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PRICE AND QUANTITY INDEX: INDICATORS OF BUSINESS SUSTAINABILITY

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Abstract

Theory of Index number has been developed mainly in the context of price statistics. In view of that, this study analysed the price and quantity index as indicators of business sustainability. A brief comparison between price statistics and commodities statistics of some household commodities is carried out in this study. The essence of price statistics is the need to monitor the evolution of prices, isolating the price developments from changes in prices and quantities. In this paper, an attempt has been made to apply the index number on some selected commodities, using a questionnaire to obtain information on prices of those commodities directly from the retailers in some selected markets within Ondo town, Ondo State. The result obtained shows that there is a significant increase in the prices of those commodities which might be because of the Incidence of COVID-19 in year 2020, while the quantity is fixed and remain constant.

Keywords: Index Number, Ondo, Price, Quantities.

INTRODUCTION

An Index number is a statistical device designed to measure changes in a variable or a group of related variables with respect to time, geographical location or other characteristics such as income, employment, profession, etc. It is a measure of the average change in a group of related variables over two different situations. It occupies an important place due to its efficacy in measuring the extent of economic changes across a stipulated period, also help to study such changes effects due that factors that cannot be directly measured. Price, Quantity and value indices are the three main types of Index number.

Definition 1.1: Price index compares changes in the price of commodities over a period of time. Whole Price Index (WPI) and Consumer Price Index (CPI) are the popular types of price indices. (Allen, 1949).

Definition 1.2: Quantity Index usually measure the changes in quantity from one period to another. One of the most used quantity index is the Industrial Production Index (IIP) (Prasada, 2015).

Index number are useful in formulating business policy, serving as indicator of business environment, adjusting wages or salaries on account of rising prices or inflation and can also be used to provide incentives to efficient workers.

The index number problem can be framed as the problem of decomposing the value of a well -defined set of transactions in a period into an aggregate price multiplied by an aggregate quantity term. The simplest price index is a fixed-basket index. In this index, fixed amounts of the n quantities in the value aggregate are chosen, and then this fixed basket of quantities at the prices of period 0 and period 1 are calculated. The fixed-basket price index which is the ratio of these two values, where the prices vary but the quantities are held fixed. Two natural choices for the fixed basket are the quantities transacted in the base period, period 0, or the quantities transacted in the current period, period 1. These two choices lead to the Laspeyres (1871) and Paasche (1874) price indices, respectively. Unfortunately, the Paasche and Laspeyres measures of aggregate price change can differ. Irving Fisher's (1922) argues that the best average to take is the geometric mean.

Diewert (2007) reported that Index numbers are used to aggregate detailed information on prices and quantities into scalar measures of price and quantity levels or their growth and also reviews four main approaches to bilateral index

number theory where two price and quantity vectors are to be aggregated. Clements (2008) consider the stochastic index number and postulated the sampling variance of the inflation estimator is proportional to the variance of relative prices. Krishnan (2010), Constructing an area-based Socio economic Index using the Principal Components analysis approach.

Akintoye (2013) constructed a tender Price Index with modeling and forecasting trends between 1980 and 1987 and reported that, in UK, Building Cost Index produced by the Building Cost Information Service increased at an annual rate of 6.3% compared with Tender Price Index 3.3% and Retail Price Index at 6.7% per annum. This significant disparity between Tender Price and Building Cost Index is unexpected in view of the attributed importance of input prices in the tender price formation.

METHODOLOGY

Convenience sampling which is a type of non-probability sampling is use to collect sample price over a price of 2 years (2109 to 2020). Interview approach was used to collected prices of food items in several price within a market and in other markets, the average price is recorded for each food items. The prices considered items are taking in up to ten locations; all existing popular markets in Ondo town are visited for this market survey.

Table 1: showing quantity and prices of some selected food items

S/N	Food items	Item quantity(kg)	Prices of Items in (₦)	
			2019	2020
1.	Beans	50	30,000	39,000
2.	Gaari	50	6,500	7,500
3.	Rice	50	16,000	30,000
4.	Semovita	50	16,000	23,000
5.	Wheat	50	13,500	17,500
6.	Corn	50	6,000	21,000
7.	Onions	50	6,000	21,000
8.	Guinea Corn	50	6,000	27,000
9.	Yam Flour	50	15,000	30,000
10.	Salt	50	5400	18000

Table 2: Index number computations of data collected

S/N	Food Items	p_o	q_o	p_1	q_1	p_oq_o	p_oq_1	p_1q_o	p_1q_1
1.	Beans	30000	50	39000	50	1500000	1500000	1950000	1950000
2.	Gaari	6500	50	7500	50	325000	325000	375000	375000
3.	Rice	16000	50	30000	50	800000	800000	1500000	1500000
4.	Semovita	16000	50	23000	50	800000	800000	1150000	1150000
5.	Wheat	13500	50	17500	50	675000	675000	875000	875000
6.	Corn	6000	50	21000	50	300000	300000	1050000	1050000
7.	Onions	6000	50	21000	50	300000	300000	1050000	1050000
8.	Guinea Corn	6000	50	27000	50	300000	300000	1350000	1350000
9.	Yam Flour	15000	50	30000	50	750000	750000	1500000	1500000
10.	Salt	5400	50	18000	50	270000	270000	900000	900000
Total						6020000	6020000	11700000	11700000

2.1 PRICE INDEX

A price index compares the price of a commodity in a given period of time to the price paid for that commodity at a particular point in time in the past.

