COMPARATIVE ANALYSIS OF RESPONSE OF INDEX NUMBERS TO CHANGES IN PRICE OF PETROLEUM PRODUCTS (A STUDY OF OGHARA DEPOT, DELTA STATE)

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Abstract

This research examined the analysis of index number on Premium Motor Spirit (PMS) and Dual Purpose Kerosene (DPK) to accenting the changes that occurred in the prices of PMS and DPK from 1998 to 2017 using Simple Relative Price Index, Laspeyres Price Index, Paasches Price Index and Fishers Price Index price with a view to determining the difference between them, the data collected were of secondary source from the central bank of Nigeria and National Bureau of Statistics bulletins 1998 to 2017. The variables used were pump prices of premium motor spirit commonly called petrol and Dual Purpose Kerosene (DPK) commonly referred to as Kerosene. A comparison of the various price indices show that about 1318.18% change has occurred in the prices of PMS from the base year and Price of DPK popularly known as kerosene in Nigeria had increased by 4333.33% from 1998 to 2017, the four methods of index numbers used gave the same result for the price of PMS and DPK within the studied period. This study therefore recommends among other things that government desist from undue interference in the prices of petroleum products since the fuel subsidy has been totally removed as claimed. This will make the forces of demand and supply as well as competition comes in to play in other for natural price reduction that will enhance industrial development in manufacturing and small scale businesses in Nigeria.

Keywords: *PMS, DPK, Index numbers, Petroleum products, Price.*

Introduction

The price of crude oil and its by-products has been one of the major determinants of the economy of Nigeria, due to the fact that all economic activities in Nigeria are based around the neighbourhood of crude oil and its products. Nigeria has since overly depended on oil and built her national revenue around crude oil and its products. Externally, Nigeria depends on crude oil export as her main source of revenue, and internally, as her main source of energy both for commercial activities and for domestic use. Because of the over dependence of oil, Nigeria presents the national budget having the price of crude oil in perspective. Internally, crude oil and its by-products have been the mainstay of economic activities. In this, any fluctuation in the price of petroleum products directly or indirectly affects prices of other goods and services, most importantly, transportation.

Due of the dependence on oil, several governments of Nigeria have reviewed the prices of petroleum products in line with economic, political and social expectations of the nation. The prices of petroleum products have undergone several reviews since discovery of crude oil in Nigeria.

The price of petrol known as Premium Motor Spirit (PMS) seems to be the most imparted in price increase as almost every government regimes must alter its price. This is due to the fact that almost every Nigerian makes use of PMS mostly for their vehicles and power generating plants. The next affected is the diesel known as automotive gas oil (AGO) used in running heavy duty vehicles and generating plants, and are mostly used in industries for power generation and transportation. The other petroleum product which seems to be of least significance is the Kerosene known as Dual Purpose Kerosene (DPK) which is mostly used by the rural dwellers in cooking and lighting. Adagunodo (2013) opined that the uniqueness of petroleum products is based on the fact that consumption of petroleum products cut across various sectors of the economy and that the elasticity of substitution of the products varies across sectors, that it consumption is low in transportation and very high in industry and residential, that the low elasticity of substitutions in transportation makes the impact of pricing policies very extensive in reach and quite sensitive in the sector, that PMS and AGO are the major fuels utilized in the road transportation sector and for small to medium sized electricity generation plants for power supply in homes and locations detached from PHCN, as well as industries.

Price Index Number

Price index numbers measure relative price changes from one time period to another. They are so widely used that discussions related to index numbers in contract pricing normally refers to price indexes. However, other index numbers could be used in contract pricing, particularly indexes that measure productivity.

Types of Index Numbers

Simple index numbers calculate price changes for a single item over time. Index numbers are more accurate if they are constructed using actual prices paid for a single commodity, product or service rather than the more general aggregated index.

Aggregate index numbers calculate price changes for a group of related items over time. Aggregate indexes permit analysis of price changes for the group of related products, such as price changes for apples, oranges, plywood, or nails. An example of an aggregate price index is the Producer Price Index (Bureau of Labor Statistics) that provides information the changes in the wholesale price of products sold in the United States over a given period of time.

