

Chapter 7: Index Numbers

NCERT · Class 11 · Statistics

Textbook exercises

Question 1

An index number which accounts for the relative importance of the items is known as

A.

weighted index

B.

simple aggregative index

C.

simple average of relatives

Answer

Correct option: A

Solution

ANSWER **(i) weighted index**. A weighted index assigns weights to items in proportion to their relative importance (such as the share of expenditure), so that more important items influence the index more.

Question 2

In most of the weighted index numbers the weight pertains to

A.

base year

B.

current year

C.

both base and current year

Answer

Correct option: A

Solution

ANSWER **(i) base year**. Base-year weights are generally preferred because calculating fresh weights every year is inconvenient, and base-year weights keep the basket fixed and comparable (this is the basis of Laspeyre's index).

Question 3

The impact of change in the price of a commodity with little weight in the index will be

A.

small

B.

large

C.

uncertain

Answer

Correct option: A

Solution

ANSWER **(i) small**. Since the contribution of an item to a weighted index is proportional to its weight, a price change in a low-weight commodity has only a small effect on the overall index.

Question 4

A consumer price index measures changes in

A.

retail prices

B.

wholesale prices

C.

producers prices

Answer

Correct option: A

Solution

ANSWER **(i) retail prices.** The CPI (cost-of-living index) reflects the prices actually paid by consumers at the retail level for a typical basket of goods and services.

Question 5

The item having the highest weight in consumer price index for industrial workers is

A.

Food

B.

Housing

C.

Clothing

Answer

Correct option: A

Solution

ANSWER **(i) Food.** Food and beverages occupy the largest proportion of a worker's expenditure, so this group carries the highest weight in the CPI for industrial workers.

Question 6

In general, inflation is calculated by using

A.

wholesale price index

B.

consumer price index

C.

producers' price index

Answer

Correct option: A

Solution

ANSWER **(i) wholesale price index**. In India the WPI is widely used to measure the rate of inflation, as it captures the general change in price level and the data are available quickly.

Question 7

Why do we need an index number?

Solution

ANSWER When many related variables change at different rates, describing each change separately is confusing. An index number condenses all these changes into a **single comparable figure**, showing the average change between two periods. Index numbers are indispensable in practice: the WPI and CPI measure inflation and the cost of living; the CPI helps calculate real wages and the purchasing power of money and is used in wage negotiation, income, price and rent policy and taxation; the IIP shows changes in industrial output; the agricultural production index tracks farm performance; and the Sensex guides investors. They are therefore essential tools in economic analysis and policy making.

Question 8

What are the desirable properties of the base period?

Solution

ANSWER The base period should be a **normal year** — free from abnormal events such as war, famine, boom, slump, earthquake or major political upheaval — so that it does not contain extreme values. It should **not be too far in the past**, because old baskets become unrepresentative (many items in a 1960 basket no longer exist); a comparison of 1993 with 2005 is more meaningful than 1960 with 2005. The base period should also be of a suitable length and the base must be **updated routinely** to keep the index relevant.

Question 9

Why is it essential to have different CPI for different categories of consumers?

Solution

ANSWER Different groups of consumers have **different consumption baskets and spending patterns**, so the same price change affects them differently. For instance, a rise in the petrol price hardly touches a poor agricultural labourer, but it matters to urban commuters. Because the items and their weights differ from group to group, a single index cannot fairly represent everyone. Hence separate CPIs are prepared — for industrial workers, agricultural labourers, rural labourers, and urban consumers — so that each measures the cost-of-living change for that category accurately.

Question 10

What does a consumer price index for industrial workers measure?

Solution

ANSWER The CPI for industrial workers measures the average change in the **retail prices of a fixed basket of goods and services typically consumed by industrial workers**, relative to a base year (base 2001 = 100). For example, a CPI(IW) of 277 in December 2014 means a worker who spent Rs 100 on that basket in 2001 needed Rs 277 in December 2014 to buy the same basket — it tracks the change in their cost of living.

Question 11

What is the difference between a price index and a quantity index?

Solution

ANSWER A **price index** measures and permits comparison of the change in the **prices** of a specified set of goods between two periods (e.g. CPI, WPI). A **quantity (volume) index** measures the change in the **physical volume** of goods — production, construction or employment — rather than their prices (e.g. the Index of Industrial Production). In short, a price index reflects price change while a quantity index reflects change in physical output.

Question 12

Is the change in any price reflected in a price index number?

Solution

ANSWER **No**. A price index is based only on a **selected, representative basket of items**. A price change is reflected in the index only if that commodity is included in the basket. If an item is not in the basket, a change in its price does not affect the index. Moreover, the impact of an included item depends on its weight, so a price change in a low-weight item has only a small effect.

Question 13

Can the CPI for urban non-manual employees represent the changes in the cost of living of the President of India?