LESPEYERS METHOD PRICE INDEX

This method is named after a German Economist Laspeyre who formulated it in 1871 (Abeyasekera, 2011). In this method the base year quantities are taken as weights. The formula for constructing Laspeyre's index number is

$$I_L^{(t)} = \frac{\sum_{i=1}^{n} p_i^{(t)} q_i^{(0)}}{\sum_{i=1}^{n} p_i^{(0)} q_i^{(0)}} \times 100$$

Where t=time period (0,1,2,…)

I=item(1,2, ……, n)

n=total number of items under consideration

$q_i^{(0)}$ = quantity of items I at time period 0

$I_L^{(t)}$ = Values of the Lespeyers price index at time t

$p_i^{(t)}$ =price paid for commodity I at time period t

$p_i^{(0)}$ =price paid for commodity I at time period 0

Thus, Values of the Lespeyer's price index at time t is given as

$$I_L^{(t)} = \frac{117{,}00000}{6020000} \times 100 = 194.35$$

Thus, the Laspeyre's price index is 194.35 indicating that the cost of purchasing these ten items in 2020 was 94.35% more than in 2019.

PAASCHE PRICE INDEX

This method is named after a German statistician Paasche who formulated it in 1874 (Abeyasekera, 2011). The quantities of the current year are taken as the weights in this method. The formula for constructing Paasche's Index number is

$$I_P^{(t)} = \frac{\sum_{i=1}^{n} p_i^{(t)} q_i^{(t)}}{\sum_{i=1}^{n} p_i^{(0)} q_i^{(0)}} \times 100$$

Where $I_P^{(t)}$ = Values of the Paasche price index at time t

Thus, Values of the Paasche price index at time t is given as

$$I_P^{(t)} = \frac{117{,}00000}{6020000} \times 100 = 194.35$$

The Paasche's price index is 194.35 indicating that the cost of purchasing these ten items in 2020 was 94.35% more than in 2019.

FISHER'S IDEAL METHOD

The geometric cross formula for price index is also known as Walsh price index. He gave this formula in 1901. In 1920, Irving Fisher called it an ideal formula for index Number. So, it is also called Fisher's Ideal Index Number. According to this method, index Number is

$$I_F^{(t)}=\sqrt{(I_L^{(t)})(I_P^{(t)})} \times 100$$

Where $I_F^{(t)}$ = Values of the Fisher's price index at time t.

Thus, Values of the Fisher's price index at time t is given as

$$I_F^{(t)}=\sqrt{(\frac{117,00000}{6020000})\,(\frac{117,00000}{6020000})} \times 100 = 194.35$$

The Fisher's price index is 194.35 indicating that the cost of purchasing these ten items in 2020 was 94.35% more than in 2019.

DORBISH AND BOWLEY'S METHOD

Dorbish and Bowley in 1901 suggested to take the arithmetic mean of the Laspeyre's and Paasche's index numbers, so that the influence of both base as well as the current years can be considered. According to this method the formula of the index number can be given as

$$I_{D\&B}^{(t)} = \frac{(I_L^{(t)})+(I_P^{(t)})}{2}=194.35$$

MARSHALL—EDGEWORTH'S METHOD

Marshall—Edgeworth suggested to take the arithmetic mean of the quantities of the base year and the current year as weights. The formula for constructing the index number is given below

$$I_{ME}^{(t)} = \frac{\sum_{i=1}^{n} p_i^{(t)} q_i^{(0)}+\sum_{i=1}^{n} p_i^{(t)} q_i^{(t)}}{\sum_{i=1}^{n} p_i^{(0)} q_i^{(0)}+\sum_{i=1}^{n} p_i^{(0)} q_i^{(t)}}= 194.35$$

From the calculated value above using five different methods, price of food items increases by 94.35%. This shows that there is no significant difference in prices index using difference method.

QUANTITY INDEX NUMBERS

For comparing quantities, quantity index numbers are used. An index number of quantity measures the change in the volumes of the commodities sold at a fixed price. To construct quantity index numbers, the prices are taken as weights and are multiplied to the quantities. The formulae of quantity index numbers can be obtained from the formulae of price index numbers by interchanging p by q and q by p. The following formulae can easily be obtained (Balk, 1996,1985).

