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Sensitivity Between Economic Growth and Gas Consumption in Nigeria

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Abstract
This paper build on the existing research (Adamu, A. and Darma M. (2016)) to further analyse the dynamic relationship between gas consumption and economic growth in the Nigeria. This helps to discover if sudden increase in the gas consumption can positively affect economic growth immediately. After administering VAR model, impulse response function and variance decomposition economic techniques were used to analyse the sensitivity between economic growth and gas consumption in the country. The research found that change in economic growth in the country cannot be explained by gas consumption in the period of shock, but change in gas consumption in the period of shock can be explained largely by changes in its own self and then by changes in economic growth. However, the change in gas consumption responded negatively to shock in the change in economic growth and vice versa in the period of the shock, but in subsequent period, change in gas consumption responded positively to change in economic growth. We concluded that among other variables, change in gas consumption has more influence to the movements of the economic growth, which further discovered the unique relationship between the gas consumption and real economic growth in the country in the event of shocks. Gas consumption is highly and positively responsive to its own innovation, which means direct investment in the sector can result to significant improvement in the gas consumption. The development of domestic gas consumption cannot significantly come as a result of shocks or intervention in the other sectors, it has to be a deliberate actions and interventions to enhance the gas development.
Keywords: Gas Consumption, Economic Growth, Nigeria, Shock, Sensitivity

Chapter 1. Introduction and Literature

Nigeria has 37 billion barrels of proven crude oil reserve, representing 2.2% of the world proven oil reserves as at end of 2015 (British Petroleum, 2016). The country has 5.1 trillion cubic metres of proven natural gas reserves, representing 2.7% of the world proven natural gas reserves as at end of 2015n (British Petroleum, 2016). There are more investments in the Nigerian oil sector than in the gas sector, and this was due to the relative expensive nature and hazards associated to the development of the gas as well as absence of regulatory framework to guide investment decisions (Giwa, O, & Akinyemi, 2014). Despite the proposed Nigerian Gas Master plan, there seem to be no deviation from the past lacklustre investment in the gas sector as evidenced by low gas consumption and incessant gas flaring in the country (International Energy Agency, 2015). This low investment may slow down the economic growth in the country, as gas consumption can boost economic activity (Adamu & Darma, 2016), and it may have an extended linkage to important economic growth indicators like capital formation, exports and even the petroleum sector related indicators like oil price.

Adamu, A. and Darma M. (2016) discovered cointegration between gas consumption and economic growth in Nigeria, and found positive and significant long run relationship between the two variables (Adamu & Darma, 2016). However, they did not explore the sensitivity between economic growth and gas consumption in the country. This will be useful in identifying the vulnerability of the economic growth to a shock in gas consumption in the country, and vice versa. This is useful for policy making and investment priority to identify the resultant effects of investment or growth in one variable on the other, in this case gas consumption and economic growth. In addition, the effects of shock in gas consumption can be further disaggregated to other economic indicators like capital formation, exports and oil price. That is why this research aim to discover the sensitivity between economic growth and gas consumption, and their extended sensitivities to capital formation, exports and oil price in Nigeria.

Therefore, the presence and magnitude of sensitivities between these two variables are examined through the impulse response function and variance decomposition. This is to observe the pattern and extent of the reaction of these variables resulting from a shock within them. "Impulse responses trace out the response of current and future values of each of the variables to a unit increase in the current value of one of the VAR structural errors, assuming that this error returns to zero thereafter" (College, B., 2015). Variance decomposition examines the contribution of a shock in each variable to the fluctuations of other variables. It shows the responsiveness of a variable due to a shock in another variable(s) (Pesaran & Shin, 1998).

Many studies attempted to examine the relationships between aggregate and disaggregate energy consumption and economic growth like in the work of Ighodaro & Ovenseri (2008), Omoto (2008), Aliero &

Ibrahim (2012), Dantama, Abdullahi, & Inuwa (2012), Abalaba & Dada (2013), Mustapha & Fagge (2015) etc. There have been differing findings on the relationship between the aggregate (as well as disaggregate) energy consumption and economic growth, depending on the methods, data and combination of variables used as pointed out by (Ocal & Ozturk, 2013).

