Impact of Agriculture and Industrialization on GDP in Nigeria: Evidence from VAR and SVAR Models

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By

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Abstract

Agriculture and industrialization has been generally accepted as the surest and most direct route to economic development of any country like Nigeria. Their potentials, if properly harnessed, has the capacity to grow a Nation income. In this paper, we investigated the impact of agriculture and industry on GDP in Nigeria. To achieve this, we employed the log transform data on Agriculture, industry and GDP from 1960 to 2011 extracted from the CBN website. The ADF test for stationarity was carried out for GDP, agriculture and industry, the result revealed stationarity of the series at 1% level of significance. Thereafter we model the time series using VAR and SVAR models. The results from the VAR model revealed that agriculture contributed about 58% to GDP while industry contributed about 32% to GDP in Nigeria. The study further revealed from the SVAR models that agriculture and industry contributed to the structural innovations of GDP in Nigeria but more contribution resulting from agriculture. The work therefore recommended that special incentive should be given to farmer and infrastructural facilities should be provided. While new approaches should be vigorously and honestly pursued by the Nigerian government in order to restore the glory of the industrial sector in Nigeria.

Keywords: Agriculture, Industry, Gross Domestic Product (GDP), Vector Autoregression (VAR) and Structural Vector Autoregression (SVAR)

Introduction

Agriculture and industrialization has been generally accepted as the surest and most direct route to economic development of any country like Nigeria. Their potentials, if properly harnessed, has the capacity to grow a Nation income. On one hand, agriculture serves as a means to provision of food; source of raw materials; provision of employments; source of income; earning of foreign exchange; creation of market for industrial product; provision of income for industries and a source of labour for industries. In the work of Shiru, (2012) revealed how mechanized agriculture can reduced poverty in Nigeria. While, on the other hand, industrialization will lead to economic development; creation of employment opportunities, increase in productivity; reduction of prices; increase in savings; diversification of the economy; it will boost agriculture, reduction of dependence on imports; and it will lead to increase in foreign exchange (Anyaela, 1990).

In Nigeria, the agricultural sector was neglected during the oil boom. Infact, the contribution of the sector to total GDP has fallen over the decades. From 1960 to 1970, the sector contributed 55.8% to GDP but fell drastically to 28.4% in 1971 to 1980. Fortunately, successive governments in Nigeria have beginning to give priority to agriculture. And in 1981 to 1990 the agricultural sector contribution to GDP rose to 32.3%; while in 1991 to 2001 and 2001 to 2009 the sector contributed 34.2% and 40.3% to GDP respectively (Mohammed, 2012). To be precise in 2008, economic activity in Nigeria was dominated by Agriculture, which accounted for 42.1% of GDP, followed by industry (22%), wholesale and retail trade (17.3%), services (16.8%) and, Building and construction (1.8%). The share of Agriculture in Nigeria's GDP increased by 11.6% points during the last twenty five years, that is, from 30.5% in 1984 to 42.1% in 2008. While within the same period, the share of industry in Nigeria's GDP decline from 42.4% to 22% given a loss of 20.4% points (Ikoku, 2010). Recently, the Government of Nigeria has made facilities available to help farmers in providing them fertilizers, and other farm inputs through the local and State governments. All these efforts are geared towards diversification of the economy.

Industrialization is another way a country like Nigeria can diversify her economy. In Nigeria indigenization policy has been formulated and implemented to serve as a process of promoting industrialization through indigenes and indigenous means. The country have employed some strategies to encouraged industry development in Nigeria, they include import substitution strategy; export promotion strategy; small-scale verses large scale industrial development and balance growth strategy. Other strategy are introduction of high tariff on some importation of goods to discouraged importation and campaign for Nigerians to patronize made in Nigeria goods. Because of the positive impact of industrialization to GDP growth, the Nigerian government through the Ministry of Trade and Investment is partnering with other nations of the world in setting up industries in Nigeria. Also the government is addressing security issues to promote peace and political stability; all these efforts are geared towards industrialization the Nigerian economy.

Therefore, to achieve vision 2020 in Nigeria, there is urgent need to diversify the Nigerian economy by reactivating the agricultural sector; the industrial sector and every other sectors of the economy (Chinude, Titus and Thaddeus, 2010).

Brief Literature on the impact of agriculture and industrialization on GDP in Nigeria

Abimiku, (n.d) in his review work found that the various agricultural measures during SAP have worsened the sector's contribution to total GDP in Nigeria. Abimiku recommended that new approaches should be vigorously and honestly pursued by the Nigerian government in other to restore the sectors' glory and move the nation forward economically. A related work was also studied by Kwanashie, Ajilima and Garba, (1998). Another review work was carried out by Liverpool-Tasie, Kuku and Ajibola, (2011) revealed that agriculture remains a crucial sector in the Nigerian economy, being a major source of raw materials, food and foreign exchange; employing over 70 percent of the Nigerian labour force, and serving as a potential vehicle for diversifying the Nigerian economy. Their work further revealed the interrelationship among agricultural productivity, food security and social capital.

On empirical evidences, Lawal, (2011) studied government spending in agricultural sector and its contribution to GDP in Nigeria using trend analysis and simple regression model. They found out that agricultural sector has not contributed to the national economy. In Olajide, Akinalabi and Tijani, (2012) their result contradicted the result of Lawal, (2011). They used OLS regression model to analyze the relationship between GDP and agricultural output in Nigeria. They found out that there is positive and significant effect of agricultural sector on GDP in Nigeria. They also found that agricultural sector contributed 34.4% variation in GDP between 1970 and 2010 in Nigeria.

Anthony, (2010) examine the impact of agricultural credit on economic growth in Nigeria. In his work, he specified a functional and operational form, therefore establishing a causal relationship between GDP and agricultural variables. Three stage least squares (3SLS) estimation technique was carried out and the result revealed that agricultural variables have impact on economic growth and their contributions to export have been encouraging. Another work was carried by Iganiga and Unemhilin, (2011) on the impact of Federal Government agricultural expenditure on agricultural output in Nigeria. They employed the Cobb Douglas growth model and, cointegration and error correction model to provide empirical evidence. Their work revealed that Federal government capital expenditure was found to be positively related to agricultural output. They suggested that importation of food should be banned as that will encouraged local producers and all round production of food through irrigation facilities should be given a priority. While work like Apata, (2010) presented an empirical analysis of the effect of global warming on Nigerian agriculture and estimated the determinant of adaptation to climate change. His work showed that climate change would have an overall positive impact on Nigeria's agriculture and recommended that government should design strategies that could help the farmers and rural communities.

Industrialization is said to be a hallmark for modern economic growth and development but Nigerian industrial sector has suffered from decades of low productivity and currently in state of coma (Tamuno and Edoumiekumo, 2012).

Ajayi, (2007) gave a detailed review on the recent trends and patterns in Nigeria's industrial development. The work revealed that industrial development in Nigeria involved considerable artisanal crafts firm in the early stages and grew progressively in number over the year to large-scale manufacturing. The work concluded that the spatial pattern could change if industrialists adopt the strategy of industrial linkages, and especially production subcontracting which has become a driving force in contemporary industrial development efforts in the world today. The work recommended that privatization of industries in Nigeria would better enhanced the situations of industrialization in the country. In another review work, Ku, Mustapha and Goh, (2010) identified problems and limitations that impede the growth of manufacturing sector in Nigeria. The problems are dependency on oil for income, weak infrastructure, shortage of skilled labour, lack of proper management and planning, and so on. They concluded that these problems must be resolved in order to rejuvenate Nigerian manufacturing establishments so that the manufacturing sector can play an important role in the country's economic development.

Among empirical work, Tamuno and Edoumiekumo, (2012) focused on the impact of globalization on the Nigerian industrial sector. They carried out cointegration analysis, and they concluded that the Nigerian industrial sector has a weak base and cannot compete favourable with foreign counterparts. They recommended that Nigeria should encourage the production of non-primary export commodities and formulate policies that would attract foreign direct investment. In Ubi, Effiom and Eyo (2012) they empirically assessed the impact of monetary policy on industrialization in Nigeria as an open economy. They considered time series variables such as industrial output, exchange rate, interest rate, money supply, balance of trade, and total reserves. They employed VECM, their results revealed that these variables have statistically significant on industrialization in Nigeria. Also, in another study, Awe, (2013) studied the impact of Foreign Direct Investment (FDI) on economic growth in Nigeria between 1976 and 2006 using two-stage least squares (2SLS) method of simultaneous equation model. The study revealed a negative relationship between GDP and FDI which was a result of insufficient FDI flow into Nigerian economy. The work finally recommended that Nigeria should encourage domestic investment to accelerate growth, and limit the multinationals repatriation of profits from Nigeria.

Akpan, Riman, Duke II and Mboto, (2012) identified the role industrial sector plays in driving the GDP in Nigeria. They used VECM to establish the cointegration relationship between industrial production, non-oil exports and GDP. Their work revealed the existence of a positive and significant uni-directional relationship that runs from industrial production to non-oil exports. They also showed that the current policies on industrial production in Nigeria do not sufficiently encourage non-oil export. They recommended that remedial measures should be taken to strengthen the ailing industries and that the Agricultural credit Guarantee Scheme in Nigeria should be strengthen as well.

Ikoku, (2010) examined whether or not stock prices contained information which could be used to improve predictions of economic activity in Nigeria. In forecasting GDP, they applied AR(1), ARIMA, Structural ARIMA and VECM models. Granger causality tests revealed that all share index is leading indicator of real GDP and but had no relationship with the Index of industrial production (IIP). In addition, no causality was found between GDP and Index of industrial production. They concluded that a high rate of economic growth will lead to an increase in firm's earnings and higher earnings would boost share prices. In addition, there was evidence that the stock market in Nigeria is not only a leading indicator of the real economy, but that Nigerian stock prices are at least partly, based on economic fundamentals.