The issue of deregulation of the downstream oil sector through gradual withdrawal of subsidy has generated serious debate in Nigeria with the claims on the side of government that it will guarantee long term stability in product supply and price, thus translating into economic growth and development. Others contrary views especially the organized labour, claims that deregulation will lead to higher cost of production, product prices, cut of jobs and will bring about recession in the economy.

The main objective of this study is to determine the changes that the prices of PMS and DPK have undergone using Index Numbers. The specific objectives of include:

1. To determine the changes that the prices of Premium Motor Spirit (petrol) and Kerosene have undergone from1990 to 2015 using Simple relative Price, Laspeyres Price , Paasches Price and Fishers Price Index.
2. To compare the results of the four price index numbers with a view to determining the difference that exist among them

2. Literature Review

There is no doubt that the increase in the price of fuel by 49 per cent, from N65 to N97 and recent increase by the President Buhari led administration has started to trim down the purchasing power of the people, especially the poor masses, who have always been at the receiving end of every harsh economic policy introduced by government.

Adagunodo (2013) and Cyoh (2012) argued that an increase of such magnitude in the current Nigerian economic context is, without doubt, a process that is either inadvertently or deliberately conceived to take money away from the pockets of all Nigerian income earners, with over 70 per cent of Nigerians who live on below N360 per day, as the prime victims. In reality, anyone in this category will end up with over 50 per cent of his daily income, which is about N365 per day, inevitably dedicated to transport costs, while the remaining is expected to cater for family feeding, health, education and other social expenses.

Arinze (2011) in his paper listed the adverse effect of petroleum price increase as follows: paralysis of social and economic activities thus bringing about socio-economic unrest, increase in transport fare, increase in market prices; High rate of inflation leading to increased spending both by government and private individuals; Excessive corruption and mismanagement bringing about corruption by both government and private individual which discourages foreign direct investment; Retardation in economic growth thereby slowing down the pace of economic development due to its negative impact on the socio-economic life of the people; high Importation cost of fuel leading to huge and excessive public expenditure on importation of fuel to augment local production which in itself is an indication of an unhealthy economy resulting in accumulated balance of payments deficit of a country; and so on, Practically, up till now Nigerians are still trying to adjust to the hardships occasioned by the recent total subsidy removal on petroleum products which has skyrocketed the prices of the product by almost 80%. The average Nigerian only manages to feed his/or herself and immediate dependents. Cost of transportation has almost doubled resulting to increase in prices of commodities in the country. His work therefore attempts to determine the price changes in petroleum products and its attendant effect on changes in GDP of Nigeria.

2.1 Effects of Fuel Price Changes in Nigeria

Fuel Prices on Economic Growth in Nigeria

It is a common knowledge today that fuel scarcity worsens inflation and poverty in Nigeria and many workers will lose their jobs as companies will find it difficult to cope. Arinze (2011) itemized the effect as follows:

i. Fuel crisis paralyzed social and economic activities, it brings about socio-economic unrest which result in increase in transport fare, sky rocketing of market prices and prices of building materials.

ii. High rate of inflation: this leads to increased spending both by government and private individuals. Fuel scarcity creates inflation in both public and private life with a consequent increase in prices of goods and services.

iii. Excessive corruption and mismanagement: Fuel crisis bring about corruption by both government and private individual. Corruption however, discourages foreign direct investment.

iv. Retardation in economic growth: It slows down the pace of economic development because of its negative impact on the socio-economic life of the people.

v. Importation cost of fuel: It leads to huge and excessive public expenditure on importation of fuel to augment local production which in itself is an indication of an unhealthy economy resulting in accumulated balance of payments deficit of a country. The attendant consequences of this includes abandonment of several on-going economic and infrastructural development projects to meet the foreign exchange requirements for the purchase of refined petroleum products from overseas countries to augment local consumption, poverty and underdevelopment.

vi. Fire disaster: During fuel scarcity, the product becomes more available in the hands of unauthorized road-side dealers (black marketers) who take undue advantage of the unfortunate situation to sell the product at exorbitant prices and engage in profiteering.