LESPEYERS METHOD QUANTITY INDEX

$$Q_L^{(t)} = \frac{\sum_{i=1}^{n} q_i^{(t)} p_i^{(0)}}{\sum_{i=1}^{n} q_i^{(0)} p_i^{(0)}} \times 100 = 100.00$$

PAASCHE QUANTITY INDEX

$$Q_P^{(t)} = \frac{\sum_{i=1}^{n} q_i^{(t)} p_i^{(t)}}{\sum_{i=1}^{n} q_i^{(0)} p_i^{(t)}} \times 100 = 100$$

DORBISH AND BOWLEY METHOD

$$Q_{DB}^{(t)} = \frac{\frac{\sum_{i=1}^{n} g_i^{(t)} p_i^{(0)}}{\sum_{i=1}^{n} g_i^{(0)} p_i^{(0)}} + \frac{\sum_{i=1}^{n} g_i^{(t)} p_i^{(t)}}{\sum_{i=1}^{n} g_i^{(0)} p_i^{(t)}}}{2} \times 100 = 100$$

FISHER'S IDEAL QUANTITY METHOD

$$Q_F^{(t)} = \sqrt{(Q_L^{(t)})(Q_P^{(t)})} \times 100 = 100$$

MARSHALL EDGEWORTH METHOD

$$Q_{M\&B}^{(t)} = \frac{\sum_{i=1}^{n} q_i^{(t)} p_i^{(0)}}{\sum_{i=1}^{n} q_i^{(0)} p_i^{(0)}} + \frac{\sum_{i=1}^{n} q_i^{(t)} p_i^{(t)}}{\sum_{i=1}^{n} q_i^{(0)} p_i^{(t)}} \times 100 = 100$$

TIME REVERSAL TESTS

$$I_{01} \times I_{10} = \sqrt{\frac{\sum p_1 q_o}{\sum p_o q_o} \times \frac{\sum p_1 q_1}{\sum p_o q_1} \times \frac{\sum p_o q_1}{\sum p_1 q_1} \times \frac{\sum p_0 q_o}{\sum p_1 q_o}}$$

$$= \sqrt{\frac{11700000}{6020000} \times \frac{11700000}{6020000} \times \frac{6020000}{11700000} \times \frac{6020000}{11700000}}$$

$$= 1$$

Thus, Fisher's Index number satisfy the Time Reversal Test.

FACTOR REVERSAL TESTS

$$P_{01} \times Q_{10} = \sqrt{\frac{\sum p_1 q_o}{\sum p_o q_o} \times \frac{\sum p_1 q_1}{\sum p_o q_1}} \times \sqrt{\frac{\sum p_o q_1}{\sum p_1 q_1} \times \frac{\sum p_0 q_o}{\sum p_1 q_o}}$$

$$= \sqrt{\frac{11700000}{6020000} \times \frac{11700000}{6020000}} \times \sqrt{\frac{6020000}{11700000} \times \frac{6020000}{11700000}}$$

$$= \frac{11700000}{6020000} = \frac{\sum p_1 q_1}{\sum p_o q_O}$$

Thus, Factor Reversal Test is satisfied

CONCLUSION

The paper considers the price and weight index of some food items, the prices and quantity of the food items were collected from markets located at Ondo town. The result obtained indicated that there is a significant increase in the prices of those commodities while the quantity is fixed and remain constant and thus recommend that Government should give more priority to agriculture sectors by assistant the farmer through provision of fertilizer at a cheaper rate, reducing the import duties of farm implements, educating the farmer on modern day techniques of farming, giving interest free loan to farmers and providing motor able roads to farm settlements.

Government can also establish a price control board to fix price of agricultural products to curtail the excess of middleman.

REFERENCES

Allen, R.G.D. (1949), "The Economic Theory of Index Numbers", Economica NS 16, 197-203.

Abeyasekera S. (2011). Multivariate methods for index construction; Statistical Services Centre. The University of Reading, Reading, U.K.

Akintoye A.S. (2013). Construction tender price index and modeling and forecasting trends; A Thesis Submitted for the Degree of Doctor of Philosophy, University of Salford.

Balk, B.M. (1985), "A Simple Characterization of Fisher's Price Index," Statistische Hefte 26, 59-63

Balk, B.M. (1996), "A Comparison of Ten Methods for Multilateral International Price and Volume Comparisons", Journal of Official Statistics 12. 199-222.

Clements K.W. (2008). Stochastic index number-E Antony Selvanathan School of International Business Griffith University.

Diewert, W. Erwin (2007). Index Numbers. Journal of Economic Literature Classification Numbers, 07(02), 1-48.

Krishnan V. (2010). Constructing an Area-based Socioeconomic Index: University of Alberta, Edmonton, Alberta T5J 4P6, Canada.

Prasada D.S. (2015). Construction Of Cost-Of-Living Index Numbers- A Unified Approach, University of New England, Armidale, Australia