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Sub math: Price indices

Index numbers are statistical measures that show trends in a variable or group of variable with time. In Economic they are commonly used to calculate changes in prices.

Terms Used

Base year (P_0) is a year or period when prices of items considered being stable or it is a reference year

Current year (P_n) is a year for which the indices are to be computed

Types of price indices

- (a) Price relative (P,R) = $\frac{P_n}{P_0} \times 100$
- (b) Simple price index = $\frac{\sum \frac{P_n}{P_0} \times 100}{n}$
- (c) Simple Aggregate Price Index (S.A.PI) = $\frac{\sum P_n}{\sum P_0} \times 100$
- (d) the weighted price index = $\frac{\sum wP_n}{\sum wP_0} \times 100$

Examples 1

The table below shows the prices of items and their corresponding weights in the years 2000 and 2004

Item	Price (U Shs)		Weight
	2000	2004	
Food	55,000	60,000	4
Housing	48,000	52,000	2
Transport	16,000	20,000	1

Using 2000 as the base year calculate the weighted price index for the items in 2004. (05 marks)

$$W.P.I = \frac{\sum wP_{2004}}{\sum wP_{2000}} \times 100 = \frac{60,000 \times 4 + 52,000 \times 2 + 20,000 \times 1}{55,000 \times 4 + 48,000 \times 2 + 16,000 \times 1} \times 100 = 111.15(2DP)$$

Examples 2

The table below shows the expenditure in shillings of University student for the years 2005 and 2006.

ITEM	EXPENDITURE(Shs)		WEIGHT
	2005	2006	
Text books	100,000	120,000	3
Pocket money	50,000	70,000	2
Research	40,000	50,000	1

Using the year 2005 as the base, calculate the weighted aggregate price index. (05marks)

$$\begin{aligned}\text{Weighted aggregate index} &= \frac{\sum wP_{2006}}{\sum wP_{2005}} \times 100 \\ &= \frac{3 \times 120,000 + 2 \times 70,000 + 1 \times 50,000}{3 \times 100,000 + 2 \times 50,000 + 1 \times 40,000} \times 100 \\ &= \frac{550,000}{440,000} \times 100 \\ &= 125\end{aligned}$$

Examples 3

The table below shows the expenditure of a family for the months of January and July in a certain year.

Item	Expenditure (Shs)		Weight
	January	July	
Food	150,000	174,000	8
Rent	50,000	60,000	2
Clothing	100,000	125,000	6
Power	20,000	25,000	1
Water	60,000	90,000	4

(a) Calculate the:

- (i) Price relative for each item (03 marks)

Solution

$$\text{Price relative} = \frac{P_{July}}{P_{June}} \times 100$$

$$\text{Price relative for food} = \frac{174,000}{150,000} \times 100 = 116$$

$$\text{Price relative for rent} = \frac{60,000}{50,000} \times 100 = 120$$

$$\text{Price relative for clothing} = \frac{125,000}{100,000} \times 100 = 125$$

$$\text{Price relative for Power} = \frac{25,000}{20,000} \times 100 = 125$$

$$\text{Price relative for Water} = \frac{90,000}{60,000} \times 100 = 150$$

- (ii) Simple aggregate index (04 marks)

Solution

$$\begin{aligned} \text{Simple aggregate index} &= \frac{\sum P_{July}}{\sum P_{June}} \\ &= \frac{174000+60000+125000+25000+900}{150000+50000+100000+20000+60000} \\ &= \frac{474,000}{380,000} \\ &= 1.25 \end{aligned}$$

- (b) (i) find the weighted aggregate price index. (06 marks)

Solution

$$\begin{aligned} \text{Weighed aggregate price index} &= \frac{\sum P_{July} \times w}{\sum P_{June} \times w} \times 100 \\ &= \frac{174000 \times 8 + 60000 \times 2 + 125000 \times 6 + 25000 \times 1 + 900 \times 4}{150000 \times 8 + 50000 \times 2 + 100000 \times 6 + 20000 \times 1 + 60000 \times 4} \times 100 \\ &= \frac{2,647,000}{1,160,000} \times 100 \\ &= 123 \end{aligned}$$

- (ii) comment on your result in (b) (i) (02marks)

Prices increased by 23%

Examples 4

The table below shows the prices in US dollars and weights of five components of an engine, in 1998 and 2005.

COMPONENT	A	B	C	D	E
PRICE (\$) 1998	35	70	43	180	480
PRICE (\$) 2005	60	135	105	290	800
WEIGHT	6	5	3	2	1

Taking 1998 as the base year

- (a) Calculate for 2005the:

- (i) simple aggregate price index. (03marks)

$$\text{S.A.P.I} = \frac{\sum P_{2005}}{\sum P_{1998}} \times 100 = \frac{60+135+105+290+800}{35+70+43+180+480} \times 100 = \frac{1390}{808} \times 100 = 172$$

- (ii) price relative of each component. (03marks)

$$\text{Price relative} = \frac{P_{2005}}{P_{1998}} \times 100$$

$$\text{Price relative for A} = \frac{60}{35} \times 100 = 171.4$$

$$\text{Price relative for B} = \frac{135}{70} \times 100 = 192.9$$

$$\text{Price relative for C} = \frac{105}{43} \times 100 = 244.2$$

$$\text{Price relative for D} = \frac{290}{180} \times 100 = 161.1$$

$$\text{Price relative for E} = \frac{800}{480} \times 100 = 166.7$$

(iii) weighted aggregate price index. (06marks)

$$\text{W.A.P.I} = \frac{\sum wP_{2005}}{\sum wP_{1998}} \times 100 = \frac{60x6+135x5+105x3+290x2+800x1}{35x6+70x5+43x3+180x2+480x1} \times 100 = \frac{2730}{1529} \times 100 = 178.5$$

