Petroleum Product Prices and Inflation in Nigeria (1990-2012)

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ABSTRACT

In this study effort was made to see if there was any relationship between petroleum products prices (PPP) and inflation (INF) in the country. The study examines the impact of petroleum products prices increases on the level of inflation in the Nigerian economy. The scope of the study covers a period of twenty two years that is from 1990-2012, time series data on quarterly basis were employed for this work. The methodology employed in this study includes; ADF test, VAR model (Vector Autoregression Model), granger causality test, impulse response function and variance decomposition. A stationary test was carried out using the Augmented Dickey-Fuller (ADF) the variable were found to be stationary at difference order at 5% level of significance. The VAR result indicates an increase in PPP leads to rise in the level of inflation. The granger causality test revealed that bi-directional causality existed between PPP and INF, while the accumulated impulse response function and the variance decomposition also indicated a positive relationship existed between INF and PPP in Nigeria. The major findings from this study is that increase in the prices of petroleum products (PMS, AGO, and DPK) has a positive impact on the general price level of goods and services in the Nigeria economy. In conclusion the CBN and policy makers in Nigeria should also pay special attention to the supply management of petroleum products in the country.

Keyword: Petroleum product prices, inflation, VAR, granger causality, accumulated impulse response function, variance decomposition and Nigeria.

1. Introduction

Inflation in Nigeria has been considered as a purely monetary phenomenon. Hence inflation targeting has been through the manipulation of monetary variables such as exchange rate, money supply, interest rate which are aimed at attaining price stability in the economy (CBN, 2004). However,

over the years, Nigeria has experienced unprecedented persistent and appreciable increase in the prices of petroleum products. Petroleum products are major inputs to industrial production, they have a lot of domestic uses, in fact, and they are regarded as the life wire of the nation. Consequently any unprecedented increase in their prices would therefore have a multiplier effect in the economy (Gbadomosi, *et al.,* 2007).

The effect of petroleum products price increase to the growth and development of the Nigerian economy cannot be overemphasized. This is because the price of petroleum products is critical to production cost and the welfare of the people in every economy. Consequently, it has worsened the economic crises in the Nigerian economy. The outrageous price increases has made life unbearable for Nigerians as prices of goods and services have risen and thus causing hardship to most people in the country (Mba-Afolabi, 1999).

Iwayemi (2000) emphasized the use of pricing instruments for correcting disequilibrium in the energy market. Since the demand for the domestically consumed petroleum products are greater than their supply and the government policies cannot match the market forces, this has always led to shortage in supply of the products. According to World Bank (2002), a sizeable number of firms in Nigeria depend on petroleum powered generating sets for their energy supply as electricity supply is grossly inadequate and/or unreliable. With these and other problems, small and medium scale enterprises in the country are faced with problem of high cost of production which has made the whole business environment to be very unfriendly for most of these companies, thereby leading to their closure. Consequently, these led to redundancy, high crime rate, and other social vices in the country at the time. Because domestic prices of petroleum products[2] in the country are much lower than what is obtains in the neighboring countries, some percentage of the petroleum products are smuggled to those countries thereby causing shortage of domestic supplies (Iwayemi et al., 2009). In fact, speculative hoarding of the petroleum products in the country also increase the prices of the products in the economy. The main objective of this study is to examining the impact of petroleum products prices and inflation in Nigeria. The rest of the paper is structured as follows; section two is the literature reviewed, the methodology used is found in section three, the results of the study was discussed in section four, finally section five concluded the study.

2.0 Theoretical literature

In addition to creating wealth transfers from oil importing to oil exporting economies, oil price changes affect macroeconomic activity in a number of ways. Oil price increases reduce production output and wages. They induce inflationary tendencies and raise interest rates thereby reducing

[2] The three major petroleum products mostly consumed in Nigeria; Premium Motor Spirit (Petrol), Automotive Gas Oil (Diesel) and Dual Purpose Kerosene (Kerosene) are the products of interest in this research work. It is to be noted that these products are inadequate in terms of supply most of the time in Nigeria.

aggregate demand (Awerbuch *et al.,* 2004:8). In most developing countries governments act as guardians of the natural resource wealth hence serve as a conduit through which the higher oil revenues flow into the economy through higher public spending. This will not be a problem if the increased oil revenues remain stable, but typically they do not, because oil prices are notoriously volatile (Aizenman and Pinto, 2003:20).

2.1 Theoretical framework

The Structuralist's Approach to inflation is the theoretical framework for this work.

According to the structuralist's view inflation is inevitable in the less developed countries embarking on ambitious development programmes and is caused mainly by the characteristic structural imbalance in such countries. Major structural imbalance include: scarcity in the supply of some major goods and services, resource imbalance, foreign exchange bottleneck, infrastructural bottleneck and social and political constraints (Dwivedi, 2007 p. 428). The implication of the scarcity of petroleum products on the growth of output and price level in the economy cannot be overemphasized. However, this has led to imbalance on the demand for and supply of petroleum products due to inelastic products supply in the country, which had often led to rise in the prices of petroleum products in the country. Some of the reasons for low petroleum product supply are: Technological backwardness, Low level of petroleum infrastructure, Low rate of saving and investment, high rate of mismanagement and corruption in the economy etc which also hold petroleum products supply at low level against the rising demand due to increase in population and urbanization, which bring about a widening gap between demand for and supply of petroleum products in Nigeria. Speculative hoarding of the petroleum products in the country also increase the prices of the products. Since the demand for petroleum products is always greater than supply of the product government has to import the shortage to meet up with the demand. Rise in the prices of petroleum products in Nigeria lies as one of the major price structures in the economy and a cause of inflation in the Nigerian economy.