However, there had not been a deliberate study to examine the vulnerability of the economic growth to a shock in gas consumption in Nigeria, and vice versa. Even though Mustapha and Fagge (2012) attempted to apply impulse response and variance decomposition to examine the vulnerability of economic growth to aggregate energy consumption in Nigeria, but used Cholesky method instead of generalised method. The generalised method provides more robust result than the orthogonalized impulse response method, and allows meaningful interpretation of the corresponding variance decomposition (Pesaran & Shin, 1998). They also used aggregate energy consumption, and refused to provide clear explanation and policy implication of the impulse response and variance decomposition in their analysis, they should have followed the explanation used in the work of Kakali & Sajal (2014) in India, and Farzanegan & Markwardt (2009) in Iran and particularly Essien (2011) in Nigeria. Even though, Essien studied CO_2 emissions and economic growth relationships in Nigeria (Essien, 2011), but his analytical approach is appropriate. None of the literature have conducted impulse response and variance decomposition on the nexus between domestic gas consumption and economic growth in Nigeria in recent years.

Chapter 2. Model specification and procedure:

This study is interested in examining the reactions of economic growth represented by real Gross Domestic Product (GDP) and gas consumption (GC) to shocks in each of the specified variables incorporating the effects of other likely influential variables (real GDP, gas consumption, exports (XP), capital formation (CF) and oil price (PR)) as specified in an autoregressive model in equation 1 (Pesaran, M.H.; Shin, Y., 1999).

$$\Delta lgdp_t = a_0 + \sum_{i=1}^{p} a_{1i}\Delta lgdp_{t-i} + \sum_{i=0}^{q1} a_{2i}\Delta lgc_{t-i} + \sum_{i=0}^{q2} a_{3i}\Delta lcf_{t-i} + \sum_{i=0}^{q3} a_{4i}\Delta lxp_{t-i} + \sum_{i=0}^{q4} a_{5i}\Delta lpr + \sigma_1 lgdp_{t-1} + \sigma_2 lgc_{t-1} + \sigma_3 lcf_{t-1} + \sigma_4 lxp_{t-1} + \sigma_5 lpr_{t-1} + \varepsilon_t. \quad (1)$$

Where Δ stands as the first difference operator. Where a_0 and b_0 are the constants, other a_i, and b_i are the coefficients of the differenced variables, and σ_i and δ_i are the coefficients of the lagged variables. A cointegration test was run using the ARDL, but there is absence of cointegration in the model above, as such the long run relationship will not be analysed here. Serial correlation and stability test were run using Breusch-Godfrey (BG) autocorrelation test and CUSUM stability test respectively, and the model was found fit and stable (Baltagi, 2005) (Gujarati & Porter, 2008). All the variables were found to be stationary at first difference including intercept as judged by Augmented Dickey-Fuller method.

Therefore, we will go straight to examine the implications of possible shocks among these variables. A shock in this context would refer to a sudden change in some of these variables. For illustration purpose, a y variable is defined using a classical linear regression model where it depends on a variable x, in a sample size of $n(j = 1,2, \ldots..n)$. To identify the coefficient of the x variable lets say β, an ordinary least square can estimate that, and from any period, the observed value of the y variable could differ from what the x variable could explain βx, and this difference is called the error term (ε), in other word the innovation. In our examination, a one-time standardised shock will be enforced on the innovation at time t, that is shock of one standard deviation to the innovation. The resulting reaction of the variables under study will be traced for some future time period. In order to achieve this, we will estimate vector autoregression (VAR) model for these variables, and we will apply the impulse response analysis as a method for accounting for the corresponding innovation (Mills, 1999).

The VAR model will have both stationary ΔLGDP, ΔLGC, ΔLCF, ΔLXP and ΔLPR as endogenous variables. The conventional orthogonalized impulse responses, under which the shocks in the VAR system are orthogonalized by using the Cholesky decomposition prior to the impulse response and the variance decomposition will not be considered in this examination as its sensitive to the order of the variables. We will use the generalised impulse response method, which is not sensitive to the above restrictions, it does not need orthogonalisation of shocks and it is invariant to VAR order of the variables (Pesaran, M.H.; Shin, Y., 1998).