Solution

ANSWER **No**. The CPI for urban non-manual employees is built from the consumption basket and spending pattern of ordinary urban non-manual workers. The President of India has an entirely different lifestyle and basket of goods and services, so this index cannot represent the change in the President's cost of living. An index represents only the group for whose typical basket it is constructed.

Question 14

The monthly per capita expenditure incurred by workers for an industrial centre during 1980 and 2005 on the following items are given below. The weights of these items are 75, 10, 5, 6 and 4 respectively. Prepare a weighted index number for cost of living for 2005 with 1980 as the base.

Items	Price in 1980	Price in 2005
Food	100	200
Clothing	20	25

Fuel & lighting	15	20
House rent	30	40
Misc	35	65

Solution

ANSWER Use the weighted index of price relatives: $CPI = \Sigma WR / \Sigma W$, where $R = (P_1/P_0) \times 100$.

Item	Weight W	P ₀ (1980)	P ₁ (2005)	R = (P ₁ /P ₀)×100	WR
Food	75	100	200	200.00	15000.00
Clothing	10	20	25	125.00	1250.00
Fuel & lighting	5	15	20	133.33	666.67
House rent	6	30	40	133.33	800.00
Misc	4	35	65	185.71	742.86
Total	100				18459.53

$CPI = \Sigma WR / \Sigma W = 18459.53 / 100 = \mathbf{184.6}$ (approx.). **Interpretation:** the cost of living in 2005 is about 184.6, i.e. it has risen by roughly 84.6 per cent compared with 1980.

Question 15

Read the following table carefully and give your comments.

INDEX OF INDUSTRIAL PRODUCTION BASE 1993–94

Industry	Weight in %	1996–97	2003–2004
General index	100	130.8	189.0
Mining and quarrying	10.73	118.2	146.9
Manufacturing	79.58	133.6	196.6
Electricity	10.69	122.0	172.6

Solution

ANSWER With 1993–94 as base (= 100), industrial production rose in every sub-sector and overall in both years, with much higher levels in 2003–04 than in 1996–97. **General index:** rose from 130.8 (a

30.8% rise over the base) in 1996–97 to 189.0 (an 89% rise) in 2003–04, showing strong growth in industrial output over the decade. **Manufacturing** carries by far the largest weight (79.58%) and grew the most — from 133.6 to 196.6 — so it is the main driver of the rise in the general index. **Electricity** (weight 10.69%) grew from 122.0 to 172.6, and **mining and quarrying** (weight 10.73%) grew the least, from 118.2 to 146.9. **Comment:** overall industrial production improved substantially between 1996–97 and 2003–04; manufacturing, having the highest weight and highest growth, contributed the most to this rise, while mining lagged behind. This reflects healthy industrial expansion in the economy during the period.

Question 16

Try to list the important items of consumption in your family.

Solution

ANSWER This is an activity, so answers will vary; list the items your own family actually buys regularly. A model list of important items of consumption is: **Food:** cereals (rice, wheat/flour), pulses (dal), edible oil, milk and milk products, vegetables, fruits, sugar, salt, spices, eggs/fish/meat. **Fuel & light:** LPG/cooking gas, electricity, petrol/diesel. **Clothing & footwear.** **Housing:** house rent or maintenance. **Education:** school/tuition fees, books, stationery. **Health:** medicines, doctor's fees. **Transport & communication:** bus/auto fare, mobile recharge, internet. **Miscellaneous:** toiletries, cleaning items, recreation. Food usually takes the largest share of the family budget. *(Use your family's real items.)*

Question 17

If the salary of a person in the base year is Rs 4,000 per annum and the current year salary is Rs 6,000, by how much should his salary be raised to maintain the same standard of living if the CPI is 400?

Solution

ANSWER **Step 1 – salary needed to keep the base-year standard of living:** multiply the base salary by CPI/100. Required salary = Rs 4,000 $\times$ (400 / 100) = Rs 4,000 $\times$ 4 = **Rs 16,000**. **Step 2 – compare with the current salary:** the person already earns Rs 6,000, so the additional rise needed = 16,000 – 6,000 = **Rs 10,000**. **Conclusion:** to maintain the same standard of living the salary should be raised by **Rs 10,000** (i.e. to Rs 16,000 per annum).

Question 18

The consumer price index for June, 2005 was 125. The food index was 120 and that of other items 135. What is the percentage of the total weight given to food?

Solution

ANSWER Let the weight (proportion) of food = w , so the weight of other items = $(1 - w)$. The overall CPI is the weighted average of the two indices: $125 = 120w + 135(1 - w)$ $125 = 120w + 135 - 135w \Rightarrow 125 - 135 = -15w \Rightarrow -10 = -15w$ $w = 10 / 15 = 0.6667$ **Percentage weight given to food = 66.67% (about two-thirds);** the weight of other items is 33.33%.

Question 19

An enquiry into the budgets of the middle class families in a certain city gave the following information; What is the cost of living index during the year 2004 as compared with 1995?

