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THE RELATIONSHIP BETWEEN PETROL PRICE VOLATILITY, THE EXCHANGE RATE AND INFLATION IN NIGERIA (1980-2014)

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Abstract

This paper investigates empirically the relationship between petrol price volatility, the exchange rate and inflation in Nigeria over the period 1980-2014 using time series data, the Phillips-Perron test, the Augumented Dickey Fuller unit root test and the Johansen Cointegration test. An ordinary least square (OLS) regression analysis was carried out via Microsoft 7.1 econometric software. The overall results showed that petrol price volatility exerts a statistically significant positive effect on inflation in Nigeria. The result further revealed that a one naira increase in petrol price would bring about 31.1% rise in the inflation rate. Based on the result, there should be the diversification of the economy by the federal government from being monolithic in nature, domestic refineries should be made to produce at full capacity to ensure the availability of petroleum

products at all times and fixing affordable petrol price by the government to protect the interest of consumers. In addition, government at all levels should wage war against smuggling and hoarding of petroleum products to prevent artificial scarcity. The petrol price regulatory and monitoring agency should be strengthened through the deployment of state security service to enforce compliance with the price fixed by the government, and there should be the formulation of effective fiscal and monetary policies directed at achieving a realistic exchange value for the naira to prevent high inflation rate in the economy.
Keywords: **Petrol price, Inflation, Volatility, Cointegration, Ordinary least square, Unit root, Nigeria.**

Introduction

Crude oil being the mainstay of the Nigerian economy plays a vital role in shaping its economic and political destiny. The oil industry began to play a significant role in the economic life of the country after the end of the Nigeria civil war (1967-1970). Nigeria can be regarded as a country that is primarily rural and depends on primary products export especially oil products. Crude oil has had both positive and negative impacts on the economy. On the positive side, the huge amount of money paid to the government by the oil sector serves as a major source of income to the economy. Oil products are basically consumed in industries for the production of goods and services and are also used domestically for personal consumption. The oil industry has contributed a lot to the foreign exchange reserves. Another achievement of the oil sector to the Nigeria economy is the provision of cheap and readily available source of energy for industry and commerce through the operations of the local refineries and the utilization of local discovered natural gas. The oil industry has also contributed in the area of the provision of employment opportunities to millions of jobless Nigerians.

Several oil products are derived from crude oil and these include petrol, alternatively known as premium motor spirit, diesel, gasoline, kerosene, bitumen, natural gas and others. The federal government has been the custodian of petroleum and its products in Nigeria over the years. Successive regimes have reviewed upward the prices of petroleum products. The upward adjustment of prices (especially of petrol) has affected several economic variables, such as employment, savings, consumption, national income, investment, inflation, gross domestic product, national debt, the exchange and interest rates and others too numerous to mention. Several authors, such as Duncan (2008), Obioma (2006), Olomola (2006) and Olusegun (2008), have examined the impact of petroleum prices on investment, real gross domestic product and savings in Nigeria. However, the magnitude of the impact of petrol price increases by past and present regimes on inflation is yet to be ascertained. This study is motivated by the array of questions begging for answers. These questions include: What is the nexus between petrol price upward adjustments and inflation in Nigeria over the years? What is the correlation between petrol price volatility and standard of living? What policy measures should be taken by government at various levels to reduce inflation rate to a bearable level?

Research Hypotheses

The hypotheses to be verified by this study are stated below as:

1. H_0: Petrol price volatility has no statistically significant positive relationship with inflation in Nigeria
   H_1: Petrol price volatility has a statistically significant positive relationship with inflation in Nigeria.
2. H_0: The exchange rate has no statistically significant positive relationship with inflation in Nigeria
   H_1: The exchange rate has a statistically significant positive relationship with inflation in Nigeria

Objectives of the study

The overall objective of this study is to empirically examine the nexus between petrol price volatility and inflation in Nigeria over the period 1970 and 2014. The specific objectives are to:

(a) determine whether petrol price volatility is positively or negatively correlated with inflation in Nigeria over the period of study

(b) recommend policy measures to the government based on the estimated results on petrol price-inflation nexus

Literature Review

Several authors have examined the interactions between crude oil price shocks and economic growth in Nigeria. Obadan (1983) examined the impact of the development in the oil sector on the Nigerian economy through government finances. He found that the effect of oil on government revenue is positive. That is, there is a positive relationship between oil price and government expenditure, claiming that this relationship is significant and has fiscal implications and linkages. Mork (1989) found an asymmetric relationship between oil price changes and economic growth for Nigeria. Loungani (1996) also found a similar evidence for the Russian economy. Mork, Olsen and Flo (1992) conducted an empirical study on oil price volatility and its impact on key growth variables of economies. Their results indicated that oil price volatility may trigger an external inflation spike. They assert that inflation results from oil price fluctuations and not an increase in domestic money supply. Olaokun (2000) in a related study arrived at some interesting conclusions. He showed that oil price increases exert a negative effect on the economies of Ghana and Nigeria (although the latter is an oil-producing country), but has a positive effect on Russia, which like Nigeria is an oil producing country. Olomola (2006) has argued that oil price volatility is highly significant in explaining GNP growth and unemployment.