Closely related to this literature review, is the work of Atoyebi, Adekunjo, Edun and Kadiri, (2012) who studied the relationship between foreign trade and economic growth in Nigeria. Their work revealed that export, foreign direct investment and exchange rate are positively related to real GDP while variables such as import, inflation rates, and openness exert negative influence on the real GDP. They recommended that government should design appropriate strategy by diversifying the economy through export promotion, stimulating foreign direct investment and exchange rate stability in order to boost productivity of Nigeria economy. In this line also, Babajide, (2012) investigated the effects of microfinance on micro and small business growth in Nigeria. In the survey work, there was strong evidence that access to microfinance does not enhance growth of micro and small enterprises in Nigeria. The work concluded that recapitalization of the microfinance banks to enhance their capacity to support small business growth and expansion, and in the long-run lead to creations of industries in Nigeria. Lastly, Udah, (2010) investigated the causal and long-run relationship between electricity supply, industrialization and economic development in Nigeria from 1970 to 2008. The results of the long-run and error correction model showed that industrial development, electricity supply, technology and capital employed are important determinants of economic development in Nigeria.

The brief literature reviews have revealed the place of agriculture and industrialization to the growth of the economy, and from the empirical evidences much work has not been done under the VAR framework. This study therefore attempts to study the impact of agriculture and industrialization on the Nigerian GDP with the application of Vector Autoregressive (VAR) and Structural VAR models.

Model Specification

Vector Autoregressive models

We consider a VAR(p) model as

$$y_t = \mathrm{C} + \mathrm{A}_1 y_{t-1} + A_2 y_{t-2} + \ldots + \mathrm{A}_\mathrm{p} y_{t-p} + \ell_t \qquad \mathrm{t} = 0, \pm 1, \pm 2 \ldots$$

where $y_t = [y_{it}, \ldots \mathrm{y}_{\mathrm{Kt}}]'$ is a (kx1) random vector, the A_i are fixed (kxk) coefficient matrices, C is a k x 1 vector of constants (intercept) allowing for the possibility of non zero mean $\mathrm{E}(\mathrm{y}_\mathrm{t})$. Finally, $u_t = [u_{1t} . . . \mathrm{u}_{\mathrm{Kt}}]'$ is a k-dimensional white noise or innovation process, that is $E(\ell_t) = 0$, $E(\ell_t \ell_t') = \Sigma_u$ and $E(\ell_t \ell_s') = 0$ $\mathrm{s} \neq \mathrm{t}$. The Covariance matrix Σ_u is assumed to be non-singular (Lütkepohl, 2005).

We say that y_t is stable VAR(p) process if $\det(I_K - A_1 z - \ldots - A_p z^p) \neq 0 \text{ for } |z| \leq 1$

Hence this condition provides an easy tool for checking the stability of a VAR process. Since the explanatory variables are the same in each equation, the Multivariate Least Squares is equivalent to the Ordinary Least Squares (OLS) estimator applied to each equation separately, as was shown by Zellner, (1962). Detailed on VAR models are treated in Adenomon, Ojehomon, and Oyejola, (2013).

Structural vector autoregressive models

In econometric technology, VARs are reduced form models and structural restrictions are required to identify the relevant innovations and impulse responses. The general modeling strategy for SVARs is to specify and estimate a reduced form model first and then focus on the structural parameters and the resulting structural responses. In structural modeling and impulse response analysis, the stochastic part of a data generating process is of great important.

The advantages of the SVAR model is that it can be used to identify shocks and trace them out by employing Impulse Response Analysis (IRA) and Forecast Error Variance Decompositions (FEVDs) through imposition of restrictions on the matrices A and B. Actually the SVAR model is a structural model, it only departs from the reduced form VAR(p) because restrictions for A and B can be added.

The following models; A-model, B-model and AB-model are different ways to use nonsample information to specifying unique innovations and hence unique impulse responses.

In summary, we identify the three types of SVAR models (Pfaff, 2008)

A model: B is set to I_K where minimum number of restrictions for identification is K(K-1)/2.

B model: A is set to I_K where minimum number of restrictions for identification is K(K-1)/2.

AB model: restrictions can be placed on both matrices, where minimum number of restrictions for identification is K^2+K(K-1)/2. In most applied work the AB models are considered. Therefore in this work, the AB model will be our focused.

The AB-Model

It is possible to consider both types of restriction in model A and B simultaneously given by $Au_t = B\varepsilon_t$, $\varepsilon_t \sim (0, I_K)$ as a result a simultaneous equations system are formulated for the errors of the reduced form model rather than the observable variables directly. In this model, we obtain $u_t = A^{-1}B\varepsilon_t$ and, hence $\Sigma_u = A^{-1}BB'A^{-1'}$ thus we have K(K+1)/2 equations $Vech(\Sigma_u) = Vech(A^{-1}BB'A^{-1'})$ where as the two matrices A and B have K^2 elements each. This general model is useful framework for SVAR analysis. The restriction are typically normalization or zero restrictions which can be written in the form of linear equations $Vec(A) = R_A\gamma_A + r_A$ and $\text{Vec}(B) = R_B\gamma_B + r_B$ where R_A and R_B are suitable fixed matrices of zeros and ones, γ_A and γ_B are vectors of free parameters and, r_A and r_B are fixed vector of fixed parameters which allow, for example, to normalize the diagonal elements of B. the rank condition for local identification of the AB model is equal to $2K^2$.

The AB-model model offers a useful general framework for placing identifying restrictions for the structural innovations and impulse responses on a VAR process. Before we can actually use this framework in practice, it will be important to estimate the reduced form and structural parameters. Applications of these models discussed can be found in Giuliodri, (2004) and Kumah & Matovu, (2007). In Blanchard & Qual, (1989) discussed another type of restriction called the long-run restriction. In their work they focused on the total impact matrix $\Xi_\infty = \sum_{i=0}^{\infty} \Theta_i = (I_K - A_1 - \ldots - A_p)^{-1} A^{-1} B.$ In Faust and Leeper, (1997) demonstrated that structural inference under long-run identification scheme will be reliable only if the underlying structure being approximated by the VAR satisfies strong dynamic restrictions.

Estimating SVAR Models

Estimation of SVAR models, Maximum Likelihood method is normally used.

Suppose we wish to estimate the following SVAR model

$$Ay_t = AAY_{t-1} + B\varepsilon_t \tag{4.1}$$

Where $Y'_{t-1} = [y'_{t-1}, \ldots y'_{t-p}], A = [A_1, \ldots A_p]$ and ε_t is assumed to be Gaussian with covariance matrix I_K, $\varepsilon_t \sim N(0, I_K)$. The normality assumption is made to derive the estimators. The reduced form residuals corresponding (4.1) have the form $u_t = A^{-1}B\varepsilon_t$.

Then the log-likelihood function for a sample $y_1, \ldots y_T$ is given by

$$\ln l(A, A, B) = \frac{-KT}{2}\ln 2\pi - \frac{T}{2}\ln\left|A^{-1}BB'A'^{-1}\right| - \frac{1}{2}tr\{(Y - AX)'[A^{-1}BB'A'^{-1}]^{-1}(Y - AX)\}$$

$$= Cons\tan t + \frac{T}{2}\ln|A|^2 - \frac{T}{2}\ln|B|^2 - \frac{1}{2}tr\{A'B'^{-1}B^{-1}A(Y - AX)(Y - AX)'\}$$

where, as usual, $\mathrm{Y} = [\mathrm{y}_1, \ldots \mathrm{y}_\mathrm{T}]$, $\mathrm{X} = [\mathrm{y}_0, \ldots \mathrm{y}_{\mathrm{T-1}}]$ and the matrix rules

$$\left|\mathrm{A}^{-1}BB'(A^{-1})'\right| = \left|A^{-1}\right|^2 |B|^2 = |A|^{-2}|B|^2 \text{ and } \mathrm{tr(VW) = tr(WV)}$$

if there are no restriction on the reduced form parameters A. Then for any given A and B, the log-likelihood function ln l(A,A,B) is maximized with respect to A by $\bar{A} = YX'(XX')^{-1}$. Thus replacing A with $\bar{A}$ in (4.1) gives the concentrated log-likelihood

$$\ln l_c(A,B) = constant + \frac{T}{2}\ln|A|^2 - \frac{T}{2}\ln|B|^2 - \frac{T}{2}tr(A'B'^{-1}B^{-1}A\tilde{\Sigma}_u)$$

where $\tilde{\Sigma} = T^{-1}(Y - \bar{A}X)(Y - \bar{A}X)'$.

Maximization of this function with respect to A and B, subset to the structural restrictions has to be done by numerical methods because a close form solutions is usually not available (Lutkepohl, 2005). That is an iterative optimization algorithm is always used to compute the ML estimates.

Impulse Response Analysis and Forecast Error Variance Decomposition for SVAR model

Impulse response analysis can now be based on structural innovations. The impose coefficients are obtain from the matrices $\Theta_j = \Phi_j A^{-1}B,\ j = 0,1,2,\ldots$ where $\Phi_i = \sum_{j=1}^{i}\Phi_{i-j}A_j\ \ i = 1,2,\ldots$ starting with $\Phi_0 = I_K$ and setting $A_j=0$ for j>p. furthermore, the $\Theta_i's$ are obtained from A_1, . . . A_p and Σ_u as $\Theta_i = \Phi_i P$ where P is the lower triangular choleski decomposition of Σ_u such that $\Sigma_u = PP'$. In practice, bootstrap methods are routinely employed for inference for this purpose.