Now, we will have five equations from the following VAR(p) equation having each of the variable as a dependent variable as determined by its past values and past values of other variables, and since we have confirmed that these variables are integrated of order one, we will have them in first difference (Gujarati, 2012).

$$\Delta lgdp_t = a_0 + \sum_{i=1}^{p} a_{1i}\Delta lgdp_{t-i} + \sum_{i=1}^{p} a_{2i}\Delta lgc_{t-i} + \sum_{i=1}^{p} a_{3i}\Delta lcf_{t-i} + \sum_{i=1}^{p} a_{4i}\Delta lxp_{t-i} + \sum_{i=1}^{p} a_{5i}\Delta lpr + \varepsilon_t.$$

(2)

In matrix representation, the equation is compacted as:

$$g_t = a_0 + \beta(L)g_t + \varepsilon_t \tag{3}$$

Where the g_t is the 5×1 vector of the variables under examinations, a_0 is the contant term vector, ε_t is the corresponding disturbance vector (i.e. ε_{it} are the shocks to the variables) and L represents the lag operator. If we consider the following moving average representation of the multiple equations VAR (p) where the constant terms may be ignored going by Peseran and Shin (1998) and Bradley et al (2007).

$$g_t = \Psi(L)\varepsilon_t \tag{4}$$

Letting that the shocks are contemporaneously correlated, the generalised impulse response function of g_i to a unit (one standard deviation) shock in g_j is given by:

$$\Psi_{ij,h} = (\sigma_{ii})^{-\frac{1}{2}}(e'_j\Sigma_\varepsilon e_i) \tag{5}$$

Where σ_{ii} is the ith diagonal element of Σ_ε, e_i is a selection vector with the ith element equal to 1 and all other elements equal to 0 and h is the periods to be observed post shock.

The advantage of the generalised impulse response function is not changing to the order of the variable presentation in the VAR, because orthogonality is not imposed, the method permits clear understanding of the initial reaction of each of the variables to shocks up to when it stabilises. It allows meaningful interpretation of the corresponding variance decomposition. It provides more robust result than the orthogonalized impulse response method (Mills, 1999), (Gujarati, 2012).

Chapter 3. Results of the impulse response

The five equations used ΔLGDP, ΔLGC, ΔLCF, ΔLXP and ΔLPR as dependent variable respectively, including constant parameter and past values of the other independent variables up to the length of the lags that will be defined by the Schwarz's Information Criteria (SIC). The first difference of these variables are used as they are I (1) as already established. SIC being used in many literature and as recommended for the generalised impulse method by Bradley et al (2007) is used for the lag length selection (Bradley T.E. et al., 2007). The Akaike Information Criteria (AIC) will also be considered for robust check. The lag lengths are jointly selected for the variables going by Peseran (1998) and Bradley et al (2007). Similarly, Gujarati (2012) mentioned that in most cases same number of lagged terms is use in each equation in the VAR system (p.311 (Gujarati, 2012). Therefore, similar lagged terms will be applied, and this will be checked if its optimum by running the VAR residual serial correlation LM test. All the lag length selection criteria suggested one lag length, therefore, we will have a VAR (1) models. Similarly, to verify the optimum lag selection, each variable is tested for its lag selection individually, and all of the variables were found to have one lag length as jointly suggested by both AIC and SIC. The result of the optimum lag selection is presented in table 1.

TABLE 1: OPTIMUM LAG SELECTION FOR THE VAR SYSTEM

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-9.960169	NA	1.87e-06	0.997345	1.230877	1.072054
1	90.39164	160.5629*	1.26e-08*	-4.026109*	-2.624912*	-3.577854*
2	101.3561	13.88838	3.74e-08	-3.09041	-0.521548	-2.268609
3	129.8017	26.54920	4.60e-08	-3.320115	0.416412	-2.124768

The result of the VAR model is presented in table 3, and the tool to interpret the VAR result is through the impulse response and the variance decomposition, which will enable us to examine the further dynamic sensitivity among these variables. However, from the VAR estimation results, we can see that only the coefficient of the lagged D(LCF) in D(LCF) equation as well as constant parameters in D(LGDP), D(LGC) and D(LCF) equations are statistically significant, while others are not. This further explains the non-cointegration between these variables. The residual serial correlation using LM test shows that there is no serial correlation and that using one lag length is optimal. The result is shown in table 2.