Olomola and Adejumo (2006) investigated the impacts of oil price shocks on output, inflation, real exchange rate and money supply in Nigeria within a vector autoregressive framework. They found no substantial role for oil price shocks in explaining movements in output and inflation. Only the long run money supply and the real exchange rate are significantly affected following a shock to oil prices. Jin (2008) found that the oil price increases exert a negative impact on economic growth in Japan and China and a positive impact on the economic growth of Russia. Ubogu (1984) examined the growth and development of the oil industry, government participation, government revenue, foreign exchange earnings, employment generation and industry linkages effects. He noted that oil has been responsible for the radical increase in revenue and further buttressed the stronger dependence on oil revenue as envisaged in our development plans due to the unanticipated decline in oil earnings. He was strongly in support of diversification and the need for the judicious use of the current limited revenue. Nkomo (2006) explored three areas in the determination of international crude oil prices. Prices were determined chiefly by multinational oil companies until the 1970s when the Organization of Petroleum Exporting Countries (OPEC) asserted its capacity to influence to varying degrees the price via its output decisions. Gounder and Bartleet (2007) argued that the demand-side impacts of energy crisis suggest that an energy price shock can result in higher inflation and higher unemployment at the same time; this is known as “stagflation”. Akide (2007) investigated the impact of oil price volatility on economic growth indicators in Nigeria using quarterly data from 1970-2000. He found out that within the period of study, oil price shocks did not affect output and inflation in Nigeria, but significantly influenced the real exchange rate.

Jimenez and Sanchez (2005) empirically assessed the effect of oil price volatility on the real economic activity of the main industrialized countries using both linear and non-linear models. Evidence of the non-linear impact of oil price volatility on real GDP was established. Ayadi (2005) found negligible responses of output, inflation and the real exchange rate following an oil price shock. Phillip and Akintoye (2006) asserted that the causes of oil price instability is attributed to the scarcity caused by refinery maintenance and rehabilitation problems, low capacity utilization, supply and demand inequality. The author opined that trailing oil products prices down to crude oil prices has revealed that the instability in the prices of oil products was due to the cost of refining, storing, transporting, distributing and inefficiencies in the process. Obioma (2006) explained that Nigeria became more exposed to oil price fluctuations the moment she started importing refined petroleum products due to the collapse of local refineries in the late 1980's. Thus, the country could not grapple with the enormous subsidy it commited itself to, so that between 1999 and 2010, the federal government had adjusted its subsidy on petroleum products back and forth approximately 8 times. This has negatively affected inflation, production, consumption, general welfare and hence the pace of economic growth.

Cunado and Gracia (2005) examined the relation between oil price shocks and macroeconomic activities in six Asian countries, namely Singapore, South Korea, Malaysia, Japan, Thailand and the Philippines. The relationship between oil price shocks and economic growth rates was more significant when oil price shocks were defined in local currencies than when defined in the United States dollar (USD). According to Plante (2008), theoretically the immediate effect of positive oil price shocks is the increase in the cost of product for oil importing countries. This is likely to reduce output. The magnitude of this will depend on the demand curve for oil. Higher oil prices lower disposable income, which then leads to a decrease in consumption. Duncan (2008) defined Nigeria as a crude oil exporter and importer of refined petroleum products. He restated the fact that oil price volatility tends to exert a positive effect on the GDP growth of a net-oil exporting country and a negative effect on a net-oil importing country. Olusegun (2008) stated that the dominance of petroleum in the Nigerian economy has led to instability in the economy, which as a result makes price instability of oil products prevalent in Nigeria. The authors observed that smuggling is attractive and profitable due to price differentials. Oyeyemi (2013) examined the growth implications of oil price shock in Nigeria using multiple regression analysis for the period 1979-2010. He found that a little shock in the price of crude oil in the global oil market would produce a long term effect on economic growth in Nigeria. Most of the papers reviewed showed that the price instability of oil products are prevalent due to the poor maintenance of refineries, the underutilization of capacity, rehabilitation challenge, the inequality of the demand and supply of petroleum products, decrease in crude oil allocation and the persistent smuggling of petroleum products. This study differs from the existing ones because it examines the connection between petrol price volatility, exchange rate and inflation in Nigeria while previous studies investigated the impact of crude oil price volatility on economic growth.

