Inferential statistics

Prepared by:

Sohaila Mahmoud Alashry

Section (1)

Chapter one

Index numbers

INDEX NUMBER: A number that expresses the relative change in price, quantity, or value compared to a base period.

Simple index

$$P = \frac{p_t}{p_0} \times 100$$

P is the price index.

P_t is the price of current period.

P_0 is the price of base period.

Item	2000		2018	
	Price P_0	Quantity Q_0	Price p_t	Quantity Q_t
A	1	30	3	50
B	5	15	4	30
C	6	40	6	20

1-compute a simple price index for each item.
2-compute a simple quantity index for each item.

Solution

1-simple price index

$$P = \frac{p_t}{p_0} \times 100$$

*A = $\frac{3}{1}$×100 =150

price increased by 50%

*B = $\frac{4}{5}$×100 =80

price decreased by 20 %

*C = $\frac{6}{6}$×100=100

no change

2- simple quantity index

q = $\frac{q_t}{q_0} \times 100$

*A= $\frac{50}{30}$×100 =166.6

quantity increased by 66.6%

*B = $\frac{30}{15}$×100 =200

quantity increased by 100%

*C= $\frac{20}{40}$×100 =50

quantity decreased by 50%

SIMPLE AVERAGE OF THE PRICE INDICES

Item	2000		2018		Simple index number
	P_0	Q_0	p_t	Q_t	$Pi = pt/p0$
A	1	30	3	50	150
B	5	15	4	30	80
C	6	40	6	20	100
sum	12		13		

$$P = \frac{\sum p_i}{n}$$

$$P = \frac{150 + 80 + 100}{3} = 110$$

-the mean of the group of indices Increased 10% from 2000 to 2018.

Simple Aggregate Index

$$P = \frac{\Sigma p_t}{\Sigma P_0} (100)$$

$$P = \frac{13}{12} (100) = 108.33$$

-the aggregate of the group of indices increased 8.33% from 2000 to 2018.

WEIGHTED INDEXES:

1-LASPEYRE'S Price Index:

$$P = \frac{\Sigma p_t q_0}{\Sigma P_0 q_0} (100)$$

2- PAASCHE price index:

$$P = \frac{\Sigma p_t q_t}{\Sigma P_0 q_t} (100)$$

3- FISHER'S IDEAL INDEX:

$$P = \sqrt{(\text{laspeyre's index})(\text{paasche index})}$$

Example: let the price for 6 foods are repeated below

Item	2000		2018	
	P_0	q0	P_T	qt
bread	0.77	50	0.89	55
eggs	1.85	26	1.84	20
milk	0.88	102	1.01	130
apples	1.46	30	1.56	40
orange	1.58	40	1.7	41
coffee	4.4	12	4.62	12

Required:

(1) compute LASPEYRE'S Price Index.

(2) compute PAASCHE price index.

(3) compute FISHER'S ideal index.

Solution

Item	2000		2018		p_{t*q0}	P_{0*q0}	P_{t*qt}	P_{0*qt}
	P_0	q0	p_t	qt				
bread	0.77	50	0.89	55	44.5	38.5	48.95	42.35
eggs	1.85	26	1.84	20	47.84	48.1	36.8	37
milk	0.88	102	1.01	130	103.02	89.76	131.3	114.4
apples	1.46	30	1.56	40	46.8	43.8	62.4	58.4
orange	1.58	40	1.7	41	68	63.2	69.7	64.78
coffee	4.4	12	4.62	12	55.44	52.8	55.44	52.8
sum					365.6	336.16	404.59	369.73

✓Laspeyres's price index

$P = \frac{\Sigma p_t q_0}{\Sigma P_0 q_0}$ (100)

$= \frac{365.6}{336.16} \times 100 = 108.8\%$

Price increased by 8.8%

✓ the Paasche price index

$$P = \frac{\Sigma p_t q_t}{\Sigma P_0 q_t} (100)$$

$$= \frac{404.59}{369.73} \times 100 = 109.4\%$$

Price increased by 9.4%

✓ the fisher's ideal index

$$P = \sqrt{(\text{laspeyre's index})(\text{paasche index})}$$

$$= \sqrt{108.8 \times 109.4} = 109.1\%$$

Price increased by 9.1%

Value index (price × quantity)

$$= \frac{\sum p_t q_t}{\sum P_0 q_0}$$

Example:

Item	2015		2020	
	Price P_0	Quantity Q_0	Price p_t	Quantity Q_t
A	1	1000	2	900
B	30	100	40	120
C	10	5000	8	500

What is the value index?

$$V = \frac{(2*900)+(40*120)+(8*500)}{(1*1000)+(30*100)+(10*5000)} \times 100$$

=117.8

*the value increased by 17.8%

The prices of the fruit and the quantity consumed for a year2000 ,2005 explained in the following table, use 2000 as a base year:

fruit	2000		2005	
	P_0	q0	P_T	qt
banana	0.23	100	0.35	120
grapes	0.29	50	0.27	55
apples	0.35	85	0.35	85
strawberry	1.08	10	1.6	12
orange	0.55	5	0.65	7

Required:

(1) compute the simple price index for each item.

(2) compute the Simple Aggregate Index.

(3) compute the simple average of the price indices.

(4) compute LASPEYRE'S Price Index.

(5) compute PAASCHE price index.

(6) compute FISHER'S ideal index.

Solution

Item	2000		2005		$P_i = p_t/p_0$	p_t*q_0	P_0*q_0	P_t*q_t	P_0*q_t
	P_0	q_0	p_t	q_t					
banana	0.23	100	0.35	120					
grapes	0.29	50	0.27	55					
apples	0.35	85	0.35	85					
strawberry	1.08	10	1.6	12					
orange	0.55	5	0.65	7					
sum		----		----					

Example:

Suppose we have the following data:

item	2017		2020	
	P_0	q0	P_T	qt
A	0.09	1800	0.20	2000
B	0.04	1500	0.02	1550
C	0.18	2000	0.18	2000
D	0.07	6500	0.10	6800

Required:

(1) compute the simple price index for each item and the average of all simple index

(2) compute the Simple Aggregate Index.

(3) compute LASPEYRE'S Price Index.

(4) compute PAASCHE price index.

(5) compute FISHER'S ideal index.

Solution