Data

The data used for this work is a secondary data extracted from the CBN Website. Annual data was collected for Agriculture, Industry and GDP for Nigeria from 1960 to 2011. In order to minimize the scale effect, maximize the chances of normality and to enhance interpretation of estimated coefficients, all series have been transformed into natural logarithms (Ansari, & Ahmed, 2007).

Empirical Analysis

The empirical analysis was carried out using STATA 8 and JMULTI version 4.24 (2009) software. Table 1 shows the descriptive statistics for GDP, Agriculture and Industry for Nigeria. The average of 120.255, 110.162 and 107.088 all in millions naira for GDP, Agriculture and Industry respectively for the period of 1960 to 2011.

Table 2 shows the Jarque-Bera test for normality. The test revealed that the endogenous variables follow a normal distribution.

And Fig. 1 shows the time series plot for the variables under consideration revealed some level positive growth in GDP, Agriculture and Industry for the period under review.

Table 1: Descriptive Statistics

Variable	mean	min	max	std. dev.
lnGDp	1.20255e+01	7.71110e+00	1.74410e+01	3.17317e+00
lnAgric	1.10162e+01	7.25496e+00	1.62657e+01	3.05689e+00
lnIndus	1.07088e+01	4.89784e+00	1.66044e+01	3.62694e+00

Table 2: Jarque-Bera test for normality.

variable	teststat	p-Value(Chi^2)	skewness	kurtosis
lnGDp	4.1226	0.1273	0.2268	1.6973
lnAgric	4.8963	0.0865	0.3368	1.6561
lnIndus	3.3938	0.1833	0.0178	1.7490

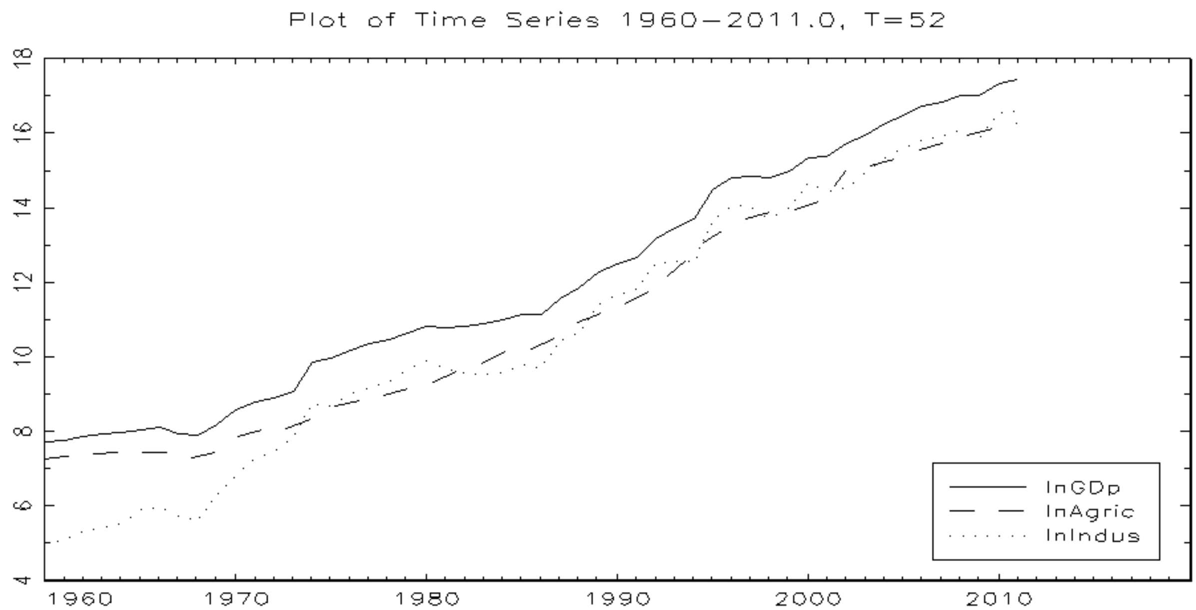

Fig. 1: Time series plot for GDP, Agriculture and industry for Nigeria from 1960 to 2011

Table 3: Stationary test on GDP, Agriculture and Industry time series

Variable	ADF Statistic
lnGDp	3.4622
lnAgric	3.7309
lnIndus	3.5081

Critical Values: 1%=-2.56; 5%=-1.94; 10%=-1.62

The Augmented Dickey Fuller (ADF) unit root tests which has the null hypothesis of unit root. The results of the ADF test indicated rejection of this null hypothesis at 1%, 5% and 10% GDP, Agriculture and industry.

We implemented the optimal endogenous lags search from information criteria from lag 1 up to 10 lags of levels, Akaike information criterion (AIC) favoured lag 10 as optimum while Hannan-Quinn information criterion (HQIC), Schwarz bayesian information criterion (SBIC) and final prediction error (FPE) favoured lag 1. Result is presented in table 4. Therefore we choose a VAR model of lag 10 because at lag 1 none of the coefficient were significant. Also at lag 10 the VAR stability condition was fulfilled and the errors were normally distributed. Details are presented at the appendix.

Table 5 shows the result for Granger causality test. The tests revealed a bi-directional causality exist among GDP, Agriculture and industry. This means that there is an interrelationship among the variables. Also, it shows that Agriculture and industry will enhance the forecast of GDP in Nigeria.

Table 4: Optimal lag Selection criteria

lag	LL	LR	df	p	FPE	AIC	HQIC	SBIC
0	-70.054	.	.	.	.0065073	3.47878	3.52427	3.6029
1	81.942	303.992	9	0.000	7.19e-06*	-3.33056	-3.14858*	-2.83408*
2	85.308	6.732	9	0.665	9.48e-06	-3.06227	-2.74381	-2.19343
3	91.440	12.264	9	0.199	.0000111	-2.9257	-2.47075	-1.68451
4	94.971	7.063	9	0.631	.0000149	-2.6653	-2.07387	-1.05175
5	103.067	16.192	9	0.063	.0000165	-2.62225	-1.89433	-.636341
6	112.845	19.556	9	0.021	.0000174	-2.65931	-1.79491	-.301042
7	124.563	23.435	9	0.005	.0000175	-2.78872	-1.78784	-.058096
8	140.348	31.571	9	0.000	.0000154	-3.11183	-1.97446	-.008848
9	152.777	24.857	9	0.003	.0000174	-3.27509	-2.00124	.200251
10	166.896	28.238*	9	0.001	.0000207	-3.51884*	-2.10851	.328854

*(minimum)

Table 5: test for Granger causality

Null hypothesis	Test statistic	df	p-value	Remark
GDP do not Granger cause Agric and Industry	143.5427	20	0.0000	Rejected
Agric do not Granger cause GDP and Industry	67.2365	20	0.0000	Rejected
Industry do not Granger cause GDP and Agric	152.7130	20	0.0000	Rejected

The VAR stability condition was carried out. The result shows that time series are stable because all the eigenvalues are less than 1, the results are presented in table 6. Furthermore, the CUSUM test was also employed to test the stability of the VAR models, the test revealed stability because they are all within bounds. Fig 2 shows the CUSUM test for GDP, Agriculture and industry.

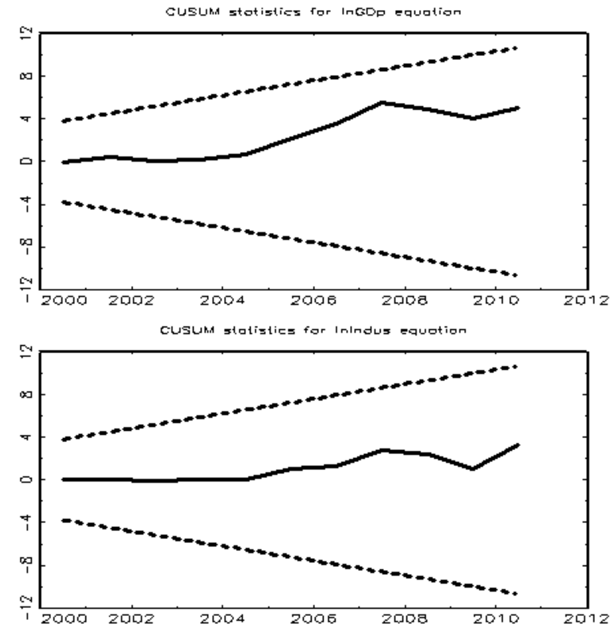

Fig. 2: CUSUM test on stability for GDP, Agric and Industry equations

Table 6: VAR eigenvalue stability condition

Eigenvalue	Modulus	Eigenvalue	Modulus
-.937071 + .12584071	.94548295	.2359224 - .9306841	.96012096
-.937071 - .12584071	.94548295	.9060005 + .34185675	.96835065
-.8951741 + .35061477	.96138829	.9060005 - .34185675	.96835065
-.8951741 - .35061477	.96138829	.9898743 + .05734345	.99153385
-.7554693 + .63254056	.98531282	.9898743 - .05734345	.99153385
-.7554693 - .63254056	.98531282	.8419286	.84192856
-.4871315 + .71273425	.86330017	.7595045 + .58916527	.96122984
-.4871315 - .71273425	.86330017	.7595045 - .58916527	.96122984
-.1845343 + .96367422	.98118343	.6658508 + .68995637	.95885197
-.1845343 - .96367422	.98118343	.6658508 - .68995637	.95885197
-.3502966 + .65616213	.74381212	.3338283 + .79320843	.86059338
-.3502966 - .65616213	.74381212	.3338283 - .79320843	.86059338
-.07956311 + .89515149	.89868041	.435307 + .60052434	.74170184
-.07956311 - .89515149	.89868041	.435307 - .60052434	.74170184
.2359224 + .9306841	.96012096	-.2283519	.22835194

Remark: All the eigenvalues lie inside the unit circle VAR satisfies stability condition.