TABLE 2: RESIDUAL SERIAL CORRELATION FROM THE VAR MODEL

Lags	LM-Stat	Prob
1	36.12417	0.0697
2	27.15054	0.3484
3	14.34624	0.9554
4	16.95348	0.8835
Probs from chi-square with 25 df.		

From the serial correlation test results, the calculated LM statistic at lag 1 is lower than the Chi-square critical value (37.652) at degree of freedom of 25 and at 5% level of significance. Therefore, the null hypothesis of no serial correlation will be accepted. For the impulse response function, we applied for 10 periods, which means there is going to be 9 periods after the shock. In order to determine the level of significance of each reaction, a confidence interval of +/- two standard deviations are used. The confidence bands are set that if it does not intersect zero at a particular period, then the response is statistically significant, and is assumed to be statistically different from zero at 5% level of significance. The impulse response results are show in Fig 1.

TABLE 3: VECTOR AUTOREGRESSION RESULTS

	D(LGDP)		D(LGC)		D(LCF)		D(LXP)		D(LPR)	
D(LGDP(-1))	-0.19407	[-0.49766]	0.127682	[0.69867]	-0.24057	[-0.48984]	0.288823	[0.61774]	0.236672	[0.61247]
D(LGC(-1))	-0.60009	[-1.25234]	-0.04267	[-0.19003]	-1.35571	[-2.24652]	-0.25728	[-0.44783]	-0.14576	[-0.30698]
D(LCF(-1))	0.263071	[1.17668]	0.050866	[0.48549]	0.426750**	[1.51563]	0.021303	[0.07947]	0.079722	[0.35985]
D(LXP(-1))	0.157400	[0.41109]	-0.00319	[-0.01780]	0.111398	[0.23101]	-0.38885	[-0.84705]	-0.24137	[-0.63616]
D(LPR(-1))	-0.20203	[-0.39807]	-0.1589	[-0.66808]	0.090213	[0.14114]	0.189410	[0.31128]	0.023862	[0.04745]
C	0.086093*	[1.46061]	0.049827*	[1.80385]	0.106844*	[1.43930]	0.050666	[0.71695]	0.015594	[0.26699]
R^2	0.139411		Adj. R^2	0.032707						

There are 31 observations after adjustments, t-statistics are shown in brackets. * means significance at 10% level of significance, and ** means significant at 5% level of significance.