Data and Methodology

The data used for this study were obtained from the Central Bank of Nigeria Annual Reports and Statement of Accounts, Central Bank of Nigeria Statistical Bulletin and Annual Report of Private Petroleum Producing Countries. The method that was employed in analyzing the data is simple regression analysis. The price of petrol and exchange rate are the exogenous or explanatory variables while the inflation rate is the endogenous or dependent variable.

Model Specification

The regression analysis of Ordinary Least Square Technique (OLS), the Augumented Dickey Fuller (ADF) Unit Root Test, the Phillips Perron unit root test and the Johansen Cointegration test were employed to examine the nexus between inflation and petrol price volatility in Nigeria over the period 1970-2014. Specifically, the estimated regression equation is of the following form

$$INFR = b_0 + b_1\, PPV + b_2\, EXGR + U$$

where
INFR = Inflation Rate
PPV = Petrol Price Volatility
EXGR = Exchange Rate
U = Stochastic Error Term

Description of Variables

The dependent variable used in this study is the inflation rate. The figures for this were obtained from the Central Bank of Nigeria Statistical Bulletin (2008, 2010, 2013 & 2014). The explanatory or exogenous variables included in the model are:

Petrol Price: This exogenous variable is expected theoretically to exert a positive influence on the inflation rate in Nigeria. The hypothesis is that the lower the price of petrol fixed by the federal government of Nigeria, the lower will be the prices of goods and services charged by producers in the economy. Therefore, the smaller or lower the rate of inflation would be. On the other hand, the higher the price of petrol, the greater the prices of goods and services would be and the higher the rate of inflation prevailing in the economy.

The Exchange Rate: This explanatory variable is expected to have a negative relationship with the inflation rate in Nigeria. It is expected that a lower exchange rate of the Naira will elicit a high volume of domestic and foreign investments and hence higher economic growth. Increased economic growth would bring about lower prices of goods and services in the economy, which is tantamount to a lower inflation rate.

The exchange rate variable represents the exchange rate of the naira to other foreign currencies.

Random Variable: This variable takes care of other explanatory variables influencing inflation, which are not included in the model.

Table 1: Stationary Test

Variables	Augumented Dickey Fuller Statistics	Phillips-Perron Test Statistics	Order of Integration	Maximum No of Lag
INFR	-5.897714	-9.586601	I(1)	8
PPV	-5.771412	-5.805694	I(1)	8
EXGR	-5.443141	-5.443141	I(1)	8-

Source: Author's Computation using E-view 7.1

Unit root tests were conducted for the variables using the Augumented Dickey Fuller test. The Phillips-Perron test and the results are presented in Table 1 above. Note that the Mackinnon (1996) critical values for the Augumented Dickey Fuller test and the Phillips-Perron test estimation at 1%, 5% and 10% significance levels are: -3.646342, -2.954021 and -2.615817, respectively. The Stationary (unit root) test conducted for the set of variables enumerated above revealed that all the variables are I (1) variables (Integrated of order 1). That is, they are not stationary at levels but are all stationary at their various first differences.

Table II : Johansen Cointegration Test

Unrestricted Cointegration Rank Test (Trace)

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value
None *	0.626448	45.06556	42.91525
At most 1	0.208870	12.57056	25.87211
At most 2	0.136389	4.838903	12.51798

Trace test indicates 1 cointegrating eqn(s) at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

Unrestricted Cointegration Rank Test (Maximum Eigenvalue)

Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen Statistic	0.05 Critical Value
None *	0.626448	32.49500	25.82321
At most 1	0.208870	7.731660	19.38704
At most 2	0.136389	4.838903	12.51798

Max-eigenvalue test indicates 1 cointegrating eqn(s) at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

The Table above presents the cointegration result for the variables. Here, it is observed that the variables in the equation are cointegrated. The existence of cointegration implies that there is long-run relationship existing among the variables in the equation. Trace test and Maxeigen value test indicate cointegration at the 5% level of significance.

Consequent upon this, an ordinary least square regression was estimated because the variables are stationary at their various first differences.

