplied by 100. Symbolically, it is given by

$$\text{Cost of Living Index} = \frac{\Sigma p_1 q_0}{\Sigma p_0 q_0} \times 100$$

$$= \frac{\text{Total expenditure of current year}}{\text{Total expenditure of base year}} \times 100$$

This formula is same as Laspeyre's formula and is the most popular method of constructing cost of living index numbers.

(ii) **Family Budget Method :** In this method, the family budgets of a large number of people are studied carefully to estimate the aggregate expenditure of an average family on various items. These values are used as weights. The current year prices are expressed as price relatives on the basis of the base year prices. These price relatives are then multiplied by the

respective values of the commodities in the base year. The total of these products is divided by the total value weights and the resulting value is the desired cost of living index number.

Symbolically,

$$\text{Cost of Living Index} = \frac{\Sigma \frac{p_1}{q_0} \times (p_0 q_0)}{\Sigma p_0 q_0} \times 100$$

$$= \frac{\Sigma pw}{\Sigma w}$$

Where P = Price relatives $= \frac{p_1}{p_0} \times 100$

and w = Value, weight = $\Sigma P_0 q_0$.

If I_F, I_C, I_L, I_H and I_M stand for the indices of food, clothing, fuel and lighting, house rent and miscellaneous groups, respectively and w_F, w_C, w_L, w_H and w_M denote the weights of those groups then

$$\text{Cost of Living Index} = \frac{I_F w_F + I_C w_C + I_L w_L + I_H w_H + I_M w_M}{w_F + w_C + w_L + w_H + w_M}$$

Use of Cost of Living Index Numbers :

(i) Cost of living index numbers are used for the adjustment of dearness allowance to the workers so as to enable them to meet the increased cost of living.

(ii) Cost of living index numbers are used widely in wage negotiations and wage contract.

(iii) Cost of living index numbers are used to study the purchasing power of money. The purchasing power of money varies inversely with the cost of living index.

(iv) Cost of living index numbers are used to measure the real wage.

$$\text{Real wage} = \frac{\text{Money Wages}}{\text{Cost of Living Index}} \times 100$$

Example 11 : 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

Solution : (i) **Family budget method :** To calculate the cost of living index number from the given data, we first construct the following table.

Groups	p_0	q_0	p_1	q_1	$P = \dfrac{p_1}{p_0} \times 100$	$w = p_0 q_0$	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

$$\therefore \text{ Cost of Living Index} = \frac{\Sigma Pw}{\Sigma w}$$

$$= \frac{33100}{252}$$

$$= 131.35 \ //$$

(ii) Aggregate Expenditure Method :

Here we first construct the following table :

Groups	P_0	q_0	P_1	q_1	$P_1 q_0$	$P_0 q_0$
Food	20	7	25	8	175	140
Fuel and lighting	7	4	10	5	40	28
Clothing	10	3	12	4	36	30
House rent	7	2	10	4	20	14
Miscellaneous	10	4	15	3	60	40
Total					331	252

$$\therefore \text{ Cost of Living Index} = \frac{\Sigma p_1 q_0}{\Sigma p_0 q_0} \times 100$$

$$= \frac{331}{252} \times 100$$

$$= 131.35 \ //$$

Example 12 : Construct the cost of Living Index Number from the data given below :

Groups	Weights	Group Index Numbers
Food	47	247
Fuel and lighting	7	293
Clothing	8	289
House rent	13	100
Miscellaneous	14	236

Solution : First we construct the following table :

Groups	Group Index (I)	Weights (w)	Iw
Food	247	47	11609
Fuel and lighting	293	7	2051
Clothing	289	8	2312
House Rent	100	13	1300
Miscellaneous	236	14	3304
Total		89	20576

$$\therefore \text{Cost of Living Index} = \frac{\Sigma Iw}{\Sigma w}$$

$$= \frac{20576}{89}$$

$$= 231.29 \; //$$

WHOLESALE PRICE INDEX NUMBER :

Wholesale price index number is constructed on the basis of the wholesale prices of the commodities trade 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 these index numbers data about the wholesale prices of the commodities marketed are to be selected. In this case, since all the commodities are not possible to include in the index, it is necessary to select a sample of commodities in such a way that they will be representative of the taste, habits and custom of the people. Generally, the weights of such commodities are assigned in accordance with their relative importance. The data included in this index number should be collected at regular interval of time from standard Govt. agencies, commercial centres etc. In India, the wholesale price index numbers are constructed on weekly basis. The Economic Advisor to the Govt. of India, Ministry of Commerce and Industry compile and publish this index number. Wholesale price index number can be used in forecasting demand and supply situation in the

economy, in estimation of monetary value and real value. and as an indicator of rate of inflation etc.