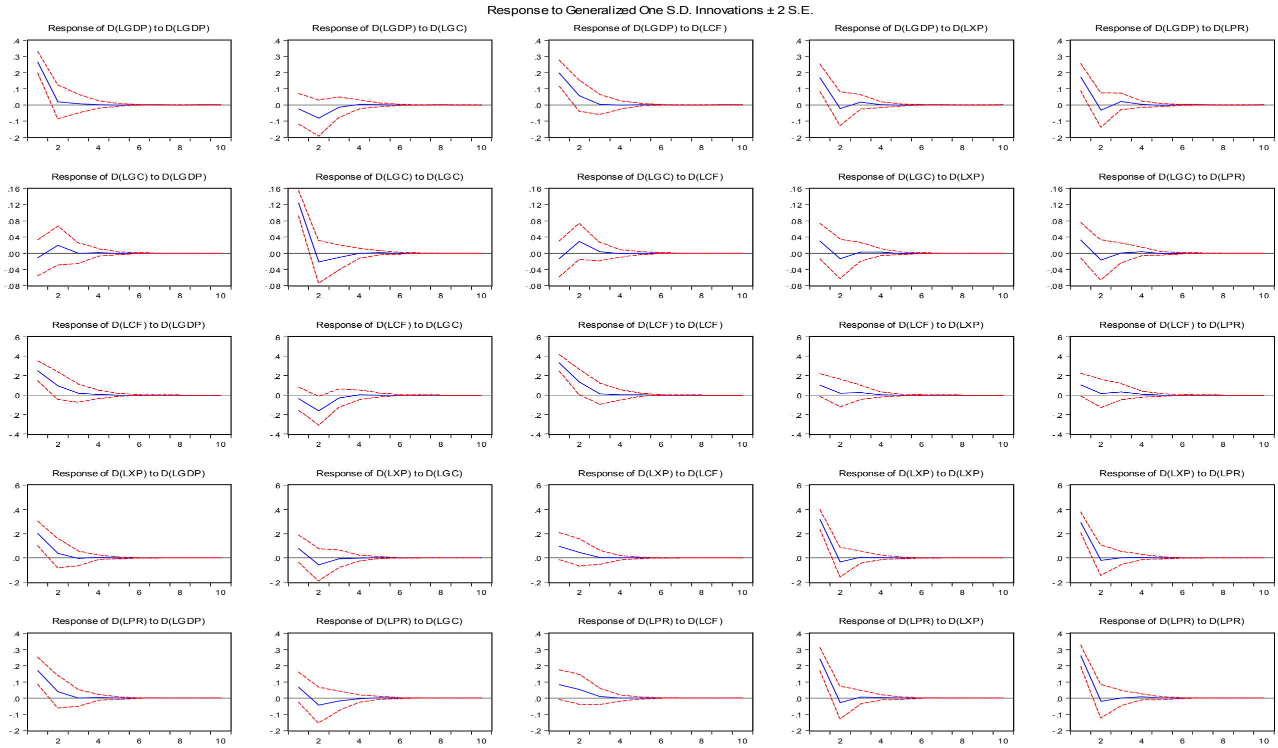

FIGURE 1: GENERALISED IMPULSE RESPONSE FUNCTIONS

Of interest to the research, the impact of shocks in ΔLGC and response of ΔLGC to other shocks will be primarily considered, that is the second column and second row respectively. Starting with the second column, ΔLGDP responded negatively in the first three periods after shock in ΔLGC with statistical significance, and eventually at period 3 aftershocks, it stabilised and returned to equilibrium. The ΔLGC responded to its own shock positively during the period of the shock with statistical significance, and then in the subsequent 3 periods it declined and returned to equilibrium. ΔLCF responded negatively to a shock in ΔLGC immediately after the shock as well as in subsequent two periods before it returned to equilibrium, even though not statistically significant. ΔLXP and ΔLPR responded the same way to a shock in ΔLGC, where they reacted positively in the period of shock with some marginal statistical significance and then negatively in the subsequent two periods with statistical significance.

In terms of the response of the ΔLGC to other shocks, ΔLGC responded positively immediately as result of shocks in its own self and shocks in ΔLXP and ΔLPR with statistical significance. However, it reacted negatively to shocks in ΔLGDP and ΔLCF also with statistical significance at the period of the shock. However, the reverse was the case in the following period, where it responded positively to shocks in ΔLGDP and ΔLCF with statistical significance. In the second period after the shock, the ΔLGC responded negatively only to its own self, and positively to other variables' shocks with statistical significance. It converged to equilibrium at the third period after the shocks.

The resulting effect of a shock in change in gas consumption lead to decrease in change in LGDP in the period of the shock and subsequent two periods, with initial and third response being statistically significant. This means that, an unexpected increase in change in LGC can cause decrease in change in LGDP at least for short period, and this could be as a result of transfer of capital or investment from some sectors and capital projects sector to the development of gas unexpectedly, which might create vacuum. Industries can consume natural gas, but the value added to the economy may not be visible at least in the short run, which means their sudden expenditure for gas consumption increase and the subsequent capital transfer lag in other investment could result to temporary adverse effect on the economy.

In addition, in the short run, gas development projects require huge amount of investment and energy own use, and may take couple of times to develop. This means putting resources or consuming energy without a yield, which is a temporary loss that explains the negative response in the change in the GDP as a result of sudden shock in the change in gas cosumption. In orther words, to achieve this sudden increase (shock) in the change in GC, more infrstructures may have to be in place which might consume some amount of energy and resources that would have been used in other sectors. Therefore, the tradeoff between other sectors and the gas development sector might cause this negative shock response in the change in GDP in the fisrst three period (Apergis & James, 2010), (Khan, M.A.; Ahmad, U., 2009), (Abdulkadir & Ozturk, 2015). In Nigeria, the economy is largely fueled by oil products, and consumption in natural gas is minimal due to low gas development infrastrures, and for the country to have a sudden change (increase) in gas consumption, it would mean redirection of some huge resources from other sectors to the gas development sectors, which might cause negative effect on the economy initially, but the eventual effects could further restore the economy back to the equilibrium and even cause significant positive impact on the real economic growth.