(b) Estimate the cost of an engine in 1998 given that its cost in 2005 was 1600 US dollars

Method 1: using S.A.P.I

Let x be the cost

$$\frac{1600}{x} \times 100 = 172; x = 930.2 \text{ US dollars}$$

Method 2 Using W.A.P.I

$$\frac{1600}{x} \times 100 = 178.5; x = 896.4 \text{ US dollars}$$

Examples 5

The table below shows the price (in Ug Shs) of some food items in January, June and December together with the corresponding weights.

Item	Price (in Ug Shs)			Weight
	January	June	December	
Matooke (1 bunch)	15,000	13,000	18,000	4
Meat (1kg)	6,500	6000	7,150	1
Posho(1kg)	2,000	1,800	1,600	3
Beans (1kg)	2,200	2,000	2,860	2

(a) Simple aggregate price index for June

$$\text{S.A.P.I} = \frac{\sum P_{June}}{\sum P_{Jan}} \times 100 = \frac{13,000+6000+1800+2000}{15000+6500+2000+2200} \times 100 = 88.71$$

Comment on your results (05 marks)

There was a general decrease in the prices of items in the month of June by 11.29%

(b) Weighted aggregate price index for December

$$\text{W.A.P.I} = \frac{\sum wP_{Dec}}{\sum wP_{June}} \times 100 = \frac{18,000x4+7150x1+1600x3+2860x2}{13000x4+6000x1+1800x2+2000x2} \times 100 = 116.6$$

Comment on your results (10 marks)

There was a general increase in the prices of items in the month of December by 11.29%

Examples 6

(a) The table below shows the price (U shs) of flour and eggs in the years of 2000 and 2010

COMMODITY	PRICE (U shs)	
	2000	2010
Flour	3000	5000
Eggs (1tray)	5000	7000

Taking 2000 as the base year, calculate the:

(i) Price relative of each commodity

$$\text{Price relative} = \frac{P_{2010}}{P_{2000}} \times 100$$

$$\text{Price relative for flour} = \frac{5000}{3000} \times 100 = 166.7$$

$$\text{Price relative for eggs} = \frac{7000}{5000} \times 100 = 140$$

(ii) Simple aggregate price index

$$\text{S.A.P.I} = \frac{\sum P_{2010}}{\sum P_{2000}} \times 100 = \frac{5000+7000}{3000+5000} \times 100 = 150$$

Comment on your results (08marks)

The prices of items increased by 50% from 2000 to 2010

(b) The data below shows items with their corresponding prices relatives and weights

ITEM	PRICE RELATIVE	WEIGHT
Food	120	172
Clothing	124	160
Housing	125	170
Transport	135	210
Others	104	140

(i) Find the cost of living index

Cost of living index = weighted price index

$$= \frac{\sum Pw}{\sum W} \text{ where } p = \text{price relative, } w = \text{weights}$$

ITEM	PRICE RELATIVE(P)	WEIGHT (w)	Pw
Food	120	172	20640
Clothing	124	160	19840
Housing	125	170	21250
Transport	135	210	28350
Others	104	140	14560
SUM		852	104640

$$\text{Cost of living index} = \frac{104640}{852} = 122.8$$

- (ii) Comment on your result . (07 marks)
The cost of living increased by 22.8%

Exercise

1. The cost of making a cake is calculated from the cost of baking flour, sugar, milk and eggs. All these ingredients are measured in kg. The table below gives the cost of these items in year 1 and year 2

ITEM (kg)	Price		Weight
	Year 1	Year 2	
Flour	60	78	20640
Sugar	50	40	19840
Milk	25	30	21250
Eggs	10	15	28350

Using year 1 as base year

- (a) (i) Calculate the price relative for each item.
Hence find simple price index for the cost of making a cake. [120]
(ii) Find the weighted aggregate price index for the cost of making a cake. [118]
(b) If the cost of making a cake in year 2 was shs 30. Find the cost in year 1 using the two indices. [25, 25.5]

2. The table below shows the price of commodities in year 1 and year 2 per kg

ITEM (kg)	Price	
	Year 1	Year 2
Flour	1200	1800
Sugar	1300	2000
Milk	800	1300
Eggs	700	1000

Find

- (i) Price relative of each item in year 2 using year 1 as base year
(ii) Simple aggregate price index in year 2 using year 1 as base year [152.5]

3. Given below are prices of food items and their corresponding weights in Year 1 and year 2

Year	Year1		Year 2	
	Price (shs)	weight	Price (shs)	weight
Chips	800	12	950	10
Bread	350	6	300	7
Cake	250	4	280	5
Fruit	350	8	430	8
Omelette	500	9	600	10
Tea	300	10	300	12
Liver	1500	15	1600	12

Using year 1 as base year, calculate

- (i) Price relative of each item
- (ii) The simple price index of the items [110]
- (iii) Weighted aggregate price index for year 2 [101]

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Thanks

Dr. Bbosa Science