Expenses on items	Food	Fuel	Clothing	Rent	Misc.
	35%	10%	20%	15%	20%
Price (in Rs) in 2004	1500	250	750	300	400
Price (in Rs) in 1995	1400	200	500	200	250

Solution

ANSWER Take 1995 as base. Cost-of-living index = $\Sigma WR / \Sigma W$, where $R = (P_{2004}/P_{1995}) \times 100$ and W is the % weight.

Item	Weight W (%)	P (1995)	P (2004)	$R = (P_{2004}/P_{1995}) \times 100$	WR
Food	35	1400	1500	107.14	3750.00
Fuel	10	200	250	125.00	1250.00
Clothing	20	500	750	150.00	3000.00
Rent	15	200	300	150.00	2250.00
Misc.	20	250	400	160.00	3200.00
Total	100				13450.00

Cost-of-living index (2004) = $\Sigma WR / \Sigma W = 13450 / 100 = 134.5$. **Interpretation:** the cost of living of middle-class families in this city rose by about 34.5 per cent in 2004 compared with 1995.

Question 20

Record the daily expenditure, quantities bought and prices paid per unit of the daily purchases of your family for two weeks. How has the price change affected your family?

Solution

ANSWER This is a project, so use your family's real data. Method: each day, note every item bought, its quantity and the price per unit, and the amount spent. Tabulate the data day-wise, then for the two-week period compute, for each item, the price relative $R = (\text{current price} / \text{first-day price}) \times 100$ and a weighted daily price index using expenditure shares as weights. **How to comment on the effect:** if the price index for the second week is higher than the first, prices have risen and your family had to spend more for the same quantities (or buy less); if it is lower, prices fell and the family saved or could buy more. Note which items (e.g. vegetables, fuel) changed most and how the family adjusted — substituting cheaper items, reducing quantity, or spending extra. (Answer using your own recorded figures.)

Question 21

Given the following data—

Year	CPI of industrial workers (1982 = 100)	CPI of agricultural labourers (1986–87 = 100)	WPI (1993–94 = 100)
1995–96	313	234	121.6
1996–97	342	256	127.2
1997–98	366	264	132.8
1998–99	414	293	140.7
1999–00	428	306	145.3
2000–01	444	306	155.7
2001–02	463	309	161.3

2002–03	482	319	166.8
2003–04	500	331	175.9

(i) Comment on the relative values of the index numbers.

(ii) Are they comparable?

Solution

ANSWER **(i) Comment on the relative values:** All three index numbers rise steadily over the period, showing a continuous increase in prices (inflation). The CPI of industrial workers is the highest throughout, rising from 313 to 500 — an increase of about 60% over the period — reflecting a sharp rise in their cost of living. The CPI of agricultural labourers rises from 234 to 331 (about 41%), a slower increase. The WPI rises from 121.6 to 175.9 (about 45%). Thus the cost of living of industrial workers rose faster than that of agricultural labourers, while wholesale prices rose moderately. **(ii) Are they comparable? No, they are not directly comparable.** The three indices have **different base years** (1982, 1986–87 and 1993–94) and cover **different baskets of goods and different categories** (industrial workers, agricultural labourers, and wholesale prices in general). Because the bases and baskets differ, their absolute values cannot be compared side by side; we can only compare the **trend or rate of change** within each series, not the level of one against another. To compare them properly they must first be converted to a common base year.

Question 22

The monthly expenditure (Rs.) of a family on some important items and the Goods and Services Tax (GST) rates applicable to these items is as follows: Calculate the average tax rate as far as this family is concerned.

Item	Monthly Expense (Rs)	GST Rate %
Cereals	1500	0
Eggs	250	0
Fish, Meat	250	0
Medicines	50	5
Biogas	50	5
Transport	100	5

Butter	50	12
Babool	10	12
Tomato Ketchup	40	12
Biscuits	75	18
Cakes, Pastries	25	18
Branded Garments	100	18
Vacuum Cleaner, Car	1000	28

Solution

ANSWER The average GST rate is a **weighted average**, where the weights are the shares of expenditure on each category and the variable is the GST rate. Group the items by their common GST rate and add up the expenditure in each group.

Category (GST slab)	Expenditure / Weight (w)	GST Rate (x)	wx
Category 1 (0%): Cereals, Eggs, Fish & Meat	2000	0.00	0
Category 2 (5%): Medicines, Biogas, Transport	200	0.05	10
Category 3 (12%): Butter, Babool, Tomato Ketchup	100	0.12	12
Category 4 (18%): Biscuits, Cakes/Pastries, Branded Garments	200	0.18	36
Category 5 (28%): Vacuum Cleaner, Car	1000	0.28	280
Total	3500		338

Average GST rate = $\Sigma wx / \Sigma w = 338 / 3500 = 0.0966$. **The average tax (GST) rate for this family is 0.0966, i.e. about 9.66 per cent.**