2.3 Empirical literature

Abah (2000) evaluated the impact of monetary policies on inflation in Nigeria from 1980-1995, the Ordinary Least Square multiple regression method was used. He discovered that impact of money supply in fueling inflation was not as great as was perceived. He indeed established that money supply lagged behind inflation, contrary to the popular belief that growth in money supply adequately explains the phenomenon of inflation in Nigeria. Discovering was made by him that other macro economy factors such as domestic credit, GDP, oil prices and exchange rate of the naira impacted on inflation in Nigeria more than money supply.

Olomola and Adejumo (2006) studied the effects of oil price shocks on output, inflation, real exchange rate and money supply in Nigeria within a VAR 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. Based on all these findings, very limited studies have been done to assess the direct effects of oil price fluctuations on the economic growth.

Odularu (2007) in his work "crude oil and the Nigerian economic performance", found out that for the past three decades, crude oil has been a major source of revenue, energy and foreign exchange for the Nigerian economy. Against this background, his paper analyses the relationship between the crude oil sector and the Nigerian economic performance. Using the Ordinary Least Square regression method, the study reveals that crude oil consumption and export have contributed to the improvement of the Nigerian economy. However, one of the recommendations of the study is that government should implement policies that would encourage the private sector to participate actively in the crude oil sector.

Gounder *et al.,* (2007) examined oil price shocks and economic growth in Venezuela using the Vector Autoregressive (VAR) methodology based on quarterly data. Three oil price measures were considered, following the various theoretical implications that oil price shocks have on economic growth. The authors analysed the short-run impact of oil price shocks in a multivariate framework which traced the direct economic impact of oil price shocks on economic growth as well as indirect linkages. Furthermore, the models employed the linear oil price and two leading nonlinear oil price transformations to examine various short-run impacts. A Wald and Likelihood Ratio tests of Granger Causality, was utilized and the results indicated that linear price change, the asymmetric price increase and the net oil price variables were significant for the system as a whole, whereas the asymmetric price variables was not. Following the causality analysis of oil price nexus, the generalized impulse responses and error variance decompositions the authors reaffirmed the direct link between the net oil price shock and growth, as well as the indirect linkages. They concluded that since oil consumption continued to increase in New Zealand, there is a need for policy-makers to consider oil price shocks as a major source of volatility for many variables in the economy.

Apkan (2009) analyses the dynamic relationship between oil price shocks and major macroeconomic variables in Nigeria by applying a VAR approach. The study pointed out the asymmetric effects of oil price shocks; for instance, positive as well as negative oil price shocks significantly increase inflation and also directly increases real national income through higher export earnings, though part of this gain is seen to be offset by losses from lower demand for exports generally due to the economic recession suffered by trading partners. The findings of the study showed a strong positive relationship between positive oil price changes and real government expenditures. Unexpectedly, the result identified a marginal impact of oil price fluctuations on industrial output growth. Furthermore, the "Dutch Disease" syndrome is observed through significant real effective exchange rate appreciation.

In her work the impact of fuel price on inflation Nwosu (2009) used the variance Autoregressive analysis model to assess the relative contribution of fuel price on inflation. The study used available quarterly data series spanning from 1995 to 2008. The finding of the study revealed that the policy of subsidizing the price of fuel should be continued so as to help cushion the economy from the adverse effects of oil-price shock.

From the foregoing, most of the empirical studies carried out have focused on different monetary policies and inflation, oil price shock and demand for petroleum product in Nigeria. However, analyzing the impact of domestic petroleum products prices on inflation using the VAR, granger causality test, accumulated impulse response function and variance decomposition for an oil consuming and exporting country like Nigeria has not yet being carried out. This study intends to fill this gap. It would be interesting to empirically verify domestic petroleum products prices and inflation in Nigeria.

3.0 Methodology

3.1 Sources of data:

The data for this analysis consist of quarterly observations from 1990-2012. The variables considered in the models are petroleum product prices (PPP)[3], government fiscal deficit (GFD), money supply (M1), exchange rate (EX) and inflation rate (INF). These data are extracted from Central Bank of Nigeria (CBN) Statistical Bulletin (2012), and Annual Report Journal gathered from NNPC, text books, and paper presentation on related issue.

3.2 Model specification

To investigate the relationship between petroleum products prices and inflation in Nigeria the Vector Autoregressive model of Akpan (2009[4]) has been adapted for this study because he used the model to analyze the relationship between oil price shock and major macroeconomic variables in Nigeria and this model will also be suitable for this study. The reason has been that the VAR model[5] provides a multivariate framework where changes in a particular variable (PPP) are related to change in its own lags and to changes in other variable and the lags of those variables. The VAR treats all variables as endogenous and does not impose a priori restriction on structural relationships. Since the VAR expresses the dependent variables in terms of predetermined lagged variables, it is a reduced-form model. Once the VAR has been estimated, the relative importance of a variable in generating variations in its own value and in the value of other variables can be assessed.

To estimate the VAR, we need to first check the time series properties of the data in order to help us decide whether the VAR will be estimated in levels, first or second difference. Here we shall use

[3] PPP is the average of the aggregated prices of PMS, AGO, and DPK in Nigeria from 1990-2010

[4] See Apkan (2009) who analyses the dynamic relationship between oil price shocks and major macroeconomic variables in Nigeria by applying a VAR approach.