Similarly, the impulse response of the ΔLGC to an unexpected change in LGDP is negative in the period of the shock, and then positive in the subsequent three periods, which is not surprising as the sudden increase in real GDP may be the resulting effect of more consumption of the oil products to fuel the economy (as a dominant fuel), which might cause reduction in the gas consumption being a substitute fuel. This is in line with the consumer theory that states that, the demand for substitute commodities increases as the demand for the other substitute commodity decreases, other things being equal. But it eventually responded positively in the following three periods, as increased GDP could eventually trigger more gas consumption to meet up with the increasing demand for energy to fuel the growing economy. The increased demand for the oil products might also cause their prices to go up, and people may resort back to use of gas as an alternative option, which explains the subsequent positive increase in gas consumption as a result of shock in GDP.

Overall, all the responses happened within only three periods, all variables returned to normal on the fourth period. This means that the effect of shocks within these variables does not last long, and the response of ΔLGC to its own shock (positive) is the highest response in the system. This signifies the significant influence of direct policy and investment intervention in the gas development sector, as it has high positive response once interventions are made within the sector as shown in the result. The development of domestic gas consumption might not significantly come as a result of shocks or intervention in the other sectors, it has to be a deliberate actions and interventions to enhance the gas development. So in order to use natural gas to deliver economic advantage, the improvement should come from the gas sector initially. To understand more of other potential sectors that may contribute to the movement of gas consumption within the VAR system, a variance decomposition is applied to understand the contribution of each of the variable to the movement of other variables within a time horizon.

Chapter 4. Variance Decomposition analysis

The impulse response functions explain how long and to what extent does the dependent variable response to shocks in the independent variables, it also provides the directional response of the variables to shocks in them. Variance decomposition allows for the examination of the measureable contribution of each shock to the movements in the variables. It helps for further understanding of the interrelations of these variables in the presence of these shocks, the variance decomposition is calculated to show the extent to which shocks in these variables contribute to a volatility or variance in one another. The variance decomposition result from the estimated VAR result is presented in table 4 and discussed accordingly.

Starting with the contribution of the shock of ΔLGC to other variables' fluctuations, a shock in ΔLGC contributed to 0%, 99%, 0.21%, 9.06% and 10.15% of the volatility in ΔLGDP, ΔLGC, ΔLCF, ΔLXP and ΔLPR respectively in the period of the shock. This means that the immediate effects of the shock in ΔLGC is more responsible for its own volatility, and apart from its own contribution, it contributed more to movements in change in oil price than to any other variable. It also contributed more to movement in ΔLXP and contributed nothing to the movements of change in LGDP. This is not surprising as there is a strong link between the oil price, exports and gas consumption. Oil price influences the crude oil production and gas consumption as they are substitute commodities, and crude oil exports constitute the large proportion of the exports basket (91%) in the country. The absence of statistical significance of the contribution of the shock in ΔLGC to the movement of changes in LGDP is likely due to lack of dependence on the natural gas in the economy, as oil products dominates the energy sector, and the effect of gas consumption may not be noticeable at least immediately.

However, the shock in ΔLGC contributed within the range of 7% to 8% to the movements of the ΔLGDP in the subsequent periods, which means the connection between the ΔLGC and ΔLGDP is not immediate. This contribution is higher than that of the other variables' contribution to the movement of ΔLGDP in the subsequent period after shock. The shock in ΔLGC also contributed between 89% and 90% of its own volatility in other periods. It also contributed 16%, 11% and 11% of the movements of the ΔLCF, ΔLXP and ΔLPR respectively in other periods. This means in other periods and apart from its own fluctuations, it contributed more to the fluctuation in ΔLCF. Similarly, apart from its own shock, the fluctuations in ΔLGC was more explained by shock in ΔLXP more than any other variable which is explained by about 4%, and this is due to the influence of crude oil production being an alternative energy resource to the gas, which influences the exports in the country being the major contributor to the exports basket. Any sudden change in export, hence oil production can have effect on gas production, so exports can explain about gas consumption in the country in the event of shock. Change in GDP is the second variable that explains more about the movements of changes in gas consumption apart from its own contribution.

