Analysing the Effects of Deregulation of the Downstream Oil Sector on Nigerian Economic Growth

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Abstract: *The issue of deregulating the downstream sector of Nigeria's oil industry has been on for a long time. It has also generated a lot of controversy. The government is of the opinion that deregulating the sector and withdrawal of subsidy will lead to stability in product supply and bring about economic growth. While, the organised labour and other civil society organisations are of the opinion that deregulation is not a panacea to the present crises in the sector. They further argued that deregulating the sector will lead to increased cost of production and loss of jobs. This paper employs an unrestricted Vector Autoregressive Model (VAR) to study the effect of deregulation of the sector on four major macroeconomics variables, namely: Inflation, Employment, Minimum wage and GDP. The result shows that deregulating the sector will trigger inflation, slow down the growth process and leads to loss of jobs. It is recommended that the government should evolve policies that will reduce the impact of deregulation on the cost of production, control inflation and protect jobs.*
Keywords: *Deregulation, Downstream Oil Sector, Economic Growth, Vector Autoregressive Model.*

1. Introduction

Oil subsidy in Nigeria started in 1973 (Oluloye 2006) when the Indigenization and Nationalization Policy of the Federal Government became effective. By the Nationalization Policy, according to NNPC (2010), the federal government acquired controlling shares in major oil companies under what was termed 'First Participation Agreement' and under this agreement the federal government acquired 35% shares in the oil companies. The shares of these companies with the federal government out lay were managed by the then government owned Nigeria National Oil Corporation (NNOC), replaced by the Nigerian National Petroleum Corporation (NNPC) in 1977.

On 1st October, 1973 the Federal Government introduced uniform pricing of petroleum products nationwide (Oluloye, 2006) which makes petroleum products available at subsidised prices in all parts of the country. Since the marketing companies are in business for profit under the Indigenization policy of the federal government the marketers preferred to sell products in major cities, seaports and refinery locations, where higher profits were made, mainly in the southern part of the country. In order to make products available in all parts of the country and at uniform rate the government therefore introduced subsidy.

According to Asekunowo (2012) the subsidy scheme was targeted at low income Nigerians so that they could be able to consume some necessary and essential goods and services and at manufacturing sector in order to boost their production of which the petroleum products serve as necessary inputs. Adenikinju (2000) postulates that Nigeria as a major producer and exporter of crude oil has always controlled the domestic prices of petroleum products so that its' citizens could enjoy the price subsidy. According to him crude oil is sold to local refineries at a lower price per barrel to bring down the cost of production and enable Nigerians to enjoy subsidy.

However since the introduction of subsidy, the downstream oil sector of the Nigerian oil industry has been anything but stable in the last three decades. This is as a result of product scarcity due to pipe-line vandalism, frequent breakdown of the refineries, unethical marketing such as products hoardings and diversions. In a bid to make petroleum products available for domestic consumption in the country, the federal government resorted to massive importation of refined petroleum products. This makes subsidy financing in the sector very expensive.

Therefore, the government decided to deregulate the sector by withdrawing subsidy and allowing the market forces of demand and supply to determine the products prices. It also decided to withdraw from all

products importation, refining and distribution. The aim is for government to allow full private sector participation in the sector. However this decision met with stiff opposition from the organised labour and other civil society organisations, claiming that deregulation will result into higher prices of manufacturing inputs, which could raise the cost of production in the country. They further argued that it will lead to lower productivity and loss of jobs. The main objective of the study is to examine the response of macroeconomic variables such as GDP, Inflation, Minimum Wage and Employment to changes in domestic petroleum prices as a result of the deregulation of downstream oil sector in Nigeria.

2. Empirical Literature and Theoretical Issues

In this section an attempt has been made to review the literature on deregulation of downstream oil sector and the way and manner through which it influences GDP, Inflation, Minimum Wage and Unemployment. The said variables were chosen because of their importance in explaining economic phenomenon not only on Nigeria's economy but also on the economies of many other countries in the world. These variables among others have been used by many scholars to measure the impact of oil price change on economic activities see for example (Hamilton, 1983; Mork, 1989; Mork and Olson 1994; Lee and Ratti 1995; Ferderar, 1996; Papapetrou, 2001).