Fig. 3 and fig. 4 shows the responses of GDP to shocks in Agriculture and industry. From the figures, GDP in Nigeria responded to shocks in agriculture and industry. Further results will be revealed by Forecast error variance decompositions.

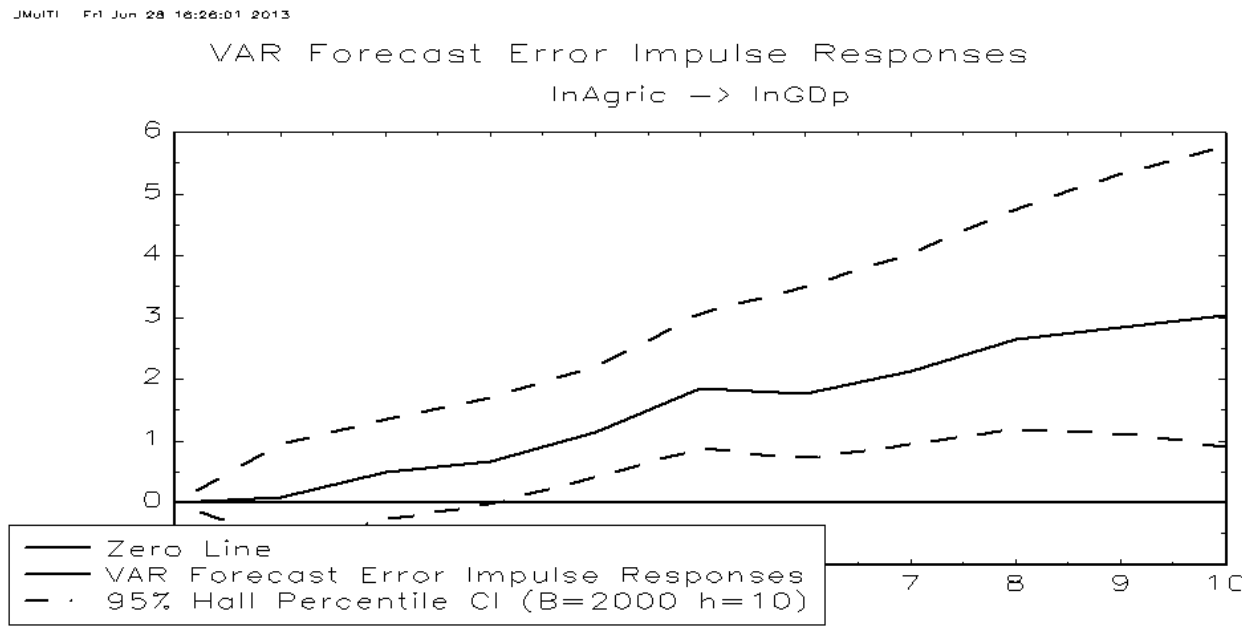

Fig. 3: Impulse response from Agric to GDP

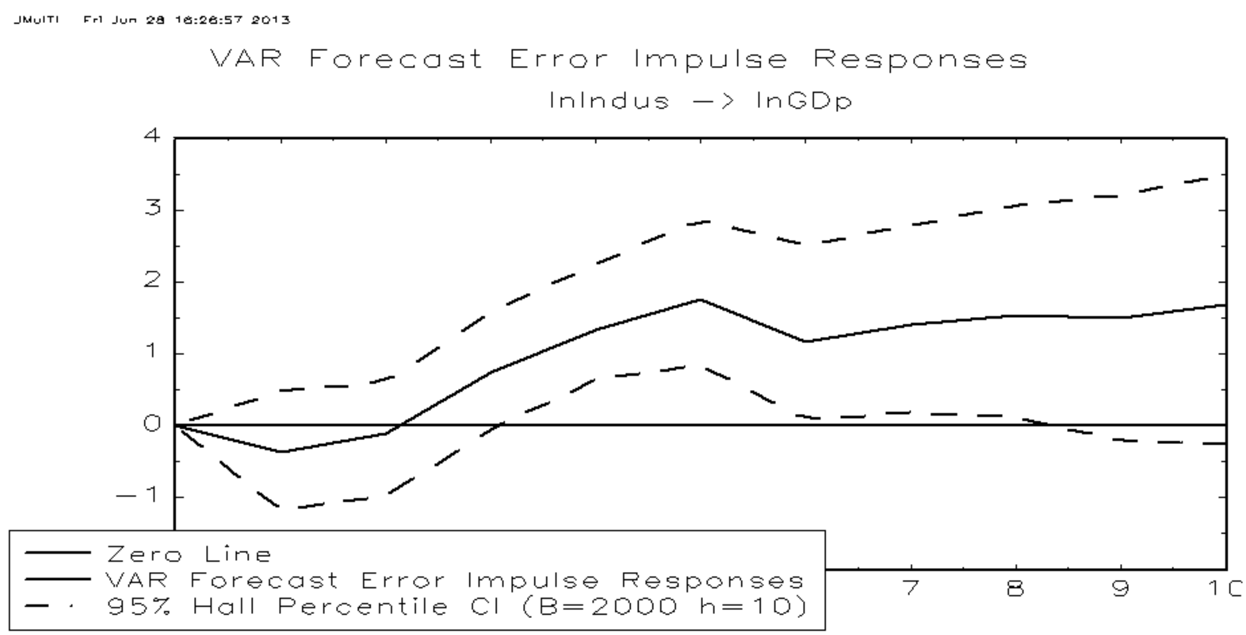

Fig.4: Impulse response from industry to GDP

Table 7: VAR FORECAST ERROR VARIANCE DECOMPOSITION

Proportions of forecast error in "lnGDp" accounted for by:			
forecast horizon	lnGDp	lnAgric	lnIndus
1	1.00	0.00	0.00
2	0.92	0.04	0.04
3	0.78	0.19	0.03

4	0.67	0.19	0.14
5	0.47	0.18	0.35
6	0.29	0.24	0.47
7	0.22	0.35	0.43
8	0.16	0.43	0.41
9	0.12	0.52	0.36
10	0.10	0.58	0.32

Table 7 revealed the VAR forecast error variance decompositions for GDP. We will only consider the GDP equation since our focus in this work is on GDP. In the long at forecast horizon 10, we see that the proportion of forecast error in GDP accounted for by Agriculture is 58% while proportion accounted for by industry is 32%. This suggests that the place of agricultural and industrial sector to the Nigerian economy cannot be overemphasized.

Residual Analysis

Since this work is extended to Structural VAR (SVAR) it is necessary to carried out residual analysis so as to avoid misleading results and interpretation. The following test were carried out: Jarque-Bera test; Univeriate and multivariate ARCH-LM tests; plots of Autocorrelation and Partial Autocorrelation and Kernel density Estimation (Gaussian Kernel).

Table 8: Jarque-Bera test for normality in the Residual

variable	teststat	p-Value(Chi^2)	skewness	kurtosis
u1(GDP)	0.0498	0.9754	0.0768	3.0700
u2(Agric)	0.0356	0.9823	-0.0431	2.8862
u3(Indus)	0.0102	0.9949	0.0343	2.9665

Table 9: ARCH-LM TEST with 16 lags for no-ARCH null hypothesis

variable	teststat	p-Value(Chi^2)	F stat	p-Value(F)
u1(GDP)	16.0813	0.4473	2.6346	0.0718
u2(Agric)	18.4784	0.2966	3.9922	0.0203
u3(Indus)	14.0716	0.5934	1.9170	0.1618

Table 10: MULTIVARIATE ARCH-LM TEST with 5 lags for no-ARCH null hypothesis

VARCHLM test statistic:	186.5097
p-value(chi^2):	0.3542
degrees of freedom:	180.0000

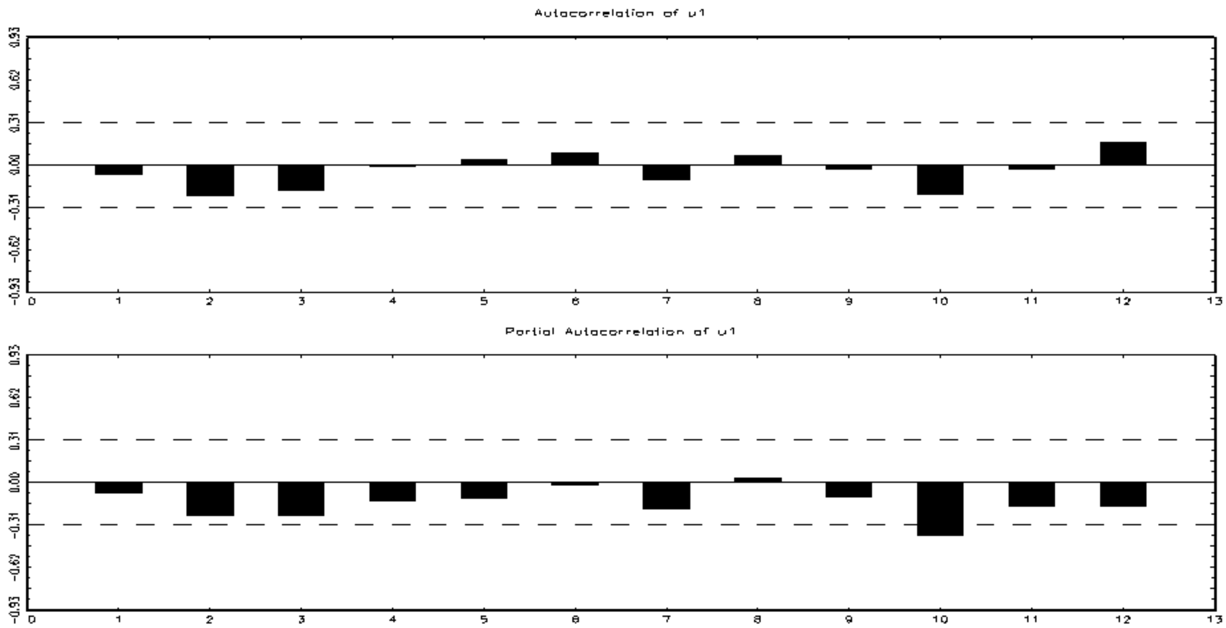

Fig 5: Autocorrelation and Partial Autocorrelation residuals of u1(GDP)

