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PRICE INDEX NUMBER AND ITS APPLICATION IN FISH PRICE ASSESSMENT

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Definition

Index Numbers:

Index numbers are devices for measuring differences in the magnitude of a group of related variables. It is a device to measure change. Changes are measured from time to time or place to place.

E.g. Group of variables at different points of time or location.

Price index number:

A price index number for a commodity or group of commodities is the price of the commodity at a particular time expressed as a percentage.

Practical Utility

Price index numbers are extensively used for a variety of purposes in economics, business management, consumption patterns, personnel and financial matters etc. In the fisheries sector rice index numbers provides an insight on assessing the price behavior and trend in fish production over the years. It is also constructed to track the profitability change in fisheries.To a fishery, index number is applied before and after catch shares are applied which results in analyzing profits improved after implementation of catch shares. They act as economic barometers and measures the changes and behavior of the fishery economy. Index numbers also provide the guidelines for formulating policies and arriving at decisions based on the measured change.

Key words

Simple index number, Laspeyre's Method, Passche's Method, Marshall Edgeworth Method

Software Support

The data can be tabulated in MS-excel. However, it may also be computed in software such as R, SPSS etc.

Data requirement

Quantity of different species fish traded across the different markets over the years of a particular place with its price at the specified period of time. Moreover the prices received for catch, prices paid for inputs, fishery stock biomass and vessel productivity over the years are also required for constructing price index numbers at different levels.

Methodology:

The methodology adopted for the arriving at the price index number of a particular commodity (eg. fish) across the different periods involves the following steps.

1. Definition of the purpose and scope.
2. Selection of species of fish to be included

3. Collection of prices of fish
4. Selection of the base period
5. Choice of average to be used
6. Selection of suitable weights

Simple index number:

$$I_t = \frac{P_t}{P_o} \times 100$$, where

I_t = Simple index

P_t = Price in period t

P_o = Price in the base period

(i) Laspeyre's Method:

$$I_t = \frac{\sum_{i=1}^{n} P_{it} Q_{it}}{\sum_{i=1}^{n} P_{i0} Q_{i0}} \times 100 \text{ or } \frac{\sum\left(\frac{P_{it}}{P_{i0}}\right) P_{i0} Q_{i0}}{\sum P_{i0} Q_{i0}} \times 100$$, where

I_t = Aggregative price index for period t

P_{it} P_{io} = Prices of i^{th} fish species in t^{th} base period.

Q_{io} = Quantity of i^{th} fish species in base period

(ii) **Passche's Method:**

$$I_{t=\frac{\sum P_{it} Q_{i0}}{\sum P_{it} Q_{it}} \times 100} \text{ Or } \frac{\sum\left(\frac{P_{it}}{P_{i0}}\right) P_{it} Q_{i0}}{\sum P_{i0} Q_{i0}}$$, where

I_t = Aggregative price index for period t

P_{it} P_{io} = Prices of i^{th} fish species in t^{th} on the base period

Q_{it} = Quantity of i^{th} fish species in i^{th} period.

(iii) **Marshall, Edgeworth Method:**

$$I_t = \left\{\frac{\sum_{i=1}^{n} P_{it} (Q_{it} + Q_{i0})}{\sum_{i=1}^{n} P_{i0} (Q_{it} + Q_{i0})} \times 100\right\}$$

I_t = Aggregative price index for period t

P_{it} P_{io} = Prices of i^{th} fish species in t^{th} on the base period

Q_{it} = Quantity of i^{th} fish species in i^{th} period.

(vi) Fisher's Method:

Fisher Index Number = $\sqrt{\text{Laspeyre's index for year t} \times \text{Passche's index for year t}}$

Worked out example

Given below are the tables representing the landing centre price from 2010 to 2015 and the quantity of production of the different species during the years 2010 and 2015 of the different selected varieties of fish species in Kerala. The calculation of the different index numbers with 2010 as the base year and their inferences are given below.

Table1.Landing Centre Prices (LCP) of different species of fish in Kerala.

Sl.No		2010	2011	2012	2013	2014	2015
		Landing Centre Price (LCP)					
1.	Sharks	107	275	280	360	420	380
2.	Rays	46	55	60	85	90	135
3.	Oil Sardine	34	18	19	28	45	65
4.	Lizard fishes	24	52	60	140	195	290
5.	Threadfin Breams	33	40	45	130	115	145
6.	Croakers	50	55	60	65	85	155
7.	Ribbon Fish	39	65	70	102	135	170
8	Mackerels	52	54	55	80	95	120
9.	Billfishes	40	85	90	180	230	410
10.	Penaeid prawns	320	85	110	196	220	295

Table2. Total production of the selected varieties of fish in Kerala during 2010-11 and 2015-16

Quantity			
Sl.No	**Species**	**2010-11**	**2015-16**
1.	Sharks	2014	3481
2.	Rays	926	2891
3.	Oil Sardine	259341	68431
4.	Lizard fishes	7658	12395
5.	Threadfin Breams	33421	42253
6.	Croakers	4090	4432
7.	Ribbon Fish	9674	12253
8	Mackerels	68494	70079
9.	Billfishes	2339	5314
10.	Penaeid prawns	35624	38006

Solution:

I. Computation of landing centre price index of the selected species

The domestic price behavior can be understood with the help of index numbers.The simple index numbers for the landing centre prices were constructed to compare the price across the years and are indicated in the given table 3. The landing centre price indices were worked out for the selected varieties for the years 2011, 2012,2013,2014,2015 with 2010 as the base year (year 2010 = 100). It has been found that during the period from 2011 to 2015, sharks (83.48 per cent), oil sardine (61.18 per cent) and penaeid prawns (72.19 per cent) recorded the highest increase in prices at landing centre level.