2.1 Deregulation of Oil Market and GDP

The effect of changes in the price of oil on GDP can be understood via its demand or supply side effect. The demand side effect is the situation where the prices of petroleum products increase as a result of increased economic activity which results in high demand of oil and this is consistent with the theory that the higher the demand other things being equal the higher will be the prices. Under this circumstance the effect on GDP will be positive. On the other hand if the increase in oil prices is due to supply side effect which means the increase in the oil prices is due to reasons other than increase in demand then the effect on GDP could be negative, which indicates that rising oil prices are a pointer to the reduced availability of essential input to production, leading to a reduction in prospective output (Barro 1984, Brown & Yucel 1999, Brown & Yucel 2002, Abel & Bernanke 2001). Therefore, there is an upsurge in production cost and the growth of industrial output and productivity are slowed, which could have negative effect on GDP, Minimum Wage and Employment. Another empirical study that shows the relationship between oil prices and GDP was the one conducted by Hamilton (2005) and Brown and Yucel (2002). The findings of these studies shows that oil price increases have a negative effect on wages and positive effect on Inflation.

3. Methodology

In order to find the effect of the deregulation of downstream oil sector on the economic growth of Nigeria five variables are considered in this study, which are: Domestic Petroleum Price (PEP), Gross Domestic Product (GDP), Inflation (INF), Unemployment (UNEMP) and Minimum wage (MINWG). Domestic petroleum price is the proxy for deregulation which is the explanatory variable. Others are dependent variables. Data used in this study is Quarterly Time Series data from 1980q1 to 2012q4. All the data are in logarithmic form except inflation rate and unemployment rate. The data were obtained from International Monetary Fund (IMF) International Financial Statistics (2012; 2013), IMF World Economic Outlook, (2011), Central Bank of Nigeria (CBN) Statistical Bulletin (2012) and Daily Trust Newspaper (2012). To examine the response of the above mentioned macroeconomic variables to changes in domestic oil prices an unrestricted vector autoregressive model (VAR) is used. VAR is a system regression that is used where there is more than one dependent variable (Brooks 2008). This model provides a multivariate framework where changes in a particular variable (Domestic Petroleum Prices) are related to changes in its own lags and to changes in other variables (Minimum Wage, Inflation, Unemployment rate, and GDP) and their lags. One of the advantages of this model is its ability to capture the relationship between different variables. Consider the following Vector Autoregressive model:

$$y_t = A_o + \sum_{i-1}^{p} A_i y_{t-1} + \mu_t \qquad \text{equation (3.1)}$$

Where y_t is a 5x1 vector of variables determined by p lags of all 5 variables in the system, ε_t is a 5x1 vector of error terms, A_0 is a 5x1 vector of constant term coefficients and A_i are 5x5 matrices of coefficients on the *ith* lag of y. Where y_t = [LPEP, LMINWAG, INF, UNEMPRT, LGDP]. Where PEP denotes petroleum price (domestic petroleum price in Nigeria), MINWAG denotes minimum wage, INF denotes inflation, UNEMPRT denotes unemployment rate and GDP stands for gross domestic product.

This model has been used by Farzanegan and Markwardt (2009) to measure the effect of oil price shocks on the Iranian economy. VAR was also used by Olomola and Adejumo (2006) to examine the effects of oil price shocks on output, real exchange rate, money supply and inflation in Nigeria. Jimenez-Rodriguez and Sanchez (2005) also used VAR to empirically assess the effects of oil price shocks on real economic activities in a sample of seven Organisations for Economic Co-operation and Development (OECD) countries. In fact VAR has been frequently used to examine the relationship between oil price and other macroeconomic variables since the work of Hamilton (1983) and Sims (1980). Prior to running VAR some diagnostic tests will be conducted on the time series data to check for the unit root and serial correlation. To achieve that, Augmented Dickey Fuller (1976) and Philips Peron (1996), tests will be used to check for unit root while Johansen cointegration test using both Trace statistics and Maximum Eigen value will be used to check for long run relationship among the variables. After running VAR the results of impulse response function, variance decomposition and granger causality tests will be presented and analysed.