The unauthorized dealers also engage in reckless storage of this product in exposed tanks, drums and buckets roadside to extort money from members of the public. This however has resulted in several economic losses, deepening underdevelopment and poverty in our society as in some cases, the exposed tanks get exploded into flames that have burnt people's houses and vehicles and even loss of life in the process.

Adedipe and Olorunfemi (2012) predicted that inflation rate would fluctuate between 13 and 14 per cent for most part of 2012. An investment and research firm, Renaissance Capital said it expected inflation to rise from a projected 10 per cent to between 13 and 14 per cent between January and March and average about 15 per cent for the year, 2012. It however, said that should

the government be persuaded to phase the removal of petrol subsidy as a means of easing the burden of price increases, then the increase in inflation could be lesser than 15 per cent for the year. The inflation rate had been a source of worry for the Central Bank of Nigeria, which struggled throughout 2011 to reduce the figure to a single digit rate. Nigeria's inflation rates experienced a wavy flow for most parts of 2011, from January till December 2011. Although, the National Bureau of Statistics attributed the development to the upward and downward movement in the prices of food items, it also linked the movement to increase in the price of kerosene across the country.

Inflationary figure for January 2011 was 12.1 per cent as against 11.8 per cent recorded in December 2010. This, according to the NBS, was due to hike in the price of kerosene experienced across the country and increase in the prices of some household items and building materials. In the month of February, inflation declined to 11.1 per cent. As the country was trying to regain its balance, the rate yet increased to 12.8 per cent in March, the highest in the year, as a result of the major determinant, according to the monthly release by NBS. April inflation rate was put at 11.3 per cent which was slightly lower than the 12.8 recorded in March. There was a huge jump again in May from 11.3 per cent recorded earlier to 12.4 per cent. The statistical data in May revealed that the percentage increase which was higher than the corresponding level a year ago was as a result of the planting season in the country. In June, the inflation reduced to 10.2 per cent as against the corresponding month which was 12.4 per cent.

"The increase in the price of fuel will automatically reduce the purchasing power of Nigerians. It will increase their fears and deteriorate their health status. Food, water and housing are three important parameters to measure the values of our lives and these things have become elusive to the masses in Nigerians. With the increase from N65 per litre to N97 per litre, Nigeria is now the most expensive place to buy petrol in all oil producing nations. It is rather paradoxical that the CBN would lend support to any policy that would instigate the rate of inflation to such an oppressive level. In successful economies elsewhere, an inflation rate above four per cent is considered as socially and economically oppressive and offensive, and government policies would be recognized to have failed. Indeed, with inflationary rate of up to 15 per cent, motivation for savings becomes meaningless. Government, however, has said that a lot of the concerns about inflation were a bit exaggerated.

Increase in cost of production: Removing fuel subsidy while at the same time devaluing the naira would result in increase in the cost of production for the few companies that are still existing. This would lead to more job losses (as the companies would be forced to down-size in order to survive)

in addition to the unavoidable increase in the cost of the companies' products is the increase in the cost of providing services Removal of fuel subsidy would make nonsense of the proposed 2012 budget estimates because the astronomical inflation arising from subsidy removal would not have been factored into the budget. It will certainly cost much more to construct a kilometer of road or a borehole for example when subsidy is removed. In actual fact, simple photocopying paper would cost much more post subsidy removal than is the case now. So how can anyone convince us to expect more dividends of democracy when fuel subsidy is removed?

Increase in cost of living: In addition to school fees, house rent, etc. the cost of every item of food will astronomically increase with removal of fuel subsidy and, for all sane people, this is where the trouble is. When poor people are unable to eat because they cannot buy roasted corn or yam (which they usually eat as meal) as is bound to happen when fuel subsidy is removed, there will be no peace in this country. This is a fact we must accept and it is one reason why the implications of all policies must be rigorously scrutinized before decision is taken. For any responsible government this is enough reason to jettison the idea of fuel subsidy removal.