[5] The VAR methodology has been extensively used by (Canzoneri et al, 2001; Olivo, 2001; Creel 2002; Morekwa, 2008 etc).

a variant of the unit root tests such as the Augmented Dickey Fuller (ADF) or Phillip Perron (PP). Depending on the nature of the time series, a variant of this test that account for structural changes may be more appropriate.

The VAR model is presented below.

PPP_t = f (PPP_{t-1}, GFD_{t-1}, $M1_{t-1}$, EX_{t-1}, INF_{t-1}, U_{1t}) … … (1)

GFD_t = f (PPP_{t-1}, GFD_{t-1}, $M1_{t-1}$, EX_{t-1}, INF_{t-1},, U_{2t}) … … (2)

$M1_t$ = f (PPP_{t-1}, GFD_{t-1}, $M1_{t-1}$, EX_{t-1}, INF_{t-1},, U_{3t}) … … (3)

EX_t = f (PPP_{t-1}, GFD_{t-1}, $M1_{t-1}$, EX_{t-1}, INF_{t-1},, U_{4t}) … … (4)

INF_t = f (PPP_{t-1}, GFD_{t-1}, $M1_{t-1}$, EX_{t-1}, INF_{t-1},, U_{5t}) … … (5)

Where PPP_{t-1} = Domestic prices of petroleum product at time $_{t-1}$

GFD_{t-1} = Government Fiscal Deficit $_{t-1}$

$M1_{t-1}$ = Money Supply $_{t-1}$

EX_{t-1} = Exchange rate at time $_{t-1}$

INF_{t-1} = Inflation rate at time $_{t-1}$

U_t = is the error term

$_{t-1}$ = lag length which be determined by the SC and AK statistics

The study seeks to use the time series values of PPP, GFD, M1, EX, and INF to analyze the relationship of PPP on inflation in Nigeria. Vector Autoregression (VAR) models are useful for policy analysis.

For simplicity, assume a VAR (1) model of the form:

$$\mathbf{X}_t = D + A_1\mathbf{x}_{t-1} + \boldsymbol{\varepsilon}_t \quad \text{...} \quad (6)$$

where the vector $\mathbf{X}_t$ = (PPP, GFD, M1, EX, INF)

The relationship can be represented as follows:

$$\begin{pmatrix} PPP_t \\ GFD_t \\ M1_t \\ EX_t \\ INF_t \end{pmatrix} = \begin{pmatrix} D_1 \\ D_2 \\ D_3 \\ D_4 \\ D_5 \end{pmatrix} + \begin{pmatrix} \beta_{11} & \beta_{12} & \beta_{13} & \beta_{14} & \beta_{15} \\ \beta_{21} & \beta_{22} & \beta_{23} & \beta_{24} & \beta_{25} \\ \beta_{31} & \beta_{32} & \beta_{33} & \beta_{34} & \beta_{35} \\ \beta_{41} & \beta_{42} & \beta_{43} & \beta_{44} & \beta_{45} \\ \beta_{51} & \beta_{52} & \beta_{53} & \beta_{54} & \beta_{55} \end{pmatrix} \begin{pmatrix} PPP_{t-1} \\ GFD_{t-1} \\ M1_{t-1} \\ EX_{t-1} \\ INF_{t-1} \end{pmatrix} + \begin{pmatrix} \varepsilon_t \\ \varepsilon_{2t} \\ \varepsilon_{3t} \\ \varepsilon_{4t} \\ \varepsilon_{5t} \end{pmatrix} \quad \dots\dots\dots\dots \quad 7$$

X_t D A X_{t-1} ε_t

Thus, in all VARS, each variable is expressed as a linear combination of lagged values of itself and lagged values of all other variables in the group.

Testing preceding to the analysis of the VAR model

Since a greater part of economic variables exhibit non-stationary properties, the presence of unit roots for each variable was checked before estimating the VAR model. If unit root exists in any variable, then the corresponding series exhibits non-stationary properties. Thus, estimations based on non-stationary series may lead to spurious regressions (see, Granger and Newbold, 1974). The variables in the models are tested for stationarity using the Augmented Dicky-Fuller *(ADF)* tests. The ADF test is conducted using regression (8) which includes intercept and time trend (see, Gujarati 2003):

$$\Delta X_t = a + bt + \rho X_{t-1} + \sum_{i=1}^{k} \Delta X_{t-i} + \mu_t \qquad (8)$$

Where ΔX_t is the first difference of the series X, k is the lag order, t is the time.

One can test for the absence of Granger causality by estimating the following VAR model:

$Y_t = a_o + a_1 Y_{t-1} + - - - + a_p Y_{t-p} + b_1 X_{t-1} + - - - + b_p X_{t-p} + U_t$ - - - (9)

$X_t = c_o + c_1 X_{t-1} + - - - + c_p X_{t-p} + d_1 Y_{t-1} + - - - + d_p Y_{t-p} + V_t$ - - - (10)

Testing

$H_o : b_1 = b_2 = \dots = b_p$

Against

$H_1 :$ NotH_o

Is a test that X_t does not granger cause Y_t

Similarly, testing $H_o : d_1 = d_2 = \dots = d_p = 0$ against

H_1 : Not H_o is a test that Y_t does not granger cause X_t

In each case, a rejection of the null hypothesis implies there is Granger causality between the variables.