4. Empirical Analysis and Discussions of Results

In this section, the empirical analysis will begin with a look at the descriptive statistics of our variables and then proceed to examine the time series properties of the series. Finally an unrestricted Vector Autoregressive Model (VAR) models is estimated and the resulting impulse response, variance decomposition and Granger causality tests are presented and analysed.

4.1 Descriptive Statistics

Table 4.1: Descriptive statistics for GDP (N million); MINWAG, PEP, UNEMPRT and INF for Nigeria.

	GDP	MINWAG	PEP	UNEMPRTSIS	INF
Mean	1910042	2879.845	22.90473	3.492248	0.044751
Median	670619.8	250	15	3.4	0.034323
Maximum	10048574	18000	141	4.7	0.201273
Minimum	11241.89	125	0.15	1.7	-0.04795
Std. Dev.	2781019	4394.221	27.9018	0.968699	0.050722
Observations	129	129	129	129	129

Source: *Authors' computation using E -views 7.0 based on data from the International Monetary Fund (IMF) International Financial Statistics (2012; 2013), IMF World Economic Outlook, (2011), Central Bank of Nigeria (CBN) Statistical Bulletin (2012) and Daily Trust (2013)*

Over the period 1980 to 2012, Nigeria had an average GDP of N1, 910,042 and the maximum over the period was N10, 048,574.00 while the minimum stood at N11, 241.89. Focusing on minimum wage, the average of N2, and 879.845 was observed over the study period with a maximum of N18, 000. In terms of domestic petroleum, the price of a litre of fuel averaged N 22.90473 per litre over the period under review. A look at Table 5.1, shows that domestic petroleum price in Nigeria was a minimum of N0.15 with a maximum of N141. Looking at the reported unemployment rate for the period under review, the reported unemployment rate stood at a maximum of 4.7% and a minimum of 1.7%.

4.2 Unit Root Tests

The stationarity of the variables was examined using Augmented Dickey Fuller and Philip Perron unit root tests and the results of both tests are presented in Tables 3.2 and 3.3 below:

Table 4.2: Augmented Dickey Fuller Unit Root Test Results (using trend and intercept) Prob. 0.05

Variables	Levels	First Difference	Order of Integration
LPEP	-1.90	-12.85?	I(1)
LGDP	-2.02	-4.31?	I(1)
LMINWAG	-2.44	-11.51?	I(1)
UNEMPRT	-2.53	-11.35?	I(1)
INF	-3.80??	-11.73	I(0)

Note:*?, ?? and???, indicates significance at 1%, 5% and 10% respectively.*
Source*: Author's computation using Eviews*

Table 4.3: Philips Peron Unit Root Test Results (Trend and Intercept) Prob. ? 0.05

Variables	Levels	First Difference	Order of Integration
LPEP	-2.05	-12.77?	I(1)
LGDP	-2.51	-12.61?	I(1)
LMINWAG	-2.45	-11.51?	I(1)
UNEMPRT	-2.49	-11.51?	I(1)
INF	-7.11?	-16.98	I(0)

Note*: ?, ?? and???, indicates significance at 1%, 5% and 10% respectively.*
Source: *Author's computation using Eviews*

From Tables 4.2 and 4.3 it can be concluded that all the variables are non-stationary in their levels but they are stationary in their first difference with the exception of inflation which is stationary in its level. Therefore LPEP, LGDP, LMINWAG and UNEMPRT are characterised as I(1) variables while INF is integrated to order zero denoted by I(0). Under the above scenario we cannot continue to run a simple regression because it will give us spurious results (Brooks 2011). Therefore there is the need to run cointegration test in order to see if in the long run, the variables move together having established the fact that they don't move together in the short run. Since the variables are characterised as unit root processes.