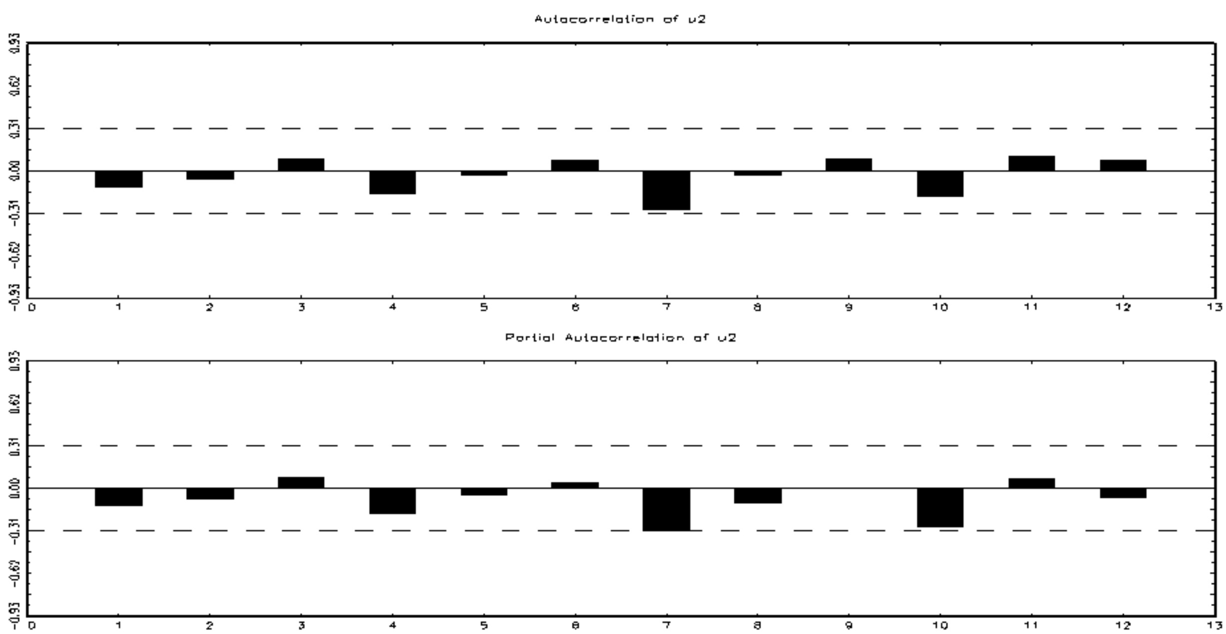

Fig 6: Autocorrelation and Partial Autocorrelation residuals of u2(Agric)

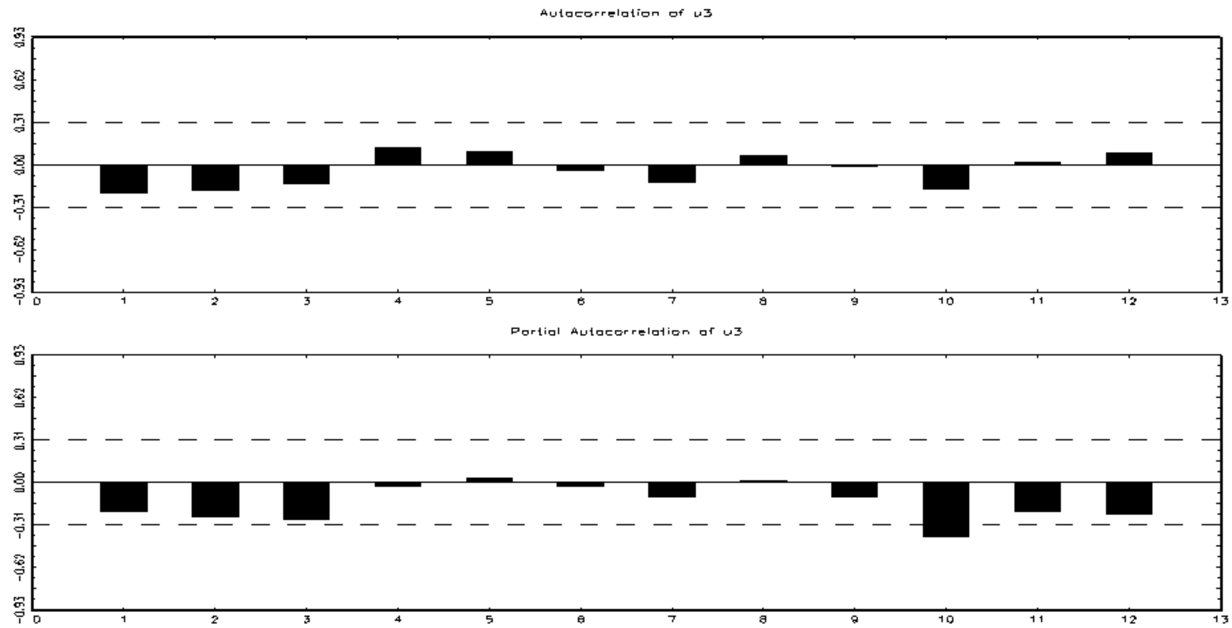

Fig.7: Autocorrelation and Partial Autocorrelation residuals of u3(Indus)

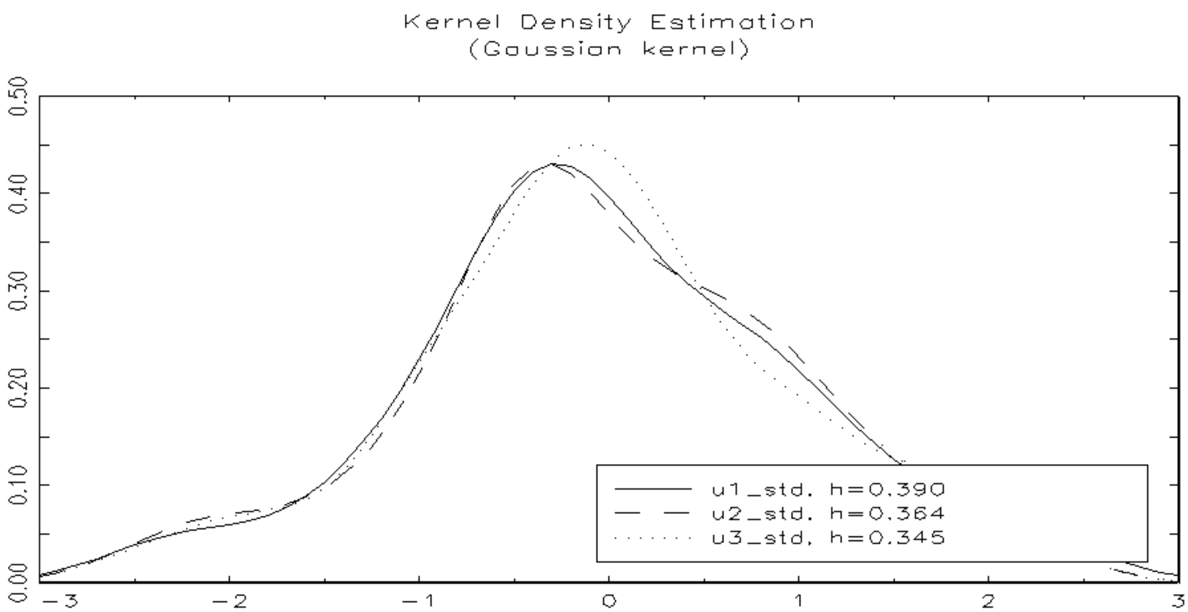

Fig. 8 : Plot of Kernel Density Estimation for the residuals

Table 8 show the Jarque-Bera test for normality for the residual, test revealed that the residuals are normally distributed (p-values>0.05). Tables 9 and 10 shows the test for univariate and multivariate ARCH-LM , the result reveal that no ARCH cannot be rejected. This shows that the residuals are homoscedastic. These results are further explained in figures 5, 6 and 7 of the Autocorrelation and Partial Autocorrelation residual plot. Lastly, the plot of Kernel Density

Estimation for the residuals follows a normal curve. These test and figures revealed that the variables under study are stable in nature.

Structural VAR (SVAR) Estimation

The reduced VAR model we estimated revealed a white noise residuals, this then prompted us to study the structural innovations from the SVAR models. We considered three SVAR models: (i). The SVAR Blanchard-Quah model (which is refers to long run restrictions), (ii) SVAR AB-model I (here in the A matrix, Agric and Industry variables are unrestricted on the GDP structural equation), (iii). SVAR AB-Model II (here, in the matrix A, the Agric and industry variables are placed with zero restrictions). Our choice of these models is to help us study the contributions of these variables on the structural innovations of the GDP in Nigeria.

The SVAR Blanchard-Quah Model

We estimated the SVAR parameters using the Blanchard-Quah model. The matrix of long run restrictions is given below

	Equations		
Variable	GDP	Agric	Industry
GDP	*	0	0
Agric	*	*	0
Industry	*	*	*

The bootstrapped t-statistics based on 2000 bootstrapped replication are given in table 16 in the appendix. Shows that the t-ratios are quite small, but that does mean that the nonzero long run effects of agriculture and industry on GDP in Nigeria is not significant, but more facts will be revealed by the SVAR impulse responses and the forecast error variance decompositions (Lutkepohl, 2005). The SVAR impulse responses revealed that GDP responded to shocks in Agriculture and industry respectively. The impulse responses are presented in figures 9 and 10. The SVAR FEVD is presented in table 11 shows that Agric contributed 5% to the structural innovation of GDP and industry contributed about 8% to GDP structural innovation.