4.0 Empirical results

4.1 Unit Root Test

The empirical analysis began with a prior investigation of stationary properties of the time series using *ADF* tests. The test is reported on Table (1) reveals that all the variables are stationary but at different levels on the basis of this, the null hypothesis of non-stationarity was rejected and it is safe to conclude that the variables are stationary. This implies that the variables are integrated of different order. However, they are stationary at different-order difference (integrated of different order). Since the variables are integrated of different order and the residuals are stationary at level, the variables may not be co-integrated (see Engle and Granger, 1987) else we resort to a VAR model.

Table 1: Augmented Dickey Fuller (ADF) Unit Root Test Result[6]

Trend & Intercept

Variable	Lag	ADF Test Statistic	5%Critical Value	Order of Integration
PPP	2	-5.780483	-3.4724	I(0)
GFD	2	-5.015894	-3.4730	I(1)
M1	2	-4.841698	-3.4721	I(1)
EX	2	-4.321302	-3.4739	I(2)
INF	2	-3.595093	-3.4721	I(0)

Notes:

• Optimal lag for conducting the ADF tests was selected based on the Schwartz and Akaike Information Criteria and also the auto-correlation function of the series. The optimal lag length in all cases was 2.

Mackinnon(1991) critical value for rejection of hypothesis of unit root applied.

Source: Author's Estimation using Eviews 4.0.

The result in the table 1 shows that two of the variables were stationary at level which is PPP and INF while GFD and M1 are not stationary at level but they were stationary at first difference. However, EX rate was stationary at second difference. Hence the variables are stationary at different order. This can be seen by comparing the observed values (in absolute terms) of both the ADF test statistics with the critical values (also in absolute terms) of the test statistics at the 5% level of significance. The table above revealed that all the variables are stationary but at different levels on the basis of this, the null hypothesis of non-stationarity was rejected and it is safe to conclude that the variables are stationary. This implies that the variables are integrated of different order. Tom and

[6] • Optimal lag for conducting the ADF tests was selected based on the Schwartz and Akaike Information Criteria and also the auto-correlation function of the series. The optimal lag length in all cases was 2. Mackinnon(1991) critical value for rejection of hypothesis of unit root applied.

Johansen (1997) assumed that if the cumulated process satisfies an I(2) model, then the results about this model can be phrased in terms of multicointegration. This was proven by Engle and Yoo (1991). Furthermore, since the variables are not stationary of the same order I(1) as can be seen in table one above but stationary at different order we then use the vector autoregression model. For one to test for cointegration the variables must all be stationary at order one I(I).

Engle-Granger Cointegration Test

The Engle-Granger test which is a two way cointegration procedure to check weather the residuals of the model specified in the work is cointregrated I(0) has revealed the following results.

Variable	ADF t-statistics @ Level	Critical value			Order of integration	Prob.
		1%	5%	10%		
Residual	-2.433275	-3.505	-2.894	-2.584	I(0)	0.1356

Source: Authors computation using Eviews 7.1

The Engle-Granger cointegration test above reveals no cointegration in the series at the 1%, 5% and 10% significance levels, and therefore justifies the adoption of a VAR process.

4.2 Optimal lag length in the VAR

A major requirement in conducting Johansen (1992, 1995) cointegration tests and estimation of a VAR system, either in its unrestricted or restricted Vector Error Correction (VEC) forms, is the choice of an optimal lag length. In this study, this choice was made by examining the lag structure in an unrestricted VAR originally specified with two lags, using a combination of VAR lag order selection criteria and examination of the roots of the characteristic polynomial to verify if the VAR is stable. Table 3 presents the evidence based on the VAR Lag Order Selection Criteria and suggests that two lags should be accommodated in the VAR. while Appendix (1) shows that the VAR satisfies the stability condition, and appendix (2) shows the inverse roots of the AR characteristic polynomial associated with the different lag orders specified by the selection criteria is within the unit circle for the VAR specification involving two lags. This indicates that the VAR Equation will be unstable if only one lag is accommodated. Thus, subsequent analyses were based on VAR with two lags. We found the optimal lag length that makes the residuals free from autocorrelations to be two.

Table: 2 OPTIMUM LAG ORDER SELECTION CRITERIA

Lag	LogL	LR	FPE	AIC	SC	HQ
0	40.24900	NA	2.58E-07	-0.979139	-0.821037	-0.916198
1	332.7583	536.2670	1.53E-10	-8.409952	-7.461341	-8.032307
2	527.3294	329.6900*	1.40E-12*	-13.12026*	-11.38114*	-12.42791*

* indicates lag order selected by the criterion

LR: sequential modified LR test statistic (each test at 5% level) FPE: Final prediction error

AIC: Akaike information criterion SC: Schwarz information criterion

HQ: Hannan-Quinn information criterion

Source: Author's Estimation using Eviews 4.0

4.3 The vector autoregression model

The vector autoregression (VAR) is commonly used for forecasting systems of interrelated time series and for analyzing the dynamic impact of random disturbances on the system of variables. The VAR approach sidesteps the need for structural modeling by treating every endogenous variable in the system as a function of the lagged values of all of the endogenous variables in the system. Since only lagged values of the endogenous variables appear on the right-hand side of the equations, simultaneity is not an issue and OLS yields consistent estimates. Moreover, even though the innovations ε_t may be contemporaneously correlated, OLS is efficient and equivalent to GLS since all equations have identical regressors, we proceed to estimate VAR result. The table 3 below shows that the variables PPP, GFD, M1, and EX all depend on INF.