4.3 Cointegration Test

Given that all our variables except INF suffer from the problem of stationarity which means they are I (1) variables we need to test for a long term relationship by means of Johansen cointegration test. Non stationary series have different properties over time and are difficult to generalize (Kozhan, 2010).Two or more variables will be cointegrated if they have a long term equilibrium relationship between them. Given that our variables of interest each contain a unit root, the Johansen cointegration test was employed to examine their long run relationship.

Table 4.4 reveals that both trace and maximum Eigen value show that there is no cointegration among the variables as we fail to reject the null of no cointegration. To determine the number of cointegrating relations, we can continue successively from zero to k-1 until we fail to reject. To reject the null hypothesis, the Trace statistics and maximum eigen value statistics must be greater than the critical value. From Table 3.4 above, we can observe that the Trace statistic of 41.85 is less than the critical value of 47.86. Thus we fail to reject the null that r=0. Similarly, the maximum eigen value statistic of 26.12 is less than the critical value of 27.58 and hence we cannot reject the null as well.

Table 4.4: Johansen Cointegration Test

Null hypotheses	**Trace statistics**	**Critical value**
r=0	41.85	47.86
r=1	15.73	27.79
r=2	6.86	15.94
r=3	0.46	3.84
Null hypotheses	**Max. Eigen statistics**	**Critical value**
r=0	26.12	27.58
r=1	8.87	21.13
r=2	6.40	14.26
r=3	0.46	3.84

***Source**: Author's computation using Eviews*

4.4 VAR

The main purpose of employing a VAR for our empirical estimation in this study is to evaluate the dynamic causal relationship and response among the five variables of interest.

4.5 Impulse Response Function

The generalised impulse response function is employed to find out the mutual impact of innovations in domestic petroleum price on macroeconomic variables in Nigeria. Under the generalised impulse response, causal ordering of the variables doesn't matter.