The shock in ΔLGDP contributed 100% of its own variance in the period of the shock, which means its fluctuation is solely explained by its own shock in the period of shock, and this is because, it takes some periods to actualise effects of shocks in other variables on the change in the GDP. However, the shock in ΔLGDP contributed 0.83%, 56%, 40% and 42% of the variance of the ΔLGC, ΔLCF, ΔLXP and ΔLPR respectively in the same period of shock. In the remaining periods, the shock in ΔLGDP contributed between 86% and 87% of its own variance. It also contributed about 3%, 46%, 38% and 40% for the fluctuations in ΔLGC, ΔLCF, ΔLXP and ΔLPR respectively. This means shocks in GDP contribute less in the movement in gas consumption, and this is due to lack of dependence on the gas resource in the country as well as low gas development infrastructures. However, apart from its own shock, the fluctuations in GDP is more explained by shock in ΔLGC which is by 8% in the subsequent periods as earlier mentioned. This means that in the events of these shocks and excluding the contribution of the ΔLGDP's own shock, the ΔLGC has contributed more to the movements of ΔLGDP more than other variables post shock. This indicates the possible bond between GC and real GDP in the country being an energy resource that facilitates other factors of production. We can now conclude that among these variables, change in gas consumption has more significance to the movements in the GDP in the subsequent periods after shock, which further discover a unique relationship between the gas consumption and economic growth in the country in the event of shocks.

Therefore, changes in GDP can be more explained by changes in gas consumption among the variables under consideration other than itself. Similarly, other than its own contribution, changes in gas consumption can be more explained by changes in exports, which had a positive and negative impulse response to changes in exports in the period of shock and a period after shock respectively. Once exports are suddenly increased in the country, it might imply increase in crude oil exports, which might be caused by increasing oil price going by the law of supply, and since the low efficient refineries in the country cannot meet up the increasing energy demand, the imported oil products prices will be high as well, and people will resort to using alternatives like the natural gas at a short term, which explains the positive response to exports increase. Even though, the impulse response of change in GDP as a result of innovation in change in GC is negative in the short-run due to the reasons earlier specified, but, change in GDP returned to equilibrium two years after the innovation in GC. This means the effect is temporary. The change in GC responded positively to innovation in GDP except in the period of the shock and then it converged to equilibrium in the subsequent three periods. It also contributed about 8% of the movement in real GDP. This means that sudden shocks in gas consumption can explain about the change in GDP more than other variables, and this suggests the close link and how much gas consumption can potentially affect the economic growth in the country, and this confirms the potential of natural gas consumption as a tool to deliver economic advantage in the country, and this is in line with the finding of Abdulkadir and Ozturk (2015). This implies that interventions in gas development sector can affect the changes in real economic growth, and justifies the need for more investment in the gas development sector.

Chapter 5. Summary:

Despite the abundance of natural resources in Nigeria, more than 50% of the country's population do not have access to electricity as reported by World Bank, and the country is facing recession from early quarters of 2016 to last quarter of the year. There have been call to invest so much on gas development to increase gas consumption in form of inputs for electricity generation and as industrial production to revitalise the economy. The country developed what it called "Nigerian Gas Master Plan" to help increase local gas consumption in the country for economic growth. Since gas development is expensive, there has to be compelling evidence to support the anticipated positive effect of such investments on the country's economy. This paper studied the sensitivity between gas consumption and real economic growth in Nigeria in a multivariate model specification. The model included real capital formation and real exports and oil price. The research administered VAR model to observe the impulse response and contribution of each of these variables to a unit shock in one another. It was found that change in real GDP was not explained by any of the variables in the period of the shock, but change in gas consumption in the period of shock was explained largely by changes in its own self and then by changes in real GDP but not explained by any change in other variables. However, the change in gas consumption responded negatively to shock in the change in real GDP and vice versa in the period of the shock, but in subsequent period change in gas consumption responded positively to change in GDP. All the responses were temporary and lasted only within three periods before returning to equilibrium. The result also shows that among these variables, change in gas consumption has more significance to the movements in the GDP in subsequent periods aftershocks. All the responses were temporary and lasted only within three periods before returning to equilibrium. We concluded that among these variables, change in gas consumption has more influence to the movements in the real GDP, which further discovered the unique relationship between the gas consumption and real economic growth in the country in the event of shocks. Gas consumption is highly and positively responsive to its own innovation, which means direct investment in the sector can result to significant improvement in the gas consumption. The development of domestic gas consumption might not significantly come as a result of shocks or intervention in the other sectors, it has to be a deliberate actions and interventions to enhance the gas development.