Table: 3 VECTOR AUTOREGRESSION MODEL RESULT

Vector Autoregressive Result of ΔINF

Regressor	Coefficient	T-value
Intercept	0.203557	3.62205
D(PPP(-1))	0.418467	2.27761
D(PPP(-2))	-0.119698	-1.07177
D(GFD(-1))	0.118426	3.65894
D(GFD(-2))	-0.092723	-2.84762
D(M1(-1))	0.276980	1.56548
D(M1(-2))	0.147303	0.80445
D(EX(-1))	0.258227	1.19753
D(EX(-2))	-0.640478	-3.09303
INF(-1)	1.676764	23.8878
INF(-2)	-0.761518	-10.9129

Source: Author's Estimation using Eviews 4.0

R-squared	0.987
Adjusted R-squared	0.985
S.E equation	0.099
F-statistic	479.58

The results of the VAR produced some salient features that are worth explaining. The VAR result in the table 3 above shows that positive relationship existed between PPP and INF at lagged one and it is statistically significant, while at lagged two it showed a negative relationship and is statistical insignificant. A one naira increase in the price of petroleum product brought about 42 percent increase in the inflation rate in Nigeria economy. However, rise in PPP has a multiplier effect on the cost of production of goods and services as well

as the welfare of people in the whole economy. It was found that the demands for the domestically consumed petroleum products are greater than their supply and government policies unable to meet up with the supply in the country. Petroleum products serve as the major input to most firms, since electricity supply is unreliable in Nigeria. Whenever there is a rise in prices of petroleum product, scarcity in petroleum products or problem with the supply of petroleum products in the country etc, these seriously affected all economic activities in Nigeria by causing hardship to most people, making life to become unbearable for Nigerian, this has contributed in worsen the economic crises where the transportation fare has skyrocketed, this is in line with (Bobai 2012) findings.

However, this alone is not good enough to proof the positive relationship between PPP and INF in the Nigerian economy. The Pair wise granger causality test, accumulated impulse response function and the variance decomposition were used to confirm the above results.

4.4 Granger Causality Tests

Causality can be described as the relationship between cause and effect. Basically, the term 'causality' suggests a cause and effect relationship between two sets of variables, say, Y and X. Recent advances in graphical models and the logic of causation have given rise to new ways in which scientists analyze cause-effect relationships (Pearl, 2012). In testing for Granger causality, two variables are usually analyzed together, while testing for their interaction. All the possible results of the analyses are four:

* Unidirectional Granger causality from variable Y_t to variable X_t

* Unidirectional Granger causality from variable X_t to Y_t

* Bi-directional causality and

* No causality

Below is the main results obtained from the Pairwise Granger-causality analysis done in the study.

Table 4: Pairwise Granger Causality Tests

Pairwise Hypothesis	Obs	F-Statistic	P-value	Decision	Type of Causality
EX↗PPP	73	7.75237	0.00093	Reject H_o	Uni-directional causality
PPP ↗EX	73	0.87207	0.42271	DNR H_o	Uni-directional causality
GFD ↗PPP	73	2.02172	0.14031	DNR H_o	Uni-directional causality
PPP ↗GFD	73	7.88420	0.00083	Reject H_o	Uni-directional causality
M1 ↗PPP	73	0.74081	0.48054	DNR H_o	No causality
PPP ↗M1	73	0.51650	0.59892	DNR H_o	No causality
INF ↗PPP	73	6.03915	0.00385	Reject H_o	Bi-directional causality
PPP ↗INF	73	8.15711	0.00067	Reject H_o	Bi-directional causality
GFD ↗EX	73	2.24647	0.11357	DNR H_o	Uni-directional causality
EX↗GFD	73	4.13542	0.02019	Reject H_o	Uni-directional causality
M1↗EX	73	4.24751	0.01827	Reject H_o	Uni-directional causality
EX ↗M1	73	0.18992	0.82746	DNR H_o	Uni-directional causality
INF ↗EX	73	3.35611	0.04074	Reject H_o	Bi-directional causality
EX ↗INF	73	5.01961	0.00926	Reject H_o	Bi-directional causality
M1 ↗GFD	73	3.55164	0.03411	Reject H_o	Uni-directional causality
GFD ↗M1	73	0.69557	0.50230	DNR H_o	Uni-directional causality
INF ↗GFD	73	9.46889	0.00024	Reject H_o	Bi-directional causality
GFD ↗INF	73	9.35576	0.00026	Reject H_o	Bi-directional causality
INF ↗M1	73	1.26378	0.28913	DNR H_o	Uni-directional causality
M1 ↗INF	73	6.03997	0.00385	Reject H_o	Uni-directional causality

Source: Author's Estimation using Eviews 4.0

Alpha (α) = 0.05 Decision rule: reject H_0 if P-value > 0.05.

Key: DNR = Do not reject;

↗ = does not Granger cause.