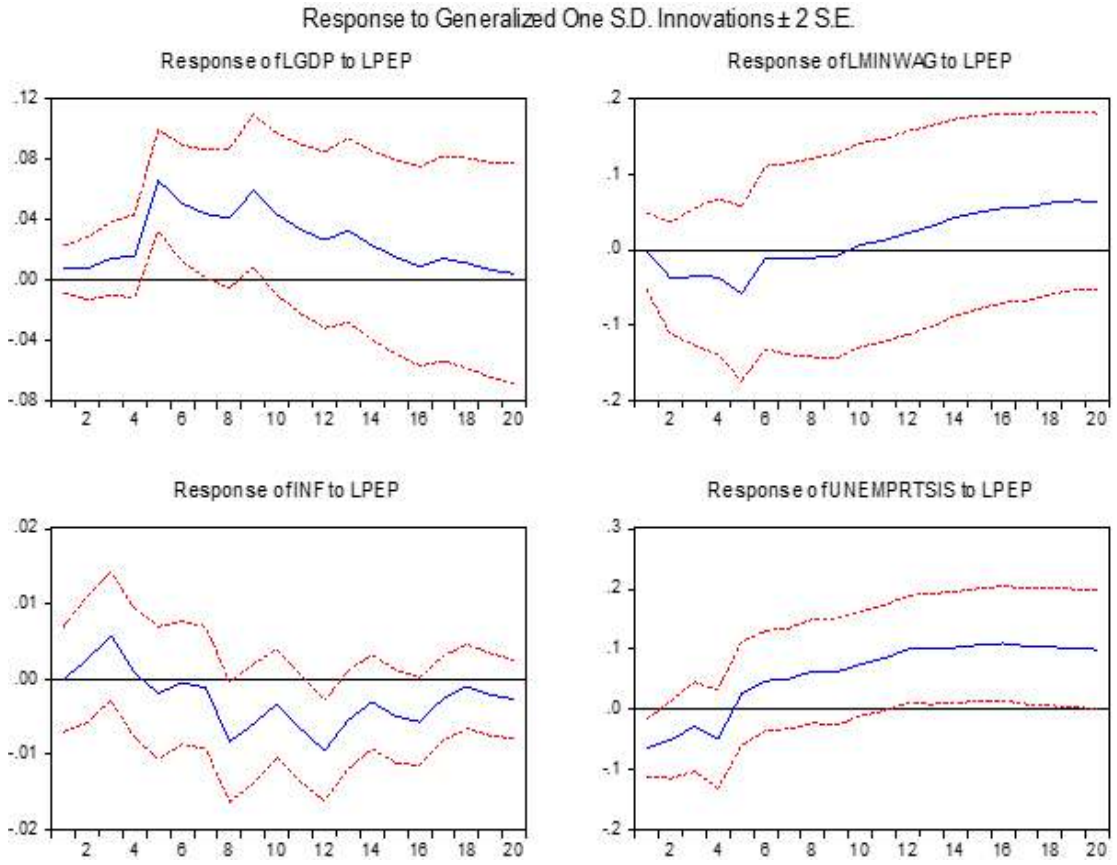

***Figure 4.1:** Impulse Response Function*

Results of Impulse response function (Fig. 4.1) indicate that in response to a positive shock in domestic petroleum prices, there is a positive impact on GDP growth in Nigeria. It can be observed that in response to a shock in domestic price of petroleum, GDP responds positively peaking at the 5th quarter and then slowly dying down with spikes in the 9th and 13th quarter. This positive relationship persisted till the twentieth quarter. The response was also statistically significant between the 4th and 8th quarter. This positive relationship is inconsistent with the classic supply side effect which argues that an oil price increase leads to increase in production cost in oil importing economies ultimately leading to reduction in output and productivity (Barro, 1984, Brown & Yucell, 1999, Abel & Bernanke, 2001). However, the observed positive relationship can be explained by the fact that Nigeria is an oil exporting economy. For an oil exporting country like Nigeria, an increase in oil price is expected to generate higher revenue to the government and hence more resources is available for increased productivity and output in the economy. Furthermore, this positive relationship can be explained by the fact that by withdrawing fuel subsidy in the domestic market, the government will have more money available for other development activities. The observed positive relationship is also inconsistent with the findings of Hamilton (2005), who demonstrated a negative relationship between increased oil prices and output.

Similarly, inflation responds positively to a shock in the domestic petroleum price. The shock from domestic petroleum prices on inflation is positive up to the 4th quarter before reversing to a negative effect from the 5th quarter which persisted throughout the remaining quarters. The theoretical literature posits a positive relationship between oil price and inflation rate. As observed Fuhrer (1995), Gordon (1997) and Hooker (2002), an oil price increase represents an inflationary shock which can be followed by an inflation wage spiral.

Turning to unemployment, a shock from domestic petroleum prices initially has a negative impact on unemployment rate in Nigeria, it becomes positive in the 5th quarter and it persists throughout the remaining quarters. This is consiste with the findings of Caruth et al (1998), Davies & Haltiwanger (2001) and Keane & Prasead (1996) who show that oil price increases tend to reduce unemployment in the short run but tend to increase it in the long run.

As to the shock from domestic petroleum prices on minimum wage, it is expected that theoretically minimum wage will be influenced by changes in domestic petroleum price through its negative relationship with inflation which erodes the purchasing power of fixed income earners. A look at figure 5.3 reveals that the response generated was initially negative while in the long run, a look at the impulse response reveals that it becomes positive from the 10th quarter up to the last quarter. This is as a result of wage increase by the government and multiplier effect in the economy to cushion the effect of subsidy withdrawal.

4.6 Variance Decomposition

The variance decomposition offers an alternative of examining the dynamics among the variables under study. It allows us to show the relative importance of an individual variable due to its own shock and the shock to other variables of interest.

Table 4.5 explains the percentages of the variations in macroeconomic variables that are attributed to domestic oil price changes. The variance decomposition indicates that Nigerian Domestic oil price changes are a significant source of variation for Nigerian GDP, Inflation and unemployment. Conversely, a domestic petroleum price change has dismal effect on Nigerian minimum wage. Throughout the 20th quarters, petroleum price changes accounted for only 0.0% to 4.65% to changes in minimum wage other than its self.