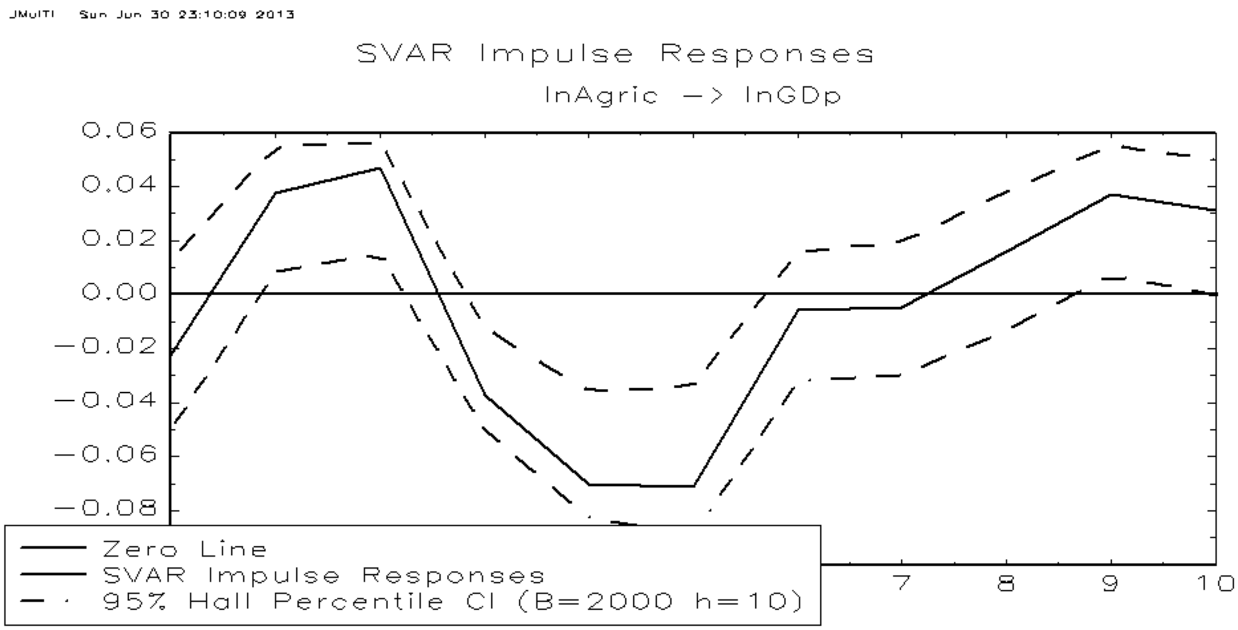

Fig. 9: SVAR impulse response from Agric to GDP (Blanchard-Quah Model)

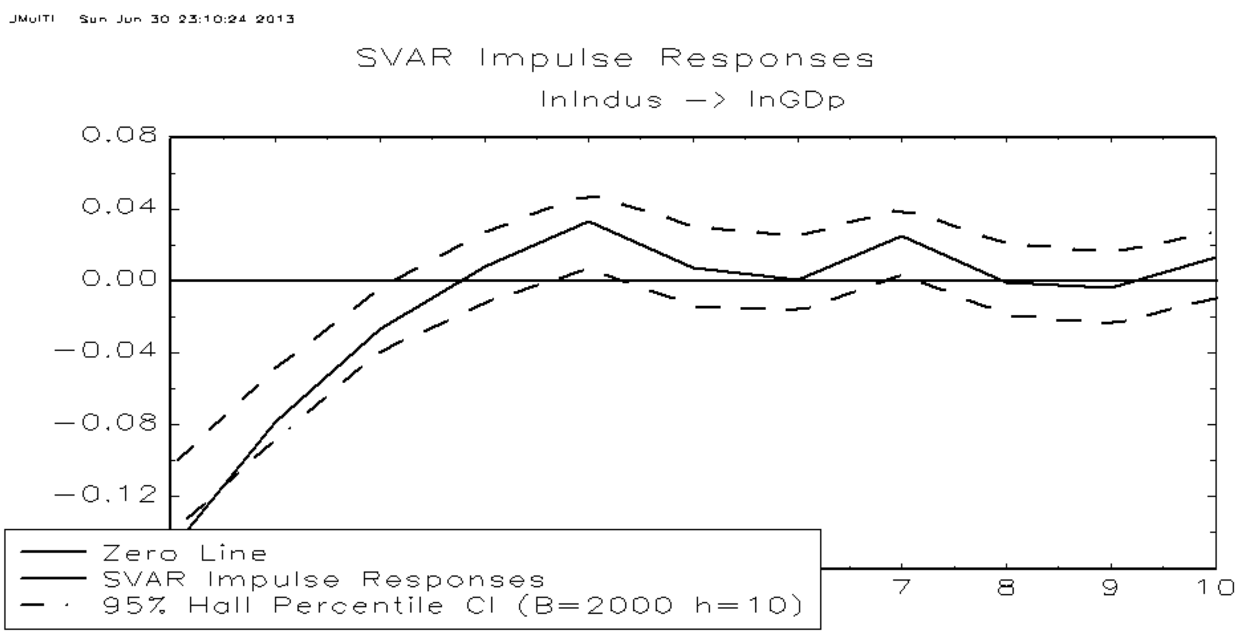

Fig. 10: SVAR impulse response from Industry to GDP (Blanchard-Quah Model)

Table 11:SVAR FORECAST ERROR VARIANCE DECOMPOSITION (Blanchard-Quah Model)

Proportions of forecast error in "lnGDp" accounted for by:			
forecast horizon	lnGDp	lnAgric	lnIndus
1	0.03	0.02	0.95
2	0.04	0.06	0.90
3	0.13	0.11	0.76
4	0.22	0.12	0.65
5	0.36	0.16	0.48
6	0.57	0.15	0.28
7	0.68	0.11	0.21
8	0.76	0.08	0.16
9	0.83	0.06	0.11
10	0.87	0.05	0.08

SVAR AB-Model I

The A and B matrices are specified below

A Matrix

	Equations		
Variable	GDP	Agric	Industry
GDP	1	0	0
Agric	*	1	0
Industry	*	*	1

B Matrix

	Equations		
Variable	GDP	Agric	Industry
GDP	*	0	0
Agric	0	*	0
Industry	0	0	*

Here we 3 zeros and 3 ones restrictions in matrix A and 6 zeros restrictions in matrix B, which gives a total of 12, which is sufficient to obtain an identified model. Here (*) are the unrestricted elements. With these restrictions we obtained a just-identified SVAR model presented in table 17 in the appendix. The structural VAR impulses for this model are presented in figures 11 and 12. We used 2000 bootstrapped replications and used the Hall percentile confidence intervals because it is more reliable because of its build-in bias correction (Lutkepohl, 2005). The SVAR Impulse Responses revealed that innovation in GDP responded to shocks in both Agric and industry. The implication is that Agriculture and industrial sectors contribute significantly to GDP in Nigeria.