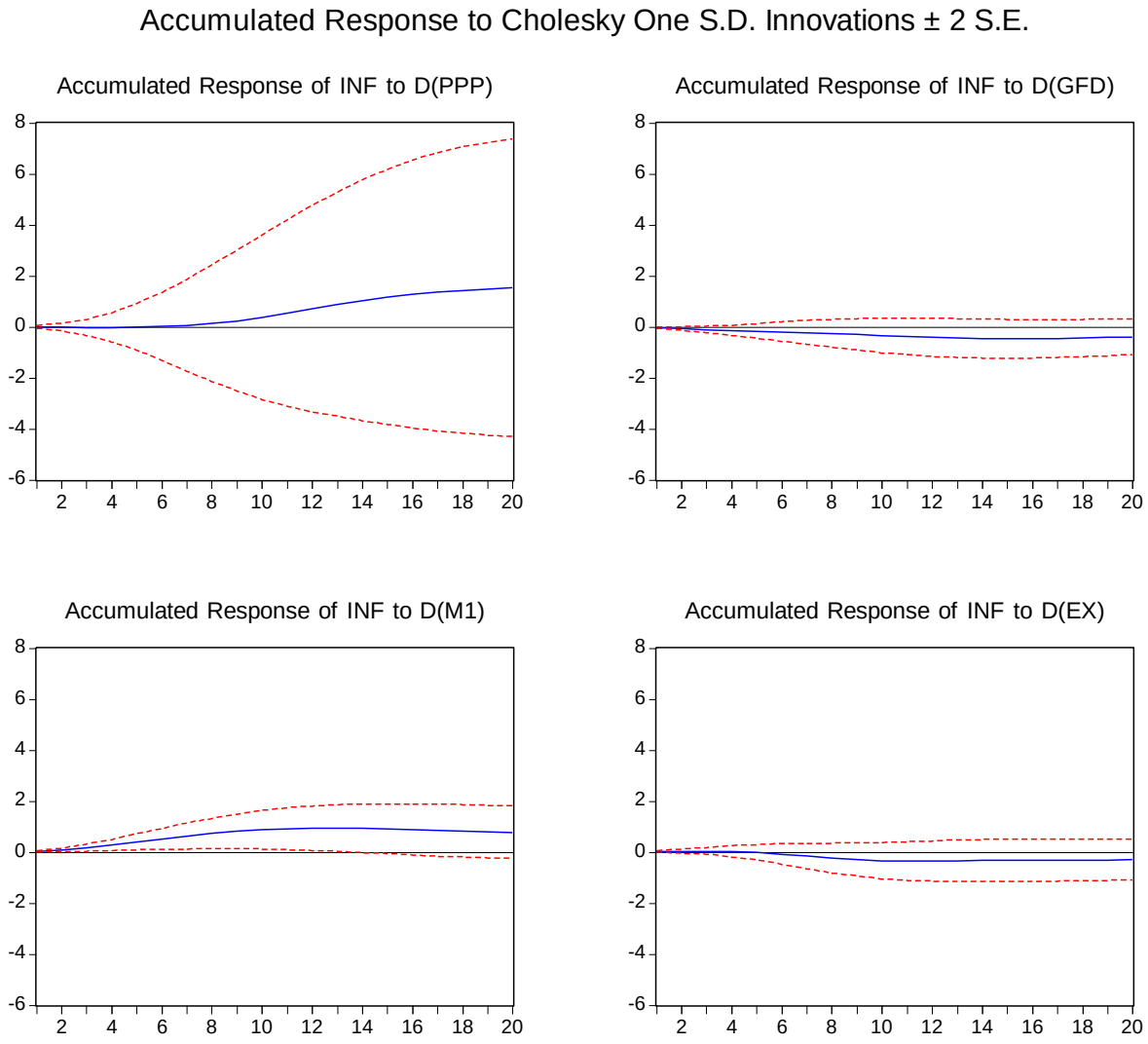
Based on the granger causality test result in table 4 above it was very obvious that uni-directional causality existed between Exchange Rate and Petroleum Products Prices, Petroleum Products Prices and Government Fiscal Deficit, Exchange rate and Government Fiscal Deficit, Money Supply and Exchange Rate, Money Supply and Government Fiscal Deficit and Money Supply and Inflation Rate. However, a bi-directional causality existed between Inflation Rate and Petroleum Products Prices, Inflation Rate and Exchange Rate, and Inflation Rate and Government Fiscal Deficit. Furthermore, there was no causality between Money Supply and Petroleum Products Prices.

4.5 ACCUMULATED IMPULSE RESPONSE FUNCTION OF PPP, GFD, M1, EX AND INF

The Accumulated Impulse responses in figure 2 below trace out the response of current and future values of each of the variables to a one unit increase in the current value of one of the VAR errors, assuming that this error returns to zero in subsequent periods and that all other errors are equal to zero. The implied thought experiment of changing one error while holding the others constant makes most sense when the errors are uncorrelated across equations, so impulse responses are typically calculated for recursive and structural VARs.

The extent at which shock in different variables influence PPP, GFD, M1, EX and INF can be assessed, through impulse response function. The simulation horizon covers 20 quarters. The solid lines are impulse response. In this study impulse response function is depicted for horizons of 20 quarters in figure one (1) below which enables us to trace out the response of PPP, GFD, M1, EX and INF to a shock in policy variables. The impulse response function depicts the growth rate relative to the base period when the shocks occurred.

Figure 1: Accumulated Response of INF to PPP, GFD, M1, and EX.



Source: Author's Estimation using Eviews 4.0.