Table 3: Index numbers of landing centre prices of selected varieties of fish in Kerala

Sl. No.	Species	2011	2012	2013	2014	2015
		LCP Index numbers				
1.	Sharks	157.01	161.68	136.45	192.52	155.14
2.	Rays	119.57	130.43	174.78	175.65	183.48
3.	Oil Sardine	102.94	155.88	182.35	132.35	161.18
4.	Lizard fishes	216.67	150.00	183.33	112.50	108.33
5.	Threadfin Breams	121.21	136.36	193.94	148.48	139.39
6.	Croakers	110.00	120.00	130.00	170.00	109.40
7.	Ribbon Fish	166.67	179.49	161.54	146.15	135.90
8	Mackerels	103.85	105.77	153.85	182.69	130.77
9.	Billfishes	112.50	125.00	150.00	175.00	125.00
10.	Penaeid prawns	126.56	134.38	161.25	168.75	172.19

2. Computation of different index numbers

The different index numbers such as Laspeyre's index, Passche's index, Marshall Edgeworth and fisher index have been calculated using the quantity and price of the different selected fish species. The calculations and the intermediate steps have been indicated in the following table 4.

Laspeyre's index $= \frac{46779013}{25999087} \times 100$

$= 179.92$

Passche's index $= \frac{40451120}{21242137} \times 100$

$= 190.42$

Marshall Edgeworth index $= \frac{87230133}{47241224} \times 100$

$= 184.64$

Fisher Index $= \sqrt{179.92 \times 190.42}$

$= 185.10$

Generally index numbers are constructed based on the data available for calculation. Different index numbers differ based on the dataset used. Among all the index numbers constructed it can be inferred that fisher index number is the best index number because it includes both current and past year's quantity as the base of price index where Laspeyre's index use base period quantity and Passche's index use the current period quantity as the base of the price index.

Table 4. Calculation of different price index numbers

Species	Price		Production in base period 2010-11	Production in 2015-16	Laspeyre's Value of production 2010 -11 at prices		Laspeyre's Price relative of 2015-16 weighted by 2010-11 value	Passche's Value of production 2010 -11 at prices		Passche'sPrice relative of 2015-16 weighted by 2010-11 value	Marshall Edgeworth Value of production 2010 -11 at prices		Marshall Edgeworth Price relative of 2015-16 weighted by 2010-11 value
	2010-11	2015-16			2010-11	2015-16		2010-11	2015-16		2010-11	2015-16	
Sharks	107	380	2014	3481	215498	765320	765320	372487	1322850	1322850	587985	2088170	2088170
Rays	46	135	926	2891	42596	125010	125010	132975	390254	390254	175571	515263.5	515264
Oil Sardine	34	65	259341	68431	8817594	16857165	16857165	2326660	4448027	4448027	11144254	21305192	21305192
Lizard fishes	24	290	7658	12395	183792	2220820	2220820	297473	3594462	3594462	481265	5815282	5815282
Threadfin Breams	33	145	33421	42253	1102893	4846045	4846045	1394347	6126678	6126678	2497240	10972723	10972723
Croakers	50	154.7	4090	4432	204500	632723	632723	221611	685664.4	685664	426111	1318387	1318387
Ribbon Fish	39	170	9674	12253	377286	1644580	1644580	477871	2083028	2083028	855157	3727608	3727608
Mackerels	52	120	68494	70079	3561688	8219280	8219280	3644132	8409535	8409535	7205820	16628815	16628815
Billfishes	40	410	2339	5314	93560	958990	958990	212562	2178762	2178762	306122	3137752	3137752
Penaeid prawns	320	295	35624	38006	11399680	10509080	10509080	12162018	11211860	11211860	23561698	21720940	21720940
Total					25999087		46779013	21242137		40451121	47241224		87230133

Suggested readings

- Deaton A (2010) Price Indexes, Inequality, and the Measurement of World Poverty. American Economic Review 100: 5–34.
- Diewert WE (2008) Index Numbers. In: Durlauf SN, Bulmer LE, editors. The New Palgrave: A Dictionary of Economics 2ed. London: MacMillan. pp. 1–38 Tveterås S, Asche F (2008) International Fish Trade and Exchange Rates: An Application to the Trade of Salmon and Fishmeal. Applied Economics 40: 1745–1756
- Food and Agricultural Organization of the United Nations (2011) FAO Food Outlook: Global Market Analysis. Rome: Food and Agricultural Organization of the United Nations
- Goldberg PK, Knetter MM (1997) Goods Prices and Exchange Rates: What Have We Learnt? Journal of Economic Literature 35: 1243–1272
- Shyam, S Salim and Biradar, R S (2001) Fisheries Economics and Marketing. Manual. Central Institute of Fisheries Education, Mumbai