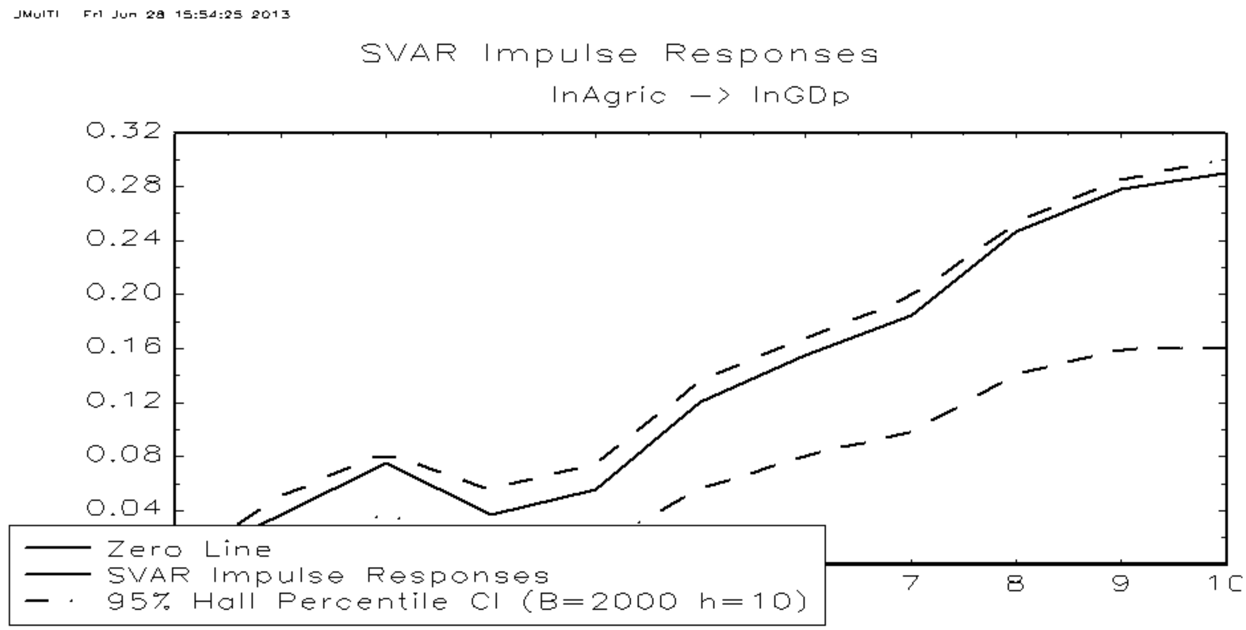

Fig. 11: SVAR Impulse from Agric to GDP for SVAR model I

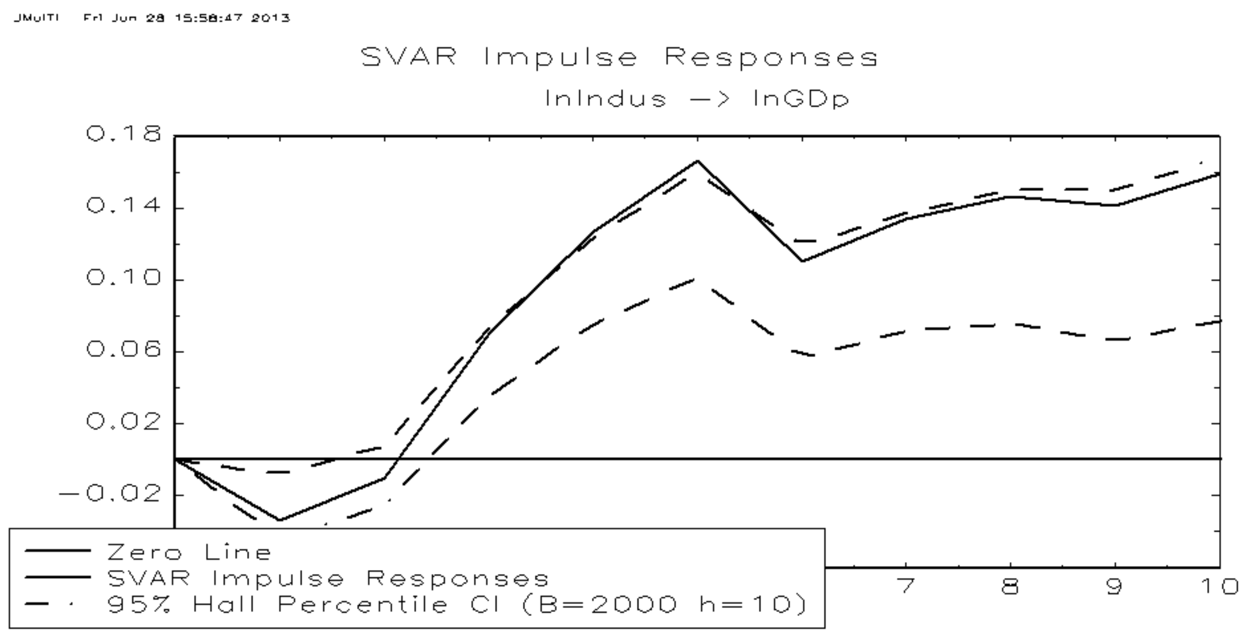

Fig 12: SVAR Impulse response from Industry to GDP for SVAR model 1.

Table 12: SVAR FORECAST ERROR VARIANCE DECOMPOSITION(AB-Model I)

Proportions of forecast error in "lnGDp" accounted for by:			
forecast horizon	lnGDp	lnAgric	lnIndus
1	1.00	0.00	0.00
2	0.92	0.04	0.04
3	0.78	0.19	0.03
4	0.67	0.19	0.14
5	0.47	0.18	0.35
6	0.29	0.24	0.47

7	0.22	0.35	0.43
8	0.16	0.43	0.41
9	0.12	0.52	0.36
10	0.10	0.58	0.32

In VAR modeling, Forecast error variance decompositions help to give more interpretation for the impulse response. Table 12 present the result for the SVAR forecast error variance decomposition. The result revealed in the long run (at forecast horizon 10) agric innovation contributed 58% to total GDP innovations, while industry contributed about 32% to the total GDP innovations. The contributions of the two variables are fairly significant.

SVAR AB-Model II

We estimated another SVAR AB-model with the following restrictions on matrix A and matrix B, as given below

A Matrix

	Equations		
Variable	GDP	Agric	Industry
GDP	1	*	*
Agric	0	1	*
industry	0	0	1

B Matrix

	Equations		
Variable	GDP	Agric	Industry
GDP	*	0	0
Agric	0	*	0
industry	0	0	*

Here we 3 zeros and 3 ones restrictions in matrix A and 6 zeros restrictions in matrix B, which gives a total of 12, which is sufficient to obtain an identified model. Here (*) are the unrestricted elements. With these restrictions we obtained a just-identified SVAR model presented in table 18 in the appendix. The structural VAR impulses for this model are presented in figures 13 and 14. The SVAR Impulse Responses revealed that innovation in GDP responded to shocks in both Agric and industry. As mention earlier, this implied that Agriculture and industrial sectors contribute significantly to GDP in Nigeria.

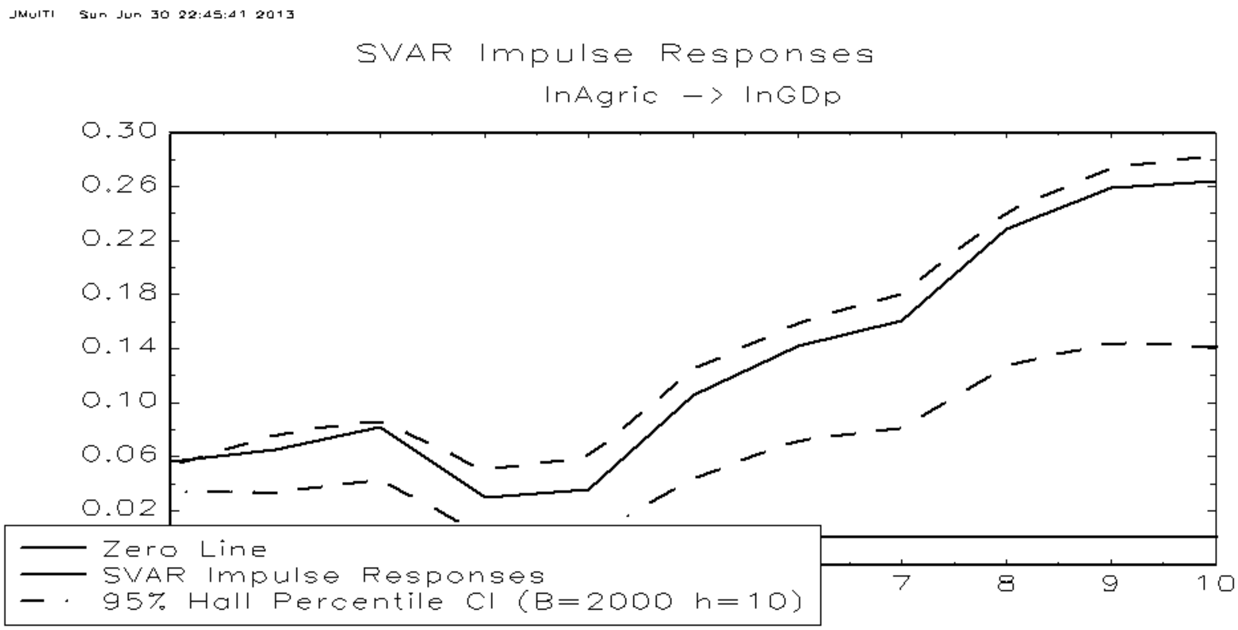

Fig 13: SVAR Impulse response from Agric to GDP for SVAR model II.

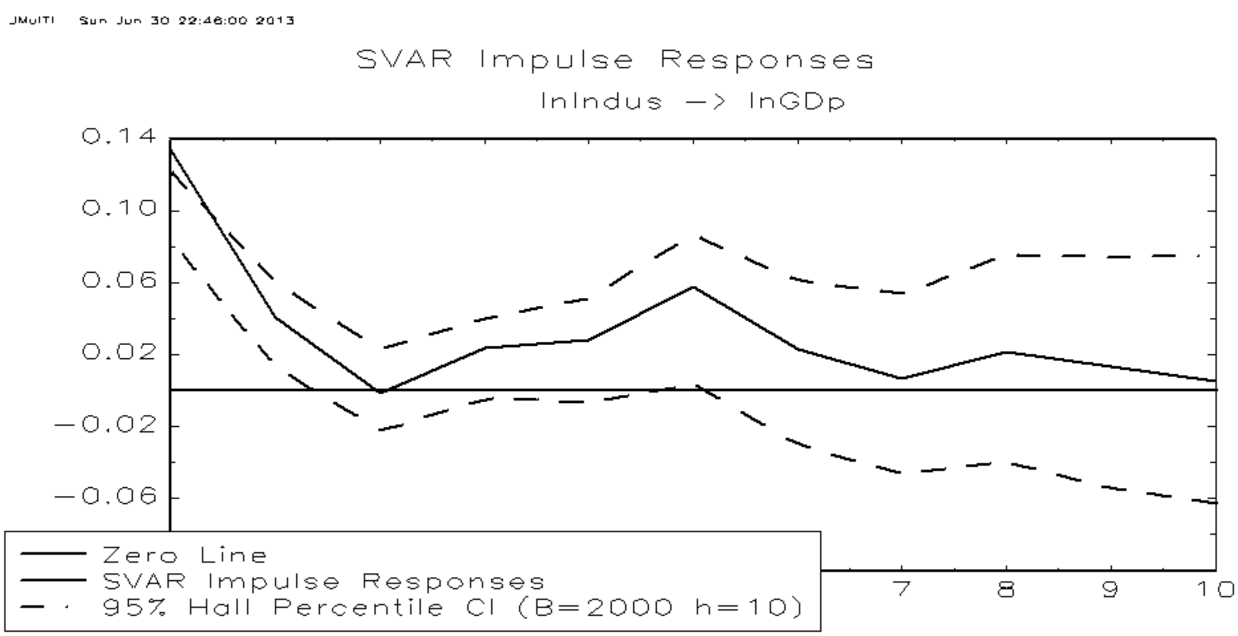

Fig 14: SVAR Impulse response from Industry to GDP for SVAR model II.