Coming to GDP, domestic oil price changes explains more than 10% of variation in GDP in 5th quarter, more than 14% by the tenth quarter, and then declining to more than 7% in the 20th quarter.

For inflation, other than itself domestic petroleum price accounted for 0% to 13% of variations over the 20th quarters of observed. This demonstrates the importance of domestic oil price to changes in inflation. Considering unemployment rate; the changes in domestic oil prices accounts from, 7% to more than 31% of variations other than itself under the review period.

Table 4.5: Variance Decomposition

Variance Decomposition of LGDP:

Period	LGDP	LPEP	LMINWAG	INF	UNEMPRTSIS
1	100.0000	0.000000	0.000000	0.000000	0.000000
5	84.00037	10.67249	0.337467	3.623008	1.366666
10	77.69035	14.69969	0.458711	6.331674	0.819578
15	80.42957	10.98631	1.868574	5.740403	0.975136
20	81.41675	7.813484	3.574585	5.280486	1.914695

Variance Decomposition of LMINWAG:

Period	LGDP	LPEP	LMINWAG	INF	UNEMPRTSIS
1	0.074135	0.009955	99.91591	0.000000	0.000000
5	5.824871	2.553385	75.15818	5.282272	11.18129
10	5.046557	1.832837	70.15266	12.73158	10.23637
15	5.504898	2.386554	67.49677	13.28702	11.32476
20	5.854473	4.655233	64.67950	13.17978	11.63101

Variance Decomposition of INF:

Period	LGDP	LPEP	LMINWAG	INF	UNEMPRTSIS
1	10.87990	0.078043	0.262208	88.77985	0.000000
5	18.14418	1.732350	1.155241	78.82278	0.145452
10	20.45541	6.002800	1.956272	71.23312	0.352399
15	19.40719	12.10089	3.177001	64.71869	0.596227
20	19.23069	13.33472	3.350965	62.87766	1.205974

Variance Decomposition of UNEMPRTSIS:

Period	LGDP	LPEP	LMINWAG	INF	UNEMPRTSIS
1	8.230958	7.080289	0.108062	1.280445	83.30025
5	11.28903	6.507133	1.913612	3.555636	76.73459
10	9.115437	11.64798	1.659461	9.872354	67.70477
15	9.041726	23.06547	2.139351	10.44976	55.30369
20	9.510138	31.59836	3.136480	10.19536	45.55966

Cholesky Ordering: LGDP LPEP LMINWAG INF UNEMPRTSIS

Source: *Author's computation using Eviews (Version 7.0)*

4.7 Granger Causality

In this study granger causality test is employed as against the use of correlation which is frequently the case in most studies; however correlation does not imply causation because in some cases the use of correlation gives spurious results (Eviews 7 Help file). "The Granger (1969) approach to the question of whether x causes y, is to see how much of the current y can be explained by past values of y and then to see whether adding lagged values of x can improve the explanation. y is said to be Granger-caused by x if x helps in the prediction of y , or equivalently if the coefficients on the lagged 's are statistically significant" (Eviews 7 User Gude I, pp428-429). In light of the above granger causality test was run on the variables LGDP, LPEP, MINWAG, INF and UNEMPRTIS and the result is presented in Table 4.6

Table 4.6: Causality Analysis

VAR Granger Causality/Block Exogeneity Wald Tests
Date: 12/03/15 Time: 22:44
Sample: 1980Q1 2012Q4
Included observations: 122

Dependent variable: LGDP

Excluded	Chi-sq	df	Prob.
LPEP	31.36707	5	0.0000
LMINWAG	2.619767	5	0.7584
UNEMPRTSIS	16.16815	5	0.0064
INF	7.636541	5	0.1774
All	64.99209	20	0.0000

Dependent variable: LPEP

Excluded	Chi-sq	Df	Prob.
LGDP	5.007211	5	0.4150
LMINWAG	1.339725	5	0.9308
UNEMPRTSIS	8.939520	5	0.1115
INF	13.35182	5	0.0203
All	30.53169	20	0.0617