Table III: Ordinary Least Square Regression Table

Dependent Variable: INFR
Method: Least Squares
Date: 12/07/15 Time: 22:04 Sample: 1980 2014
Included observations: 35

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	27.83267	4.320701	6.441703	0.0000
PPV	0.311104	0.154999	0.071637	0.0003
EXGR	0.208359	0.096289	1.125345	0.0008

R-squared	0.656614	Mean dependent var	20.32114
Adjusted R-squared	0.703903	S.D. dependent var	18.46202
S.E. of regression	17.47659	Akaike info criterion	8.641418
Sum squared resid	9773.798	Schwarz criterion	8.774734
Log likelihood	-148.2248	Hannan-Quinn criter.	8.687438
F-statistic	23.97115	Durbin-Watson stat	1.764681
Prob(F-statistic)	0.000000		

Table IV Presentation of Ordinary Least Square Regression Result
Dependent Variable: INFR Sample : 1980-2014

Variables	**Estimated Coefficien**	**T-Value**	**Ap. Expec.**	**Inference**
Constant term	27.83267	6.441703	$b_0 > 0$	Correct sign and significant
PPV	0.311104	0.071637	$b_1 > 0$	Incorrect sign and significant
EXGR	0.208359	1.125345	$b_2 > 0$	Incorrect sign and significant
Significant		R^2 =		DW = 1.7

at 5%		O.70		

The short run result in Table IV shows that there is a positive relationship between petrol price volatility and inflation in the Nigerian economy, given the coefficient of 0.311104, which is statistically significant. This can be interpreted as a one-naira increase in the price of petrol would bring about 31.1 units increase in the inflation rate. This implies that an increase in petrol price is a significant factor that can undermine or retard the growth of an economy via a high inflation rate. When the government of a country embarks on upward adjustment of petrol price, there will be significant skyrocketing in the prices of goods and services, which can retard economic growth. From the estimated result, there is a positive relationship between the exchange rate and inflation in Nigeria, given the coefficient of 0.208359, which is statistically significant with a t-value of 1.125345. This suggests that a one unit increase in the exchange rate would bring about a 20.8 units rise in inflation rate.

The coefficient of determination (R^2) indicates that over 66% changes in inflation are explained by petrol price volatility (PPV) and the exchange rate (EXGR) taken together. The unexplained variation in the model is 34%. The remaining 34% could be attributed to some other forces affecting inflation outside this model. The adjusted coefficient of determination (R^2) is 0.703903. This shows that a 70% variation in inflation (INFR) is caused by variations in petrol price volatility (PPV) and the exchange rate (EXGR). This model as specified is statistically significant given its F-test to be 23.97115.

The F-statistic value of 23.97115 is high enough. This shows the overall significance of the model and indicates that collectively all the explanatory variables are important determinants of inflation. The value of the Durbin Watson statistic is 1.764681 for the model. This falls within the determinate region and implies that the model is free from an autocorrelation problem. Since petrol price volatility exerts a statistically significant positive relationship with inflation in the model. Thus, the null hypothesis is rejected. It states that there is no significant positive relationship between petrol price volatility and inflation in Nigeria. Results from the empirical analysis provide strong evidence that petrol price volatility (PPV) is positively related to inflation.

Conclusion and Recommendations

This paper investigated the inflation implications of petrol price volatility and the exchange rate in Nigeria. Empirical analysis was conducted by applying the simple regression of the ordinary least square technique to the annual data on the Nigerian economy for the period 1980-2014. The model was found to be significant and most of its estimates are as expected. The study found that petrol price volatility has a sustained impact on inflation. The findings show a positive relationship between petrol price volatility and inflation, which is in conformity with apriori expectation. Based on the estimated results, the following recommendations are made:

(a) Diversification of the economy by the federal government from being monolithic in nature, that is, other natural resources should be tapped to provide revenue for the government and putting a stop to overdependence on crude oil as the mainstay of the economy.

(b) Domestic refineries should be made to produce at full capacity, so that there would be the availability of petroleum products to Nigerians. Scarcity of petroleum products would give room for the exploitation of consumers by unscrupulous marketers.

(c) Fixing affordable price of petrol (premium motor spirit) should be done to protect the interests of consumers by the federal government. This is because the price of petrol has a great influence on the prices of other goods and services.

(d) The existing petrol price regulatory and monitoring agency should be strengthened through the deployment of state security service to enforce compliance with the price fixed by the federal government.

(e) Government at all levels should wage war against smuggling and hoarding petroleum products to prevent artificial scarcity capable of escalating its price.

(f) Government should make effective fiscal and monetary policies directed at achieving a realistic the exchange rate for naira and prevent high inflation rate in the economy.

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