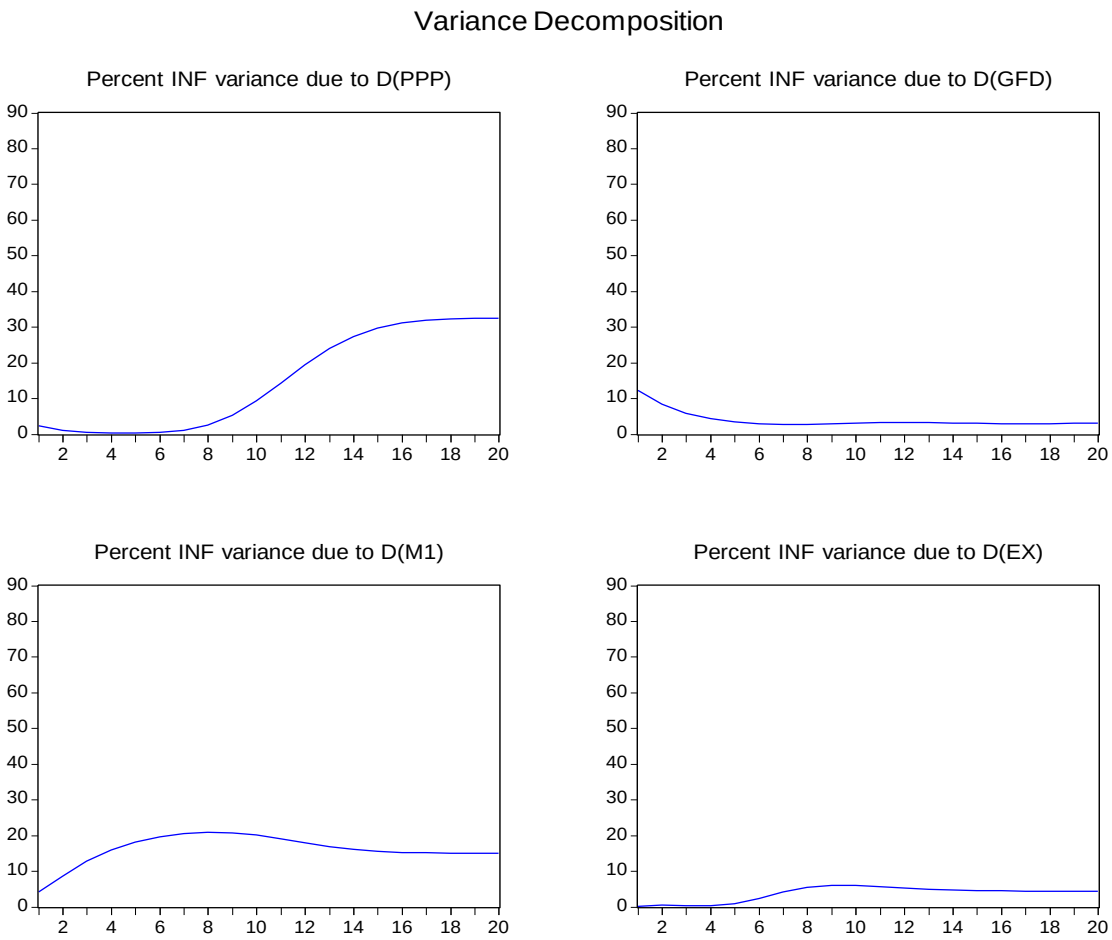
The response of INF to PPP from the above graph has shown that from the 1st to the 7th quarter inflation does not response to any change in the prices of petroleum product. However, response of INF to PPP began to show positive impact from the 8th quarter and this persisted into the long-run that is the 20th quarter. This indicated that increases in the prices of petroleum product have a positive impact on inflation in Nigeria from the 8th - 20th quarter and remained positive. The positive impact was being noted in the 8th quarter because whenever the prices of petroleum products are increased in Nigeria, people always believe that these prices will be reduced to their previous prices but after sometime they

realize that this has come to stay. This is in line with our a-priori expectation that positive relationship exist between PPP in INF in Nigeria. The accumulated response of INF to GFD show that a slight negative relationship between the two variables from the 3rd quarter to the 20th quarter. So with the response of INF to EX this implies that negative relationship exit between inflation rate and exchange rate in Nigeria. An increase in exchange rates lead to a decrease inflation rate in Nigeria and vice verse. Furthermore, inflation rate response positively to change in money supply in the country.

4.6 VARIANCE DECOMPOSITION OF PPP, GFD, M1, EX, INF

We now proceed to examine the relative strength of various processes through which petroleum product prices impulses are transmitted to inflation. This is accomplished by carrying out a decomposition of PPP, GFD, M1 EX and INF with a view to determining the size of the fluctuation in a given variable that are caused by different shocks. In this particular study, we calculated variance decomposition at forecast horizons of four through 20 quarters. VAR for each variable was estimated which included 2 lags. The results are reported in the table below, indicating the percentages of variance of the variable forecast as attributed to each variable at a 20 quarter horizon.

Figure 2: Percent INF variance due to PPP



Source: Author's Estimation using Eviews 4.0.

According to Figure 2 the percent INF variance due to PPP graph shows that a positive relationship existed between INF and PPP in the study. About 32 percent of the inflation rates in the long-run are influenced by increase in petroleum prices in Nigerian economy as can be seen in the variance decomposition graph above. The percent INF variance due to GFD, M1 and EX graphs above all shows that positive relationship exists between INF and all the variables. While about 15 percent of the inflation rates in the long-run are also influence by increase in money supply.