Increase in corruption: Removal of fuel subsidy and devaluation of the naira would render the salaries received by civil/public servants at all levels inadequate. The tendency is that corruption, which the government has proved incapable of fighting, would increase. This has always been the case and there is no reason why this will not happen now. I make bold to say that removal of fuel subsidy would not guarantee the construction of refineries by private companies for two reasons. First, if marketers (and this includes the companies that have been licensed to build refineries) import fuel and sell on the basis of the bogus PPPRA template when subsidy is removed, nothing will encourage them to build refineries. This is because they will make much more money through importation than they would by refining crude oil. Secondly, constructing new refineries would cost much more when fuel subsidy is removed and the naira devalued. That will also be a disincentive to building new refineries.

The Government of Nigeria would have to consider these effects now or deal with it In the near future. The growth of real (inflation-adjusted) GDP will reduce if the price of petrol is to stay as is. In addition, the rise in petrol price and the certainty of uneven prices across all 36 states of the federation, will add anywhere from 3 to 5 percentage points to consumer price inflation for 2012.Households' income and spending will both be affected by the rise in petrol prices. The value of minimum wage compensation will depreciate further (assuming it is finally at N18, 000) combined with the increase in inflation. At the same time, the average household's annual spending

on energy goods and services will rise by about N75, 000, and their saving rate dropped sharply. The fall in the saving rate, will erode about half of Nigeria's present middle-class citizens and further dampen the negative effects that higher prices would ordinarily have had on the economy in the short run. Consumer spending will be diminished greatly over the next few years, as citizens try to adjust and build up new savings.

Onwe (2012) examined some implications of the various petroleum policies, using the descriptive research approach. The study critically examined time-series data on relevant variables to ascertain the economic implications of the various petroleum policies. The result of the study reveals three major economic implications. The first is that rapid expansion of the number of economic actors in the Nigerian petroleum industry; the second was rapid development of the transport system; the third, improvements in the gross domestic product (GDP), foreign direct investment, and employment levels. Some negative implications of the petroleum policies were also observed, especially in relation to consumption-related policies. The analysis also showed that a major cause of these problems was ineffective administration of petroleum policies in Nigeria. The paper recommends application of a dis-aggregated approach to policy formulation and implementation by allowing stakeholders involvement in policy formulation.

Monday and Muritala (2016) analyzed the relationship between deregulation of the downstream sector and Nigerian economic performance using annual data from 1980 to 2009. Their study employed the Ordinary Least Squares regression, Chow Test and Granger Causality Test. The research findings reveal that increase in inflation rate and price of petroleum products were not caused by deregulation, and that deregulation of petroleum products prices significantly influence economic growth with marginal inflation and recommended that government should encourage private sector participation in the oil and gas industry.

Adagunodo (2013) examines welfare effects of energy reform particularly petroleum products pricing in Nigeria using data for 5000 households which were collected to estimate a demand system for PMS, AGO and DPK. The study employed marginal social cost approach to evaluate efficiency and equity implications of petroleum products subsidy reform in Nigeria. The results show that the marginal social cost of reducing subsidies on AGO is lowest whenever there is distribution concern thus supporting the reform of subsidy removal on AGO. The study also found that marginal social cost for all petroleum products are extremely low suggesting reduction of subsidies on all petroleum products in Nigeria. The study concludes that equity argument for

continue subsidization of household kerosene can no longer be justified since marginal social cost is low.

3. Research Methodology

This section presents the method employed in this study. It presents the method of index number calculation, nature and source of data, and method of statistical analysis employed.

3.1 Nature of Data

The data were of secondary source. The study employs economic data from 1990 to 2015. The variables used were pump prices of premium motor spirit (PMS) commonly called petrol and Dual Purpose Kerosene (DPK) commonly referred to as Kerosene.

3.2 Source of Data

The data was collected from the Central Bank of Nigeria and National Bureau of Statistics bulletins 1998 to 2017. The data was on prices of premium motor spirit (PMS) and Dual purpose Kerosene (DPK).