Dependent variable: LMINWAG

Excluded	Chi-sq	Df	Prob.
LGDP	7.431293	5	0.1905
LPEP	1.898836	5	0.8630
UNEMPRTSIS	20.74007	5	0.0009
INF	5.062685	5	0.4083
All	47.57407	20	0.0005

Dependent variable: UNEMPRTSIS

Excluded	Chi-sq	Df	Prob.
LGDP	7.530687	5	0.1841
LPEP	9.235556	5	0.1000
LMINWAG	2.384409	5	0.7938
INF	7.315058	5	0.1982
All	29.50887	20	0.0782

Dependent variable: INF

Excluded	Chi-sq	Df	Prob.
LGDP	9.845999	5	0.0797
LPEP	8.866989	5	0.1145
LMINWAG	1.926413	5	0.8592
UNEMPRTSIS	0.530343	5	0.9910
All	19.51074	20	0.4889

Source: *Author's computation using Eviews.*

To test for Granger causality, the block exogeneity test using Wald statistics are employed to test for the joint significance of each of the other lagged endogenous variable. There is a unidirectional causation running from LPEP to LGDP as we reject the null hypothesis that LPEP does not granger cause LGDP, but we do not reject the null hypothesis that LGDP does not granger cause LPEP. Therefore it appears that Granger causality between LPEP and LGDP runs one-way. According to the test result also it was observed that LPEP does not granger caused MINWAG nor does MINWAG granger cause LPEP because we cannot reject the null in either case. In the same vain when we consider LPEP and UNEMPRTSIS we cannot reject the null of no causation either way. Thus, it can be concluded that there is no granger causality between them.

5. Summary, Conclusion and Recommendations

5.1 Summary of Findings

This paper assessed the effect of subsidy withdrawal in the downstream oil sector on the economic growth of Nigeria using quarterly time series data from 1980q1 to 2012q4. The main focus is on the dynamic relationship between an increase in oil prices as a result of subsidy withdrawal at the downstream oil sector in Nigeria and four macroeconomic variables namely; GDP, INF, UNEMPSIS and MINWAG. The main instrument of the data analyses is the Vector Auto Regression Model techniques, using; Impulse Response Function, Variance decomposition and Granger causality. Added to that, Augmented Dickey Fuller (ADF) and Philip Perron (PP) techniques were employed to check the time series characteristics of the data, while Johansen cointegration test using both Trace and Maximum Eigen value was carried out to test the long run relationship of the variables.

The ADF and PP tests indicate that INF is stationary at its level, while the remaining variables which are PEP, GDP, UNEMPRSIS and MINWAG were non stationary at their level but are stationary at first difference. Furthermore the Johansen cointegration test was carried out to test for long run relationship among the variables employing Trace Statistics and Maximum Eigen Value and the result of both the Trace and Maximum Eigen value shows that there is no cointegration among the variables.

The result of the Impulse response function shows positive impact of deregulation on GDP and INF, while the impact was negative in the short run on MINWAG and UNEMPRT it also became positive in the long run. The result of Variance decomposition indicates that change in LPEP is a significant source of variation in GDP, INF and UNEMPRTSIS but is not significant in the variation of MINWAG. The result of Granger Causality indicates unidirectional causality running from LPEP to LGDP and from INF to LPEP, while there is no indication of granger causality either way in the case of LPEP and UNEMRTSIS and LPEP and MINWAG.

5.2 Conclusion

Overall it can be concluded that there is a strong relationship between variation in domestic oil price and major macro-economic variables in Nigeria, and variation in domestic oil price is a strong source of variation in the economic growth of Nigeria. Furthermore, going by the result of granger causality test it can be concluded that the seeming positive effect of deregulation on GDP is not as a result of increased productivity but rather a result of increased government spending due to increased revenue accrued to it from subsidy withdrawal. This is evident from the quantum of money spent in programmes like SURE P.

5.3 Recommendations

It is recommended that, oil producing countries like Nigeria wishing to deregulate their downstream oil sectors should evolve ways that will reduce the negative impact of the policy on cost of production, protect jobs, control inflation and protect real wage. This will mitigate economic recession and promote economic growth.

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