Therefore, since the accumulated impulse response function and the variance decomposition have both shown that there is a positive relationship between PPP and inflation in Nigeria. These are in accords with the supply shock inflation and structuralist view of inflation in the less developed countries like Nigeria, indicating how rise in the prices of petroleum products in Nigeria lies as one of the major

price structures in the economy and a cause of inflation in the Nigerian economy. The major findings from this study is that whenever, there is an increase in the prices of petroleum products (PMS, AGO and DPK) in Nigeria, this has a positive impact on the general price level of goods and services in the economy and also has direct negative implication on the standard of living of the populace.

5. Conclusion

The Central Bank of Nigeria as well as the policy maker in the country should as a matter of urgency have a second thought, by not perceiving inflation in Nigeria as purely a monetary phenomenon rather begin to pay special attention to the supply management of petroleum products in the country. In this study, it was revealed that domestic increase in the price of petroleum products is another serious cause of inflation in Nigeria from the VAR result and this was further proven by the causality test, accumulated impulse response function and variance decomposition graphs'. Therefore, the following recommendations were made:

Firstly, since the prices of petroleum product has a chain effect on the prices of other goods and services in the country. Government must stop the price control regime of petroleum products in Nigerian economy and allow market forces to determine their prices, this in the long run will help in stabilizing the prices of petroleum product in the economy and will stabilizes prices of other goods and services and this will go a long way in reducing the rate of inflation in Nigeria.

Secondly government should make sure that our existing refineries are functioning at full capacity and also build new ones; by so doing the existing refineries can meet Nigerians internal petroleum products needs and some excess for export and strategic reserve of product demand. This can be made possible when the nation refineries Turn-Around-Maintenance are consolidated with transparency and accountability.

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Appendix 1: Roots of Characteristic Polynomial

Roots of Characteristic Polynomial

Endogenous variables: D(PPP) D(GFD) D(M1) D(EX) INF

Exogenous variables: C

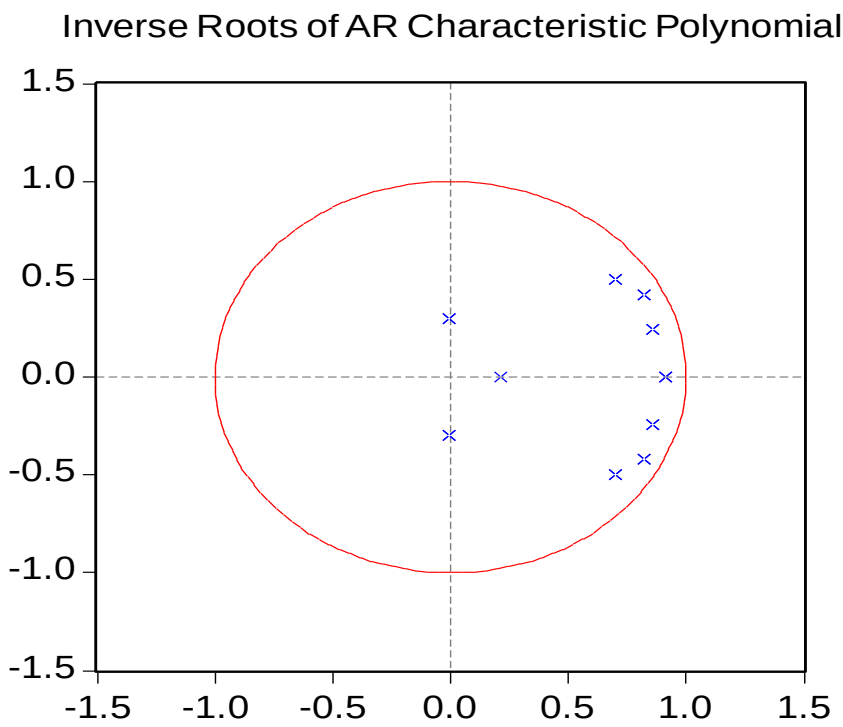
Lag specification: 1 2

Root	Modulus
0.823125 - 0.419210i	0.923727
0.823125 + 0.419210i	0.923727
0.915259	0.915259
0.856023 - 0.246222i	0.890731
0.856023 + 0.246222i	0.890731
0.701963 - 0.496042i	0.859540
0.701963 + 0.496042i	0.859540
-0.004548 - 0.297690i	0.297725
-0.004548 + 0.297690i	0.297725
0.212320	0.212320

No root lies outside the unit circle.

VAR satisfies the stability condition.

Appendix 2: Inverse Roots of AR Characteristic Polynomial



Cointegration Test using the Engel- Granger Test

Null Hypothesis: RESID01 has a unit root

Exogenous: Constant

Lag Length: 1 (Automatic - based on SIC, maxlag=11)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-2.433275	0.1356
Test critical values:	1% level	-3.504727	
	5% level	-2.893956	
	10% level	-2.584126	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation

Dependent Variable: D(RESID01)

Method: Least Squares

Date: 02/05/12 Time: 15:23

Sample (adjusted): 1990Q3 2012Q4

Included observations: 90 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
RESID01(-1)	-0.101383	0.041665	-2.433275	0.0170
D(RESID01(-1))	0.275054	0.074954	3.669639	0.0004
C	0.003315	0.020114	0.164793	0.8695

R-squared	0.164527	Mean dependent var	0.009887
Adjusted R-squared	0.145321	S.D. dependent var	0.205224
S.E. of regression	0.189727	Akaike info criterion	-0.453695
Sum squared resid	3.131683	Schwarz criterion	-0.370368
Log likelihood	23.41629	Hannan-Quinn criter.	-0.420093
F-statistic	8.566310	Durbin-Watson stat	1.994632
Prob(F-statistic)	0.000402		