TABLE 4: VARIANCE DECOMPOSITION RESULTS FROM THE VAR MODEL

Variance Decomposition of D(LGDP):					
Period	D(LGDP)	D(LGC)	D(LCF)	D(LXP)	D(LPR)
1	100.0000	0.000000	0.000000	0.000000	0.000000
2	87.30399	7.930605	4.261518	0.032918	0.470966
3	86.15316	8.056485	4.251521	0.692373	0.846463
4	86.08550	8.062447	4.262715	0.701662	0.887680
5	86.07781	8.061912	4.265612	0.702714	0.891948
6	86.07711	8.062428	4.265615	0.702908	0.891941
7	86.07704	8.062422	4.265629	0.702918	0.891988
8	86.07704	8.062424	4.265629	0.702920	0.891988
9	86.07704	8.062424	4.265629	0.702920	0.891989
10	86.07704	8.062424	4.265629	0.702920	0.891989

Variance Decomposition of D(LGC):					
Period	D(LGDP)	D(LGC)	D(LCF)	D(LXP)	D(LPR)
1	0.837100	99.16290	0.000000	0.000000	0.000000
2	2.880986	90.13231	2.586462	3.046615	1.353627
3	2.836386	89.38949	2.698220	3.724535	1.351373
4	2.849626	89.19103	2.751759	3.722256	1.485326
5	2.849743	89.18672	2.751851	3.725760	1.485926
6	2.849725	89.18604	2.752169	3.725722	1.486344
7	2.849725	89.18598	2.752169	3.725763	1.486363
8	2.849725	89.18597	2.752171	3.725762	1.486367
9	2.849725	89.18597	2.752172	3.725763	1.486368
10	2.849725	89.18597	2.752172	3.725763	1.486368

Variance Decomposition of D(LCF):					
Period	D(LGDP)	D(LGC)	D(LCF)	D(LXP)	D(LPR)
1	56.10139	0.208039	43.69057	0.000000	0.000000
2	46.94970	16.06660	36.06518	0.868848	0.049672
3	46.12275	16.29528	35.27071	1.629345	0.681922
4	46.09328	16.28271	35.24661	1.629993	0.747404
5	46.08994	16.28154	35.24755	1.630994	0.749982
6	46.08950	16.28208	35.24722	1.631217	0.749974
7	46.08946	16.28207	35.24720	1.631232	0.750035
8	46.08946	16.28207	35.24720	1.631234	0.750035
9	46.08946	16.28207	35.24720	1.631234	0.750036
10	46.08946	16.28207	35.24720	1.631234	0.750036

Variance Decomposition of D(LXP):					
Period	D(LGDP)	D(LGC)	D(LCF)	D(LXP)	D(LPR)
1	40.37972	9.063384	5.514366	45.04253	0.000000
2	38.66061	10.98938	5.539876	44.50395	0.306176
3	38.43008	10.97879	5.615102	44.61106	0.364961
4	38.40905	10.96968	5.632996	44.56139	0.426881
5	38.40803	10.97074	5.633375	44.56023	0.427619
6	38.40798	10.97084	5.633406	44.56013	0.427654
7	38.40797	10.97084	5.633405	44.56013	0.427659
8	38.40797	10.97084	5.633405	44.56013	0.427660
9	38.40797	10.97084	5.633405	44.56013	0.427660
10	38.40797	10.97084	5.633405	44.56013	0.427660

Variance Decomposition of D(LPR):					
Period	D(LGDP)	D(LGC)	D(LCF)	D(LXP)	D(LPR)
1	42.18975	10.15311	5.463163	28.66808	13.52590
2	40.53977	11.40634	6.520531	29.19551	12.33785
3	40.08003	11.63556	6.656690	29.38229	12.24542
4	40.03838	11.62383	6.676285	29.33657	12.32493
5	40.03685	11.62586	6.676232	29.33654	12.32453
6	40.03669	11.62593	6.676362	29.33640	12.32462
7	40.03667	11.62595	6.676358	29.33641	12.32462
8	40.03666	11.62595	6.676359	29.33641	12.32462
9	40.03666	11.62595	6.676359	29.33641	12.32462
10	40.03666	11.62595	6.676359	29.33641	12.32462

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