3.3 Method of Data Analysis

The Price Relative Index (PRI), Laspeyres Price Index (LPI) and Paasches Price Index (PPI) were used for this study. The price indices were compared to determine if there is any difference between them. The various methods and formula are presented below:

Price Relative Index

$$\text{PRI} = \frac{P_i}{Po} \times 100$$

Where P_i =current year price

Po = Base year price

Laspeyres Price Index

$$\text{LPI} = \frac{P_i q_0}{p_0 q_0} \times 100$$

Where p_0=base year price

q_0= base year quantity

p_i price at current year

q_i quantity at current year

Paasches Price Index

$$\text{PPI} = \frac{P_i q_i}{p_0 q_i} \times 100$$

Where p_0=base year price

p_i = price at current year

q_i = quantity at current year

Fisher's Ideal Price Index

Fisher's Index was used to strike a balance between Laspeyres and Paasches Weighted Indices, as the results of Laspeyres Index is usually at variance with that of Paasches Index. Fisher's Index uses a geometric mean of both Laspeyres and Paasches Indices as shown below:

$$\sqrt{\left(\frac{P_i q_0}{p_0 q_0}\right)\left(\frac{P_i q_i}{p_0 q_i}\right)} \mathbf{X}\ 100$$

4. Data Presentation and Analyses

This section presents the various price indices computations employed in this study. The price indices calculated include: Simple Relative Price Index, Laspeyres Index, Paasches Index and Fishers Index. A comparison of the various price indices was made to determine the differences (if any) that exist among them.

4.1 Data Presentation

This section presents the data used for this study. The data used for this study is presented in table 4.0. The data include: price of Premium Motor Spirit (PMS) popularly known as petrol, Dual Purpose Kerosene (DPK) popularly known as kerosene, total PMS consumption in Nigeria for the studied period and total DPK consumption for the studied period.

Table 4.0 Data on petroleum product prices and quantity

YEAR	PMS (naira)	DPK(naira)	Total PMS Consumption (Quadrillion)	Total Kerosene Consumption (Quadrillion)
1998	11	6	260	22
1999	20	17	252	20
2000	22	17	231	34
2001	22	17	287	40
2002	26	24	292	37
2003	39.5	41	273	28
2004	48	48	272	18
2005	50	50	293	37
2006	65	50	243	35
2007	65	50	214	30
2008	70	70	268	33
2009	65	95	231	18
2010	65	105	285	44
2011	65	105	271	44
2012	97	50	278	53
2013	97	50	283	52
2014	97	50	305	53
2015	97	50	325	54
2016	145	205	345	56
2017	145	260	355	58

Source: NBS Bulletins 1998 to 2017

4.3 INDEX NUMBERS ANALYSES

The results of the various index numbers calculated in this study are presented below. Table 4.1 presents the various computations for the price indices of Premium Motor Spirit (PMS) studied. The results for Simple price relative index, Laspeyres price index, Paasches price index and fisher's price index where calculated. The Fishers price index made use of Laspeyres and Paasches price index

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Table 4.1 Index Numbers for PMS

YEAR	PMS	PMS Consumption (Quadrillion)	Price Relative Index	Laspeyres Index	Paasches Index	Fishers Index
1998	11	260	100.00	100	100.00	100.00
1999	20	252	181.82	181.82	181.82	181.82
2000	22	231	200.00	200.00	200.00	200.00
2001	22	287	200.00	200.00	200.00	200.00
2002	26	292	236.36	236.36	236.36	236.36
2003	39.5	273	359.09	359.09	359.09	359.09
2004	48	272	436.36	436.36	436.36	436.36
2005	50	293	454.55	454.55	454.55	454.55
2006	65	243	590.91	590.91	590.91	590.91
2007	65	214	590.91	590.91	590.91	590.91
2008	70	268	636.36	636.36	636.36	636.36
2009	65	231	590.91	590.91	590.91	590.91
2010	65	285	590.91	590.91	590.91	590.91
2011	65	271	590.91	590.91	590.91	590.91
2012	97	278	881.82	881.82	881.82	881.82
2013	97	283	881.82	881.82	881.82	881.82
2014	97	305	881.82	881.82	881.82	881.82
2015	97	325	881.82	881.82	881.82	881.82
2016	145	345	1318.18	1318.18	1318.18	1318.18
2017	145	355	1318.18	1318.18	1318.18	1318.18

Table 4.1 shows that great changes have happened in the price of PMS from 1998, a period just before the current democratic dispensation and till date. The results uniformly show that about 1318.18% change has occurred in the prices of PMS from the base year, 1998 till date. The result shows that the four methods of index numbers calculated gave the same result for the price of PMS in the studied period.

Table 4.2 Index Numbers for DPK

YEAR	DPK	Kerosene (DPK) Consumption (Quadrillion)	Price Relative Index	Laspeyres Index	Paasches Index	Fisher Index
1998	6	22	54.55	100	100.00	100.00
1999	17	20	154.55	283.33	283.33	283.33
2000	17	34	154.55	283.33	283.33	283.33
2001	17	40	154.55	283.33	283.33	283.33
2002	24	37	218.18	400.00	400.00	400.00
2003	41	28	372.73	683.33	683.33	683.33
2004	48	18	436.36	800.00	800.00	800.00
2005	50	37	454.55	833.33	833.33	833.33
2006	50	35	454.55	833.33	833.33	833.33
2007	50	30	454.55	833.33	833.33	833.33
2008	70	33	636.36	1166.67	1166.67	1166.67
2009	95	18	863.64	1583.33	1583.33	1583.33
2010	105	44	954.55	1750.00	1750.00	1750.00
2011	105	44	954.55	1750.00	1750.00	1750.00
2012	50	53	454.55	833.33	833.33	833.33
2013	50	52	454.55	833.33	833.33	833.33
2014	50	53	454.55	833.33	833.33	833.33
2015	50	54	454.55	833.33	833.33	833.33
2016	205	56	1863.64	3416.67	3416.67	3416.67
2017	260	58	2363.64	4333.33	4333.33	4333.33

The results of Index number calculations for DPK is presented in table 4.2. The table presents the price relative, Laspeyres, Paasches and Fishers price indices. The results also showed that the prices of DPK in Nigeria have undergone serious changes within the study period. Price of DPK popularly known as kerosene in Nigeria had increased by 4333.33% from 1998 to 2017. The four index numbers calculation done shows that the four methods give the same results.

5. Summary, Conclusion and Recommendations

5.1 Summary of Findings

This study was aimed at determining the changes that have occurred in the prices of premium motor spirit (PMS) and Dual Purpose Kerosene (DPK) using four methods of index number calculation: simple relative price index which is a ratio of current price to base year price, Laspeyres and Paasches price indices which are weighted method of calculating price indices and Fishers price index which is a weighted mean of both the Laspeyres and Paasches price indices. The following were the findings in the study:

1. The results show that about 1318.18% change has occurred in the prices of PMS from the base year, 1998 to 2017.
2. Price of DPK popularly known as kerosene in Nigeria had increased by 4333.33% from 1998 to 2017.
3. The result shows that the four methods of index numbers used gave the same result for the price of PMS and DPK in the studied period.

5.2 Conclusion

The results of this study have been presented. The various index numbers computation as well as their comparisons has been made. The results have shown that enormous changes have occurred in the prices of PMS and DPK. Based on these findings this study therefore concludes that a great change has occurred in the prices of PMS and DPK from 1998 to 2017. The study also concludes that there is no difference in the four methods of index number calculation in relation to petroleum products prices. This may be as a result of price fixing and regulations experienced in the petroleum industry.

5.3 Recommendations

Based on the findings in this study, the following recommendations are proffered:

1. Government and petroleum products regulatory agencies should put all mechanism in place in order to drastically reduce the pump prices of petroleum products in Nigeria.
2. Government should desist from undue interference in the prices of petroleum products since the fuel subsidy has been totally removed. This will make the forces of demand and supply as well as competition comes in to play in other for natural price reduction.

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