Table 13: SVAR FORECAST ERROR VARIANCE DECOMPOSITION (AB-Model II)

Proportions of forecast error in "lnGDp" accounted for by:			
forecast horizon	lnGDp	lnAgric	lnIndus
1	0.10	0.13	0.77
2	0.14	0.24	0.62
3	0.12	0.37	0.51
4	0.21	0.34	0.45
5	0.42	0.25	0.33
6	0.52	0.25	0.23
7	0.50	0.33	0.17
8	0.50	0.37	0.13
9	0.46	0.45	0.09
10	0.43	0.51	0.07

As earlier mentioned, the Forecast error variance decompositions help to give more interpretation for the impulse response. Table 13 present the result for the SVAR forecast error variance decomposition. The result revealed in the long run (at forecast horizon 10) agric innovation contributed 51% to total GDP innovations, while industry contributed about 7% to the total GDP innovations. The contributions of the two variables are fairly significant.

Summary and Conclusion

We set out to investigate the impact of agriculture and industry on GDP in Nigeria. The annual data used in this work was collected from the Central Bank of Nigeria (CBN) website for the period of 1960 to 2011. The Jarque-Bera test for normality on the time series, the results revealed that GDP, agriculture and industry time series follows a normal distribution. The ADF test was used to test the stationarity of the variables, the test results shows that the time series (GDP, agriculture and industry) are stationary at 1% level of significance.

We estimated a Vector Autoregression (VAR) model to study the impact of agriculture and industry on GDP in Nigeria, the VAR model of lag 10 was favoured using Akaike Information criterion (AIC). The impulse response analysis revealed that GDP in nigeria responded to shocks agriculture and industry. Furthermore, forecast error variance decompositions (FEVD) revealed that agriculture contributed 58% to GDP and industry contributed 32% to GDP in Nigeria. The implication of these results shows the significant role of agricultural and industrial sectors to GDP growth in a developing country as Nigeria. These results are similar to past works (Oladije, Akinalabi & Tijani, (2012); Akpan, Riman, Duke II & Mboto, (2012)).

In addition, test for Granger causality revealed that a bi-directional causality exist among the time series variables. On this line also, the CUSUM test for stability and the VAR eigenvalue stability condition test of the VAR models revealed stable VAR models because the VAR models are within bounds, that is, the modulus of the eigenvalues are all less than 1.

To extend our work with the application of Structural VAR (SVAR) model, we carried-out residual analysis. The Jarque-Bera test; univariate and multivariate ARCH-LM test; plots of autocorrelation and partial autocorrelation; and kernel density estimation (Guassian kernel) revealed that the residuals are normally distributed (that is a white noise residuals).

We considered three SVAR models: the SVAR Blanchard-Quah model; SVAR AB-model I and SVAR AB-Model II. These models revealed that agriculture and industry contributed significantly to the structural innovations of GDP in Nigeria.

Our work therefore concluded that agricultural and industrial sectors have significant impact on GDP in Nigeria from 1960 to 2011.

Recommendations

Based on the results of this work, we proffer the following recommendations

(I). Special incentive should be given to farmers and infrastructural facilities should be provided.

(II). The government should encourage domestic investment to accelerate economic growth and limit the multinationals repatriation of profits from Nigeria.

(III). New approach should be vigorously and honestly pursued by the Nigerian government in order to restore the glory of the agricultural and industrial sectors.

(IV). More campaign programme should be carry out in order to create awareness for Nigerian to patronized "made in Nigeria" goods. Ban on imported goods that can easily be produce in Nigeria.

(V). the government should address the present security challenge in the country; this is because Insecurity can hinder economic growth and development.

References

Abimiku, C. A.(n.d): An Appraisal of the Effects of the structural Adjustment Programme (SAP) on the Contributions of Agriculture to Gross Domestic Product (GDP) in Nigeria. Economic and Financial Review. 31:26-44 (June).

Adenomon, M. O; Ojehomon, V. E. T. and Oyejola, B. A. (2013): Modelling the Dynamic Relationship Between Rainfall and Temperature Time Series Data in Niger State, Nigeria. Mathematical Theory and Modelling. 3(4):53-70.

Ajayi, D. D.(2007): Recents Trends and Patterns in Nigeria's Industrial Development. XXXII(2):139-155.

Akpan, E. S; Riman, H. B; Duke II, J; and Mboto, H. W.(2012): Industrial production and Non-oil Export: Assessing the Long-run Implication on Economic Growth in Nigeria. International Journal of Economics and Finance. 4(2):252-259.

Ansari, M. I. and Ahmed, S. M. (2007): Does Money Matter? Evidence from Vector Error-Correction for Mexico. The Journal of Developing Areas. 14(1):185-202.

Anthony, E. (2010): Agricultural Credit and Economic Growth in Nigeria: An Empirical Analysis Business and Economics Journal. 14:1-7

Anyeala, J. U.(1990): Comprehensive Economics for WASSCE. Lagos: A Johnson Publishers Ltd

Apata, T. G.(2010): Effects of Global Climate Change on Nigerian Agriculture: An Empirical Analysis: CBN Journal of Applied Statistics.2(1):31-50.

Atoyebi, K. O; Adekunjo, F. O; Edun, O. and Kadri, K. I.(2012): Foreign Trade and Economic Growth in Nigeria: An Empirical Analysis. IOSR Journal of Humanities and Social Sciences. 2(1):73-80.

Awe, A. A.(2013): The Impact of Foreign Direct Investment on Economic Growth in Nigeria. Journal of Economics and Sustainable Developments.4(2):122-132.

Babajide, A. (2012): Effects of Microfinance on Micro and Small Enterprises (MSEs) Growth in Nigeria. Asian Economic and Financial Review. 2(4):1-16.

Blanchard, O. J. and Quah, D. (1989): The Dynamic Effects of Aggregate Demand and Supply Disturbances. The American Economic Review. 79(4):655-673.

Chinedu, E. A; Titus, O. C; and Thaddeus, E. O.(2010): Achieving 2020 in Nigeria: A Review of the Economic and Market-Oriented Business Reforms. Journal of Sustainable Development in Africa. 12(4):58-71.

Faust, J. and Leeper, E. M. (1997): When Do long-Run Identifying Restrictions Give Reliable Results?. Journal of Business & Economic Statistics. 15(3):345-353.

Giuliodri, M. (2004): Nominal Shocks and the Current Account: A Structural VAR Analysis of 14 OECD Countries. Review of World. 140(4):569-591.

Iganiga, B. O. and Unemhilin, D. O. (2011): The Impact of Federal Government Agricultural Expenditure on Agricultural Output in Nigeria. J. Economics 2(2):81-88.

Ikoku, A. E.(2010). Is the Stock Market a Leading Indicator of Economic Activity in Nigeria? CBN Journal of Applied Statistics. 1(1):17-38.

JMulTi (2009): JMulTi 4 Analysing Multiple Time Series. Version 4.24 (October 15, 2009).

Ku, H; Mustapha, U. M. and Goh, S. (2010): A Literature Review of Past and Present Performance of Nigerian Manufacturing Sector. Journal of Engineering manufacture. 224(12):1894-1904.

Kumah, F. Y. and Matovu, J. M. (2007): Commodity price Shocks and the Odds on Fiscal Performance: A Structural Vector Autoregression Approach. IMF Staff Papers. 54(1):91-112

Kwanashie, M., Ajilima, I. and Garba, A-G. (1998): The Nigerian Economy: Response of Agriculture to Adjusted Policies. AERC Research paper 78.

Lawal, W. A.(2011): An Analysis of Government Spending on Agricultural Sector and its Contribution to GDP in Nigeria. International Journal of Business and Social Science: 2(20):244-250.

Liverpool-Tasie, L. S., Kuku, O. and Ajibola, A.(2011): A Review of Literature on Agricultural Productivity, Social Capital and Food Security in Nigeria. NSSP Working paper No. 21:IFRRI.

L−tkepohl, H. (2005). *New Introduction to Multiple Time Series Analysis*. New York: Springer Berlin Heidelberg.

Mohammed, M. (2012): Conservation Agriculture for the Twenty-First Century. NIJAAS. 5(2):142-150

Olajide, O. T., Akinlabi, B. H. and Tijani, A. A. (2012): Agricultural Resource and Economic Growth in Nigeria. European Scientific Journal (Oct. ed.).8(22):103-115

Pffaf, B. (2008): VAR, SVAR and SVEC Models: Implementation Within R Package vars. Journal of Statistical Software. 27(4):1-32.

Shiru, J. J.(2012): Agricultural Mechanization: The key to Poverty Alleviation in Rural Communities of Nigeria. NIJAAS. 5(2):121-132

Stata 8.0 (2003): Stata/S.E 8.0 for Windows. Stata Corporation, U.S.A.

Tamuno, S. O., and Edoumiekumo, S. G.(2012): Industrialization and Trade Globalization: What Hope for Nigeria? International Journal of Academic Research in Business and Social Sciences. 2(6):157-170.

Ubi, P. S; Effiom, L; and Eyo, E. I. (2012): Monetary Policy and Industrialization in an Emerging Open Economy: Lessons from Nigeria. International Journal of Academic Research in Business and Social Sciences. 2(8):270-288.

Udah, E. B. (2010): Industrial Development, Electricity Crisis, and Economic Performance in Nigeria. European Journal of Economics, Finance and Administrative Sciences. 18:105-121.

Appendix

Table 14: VAR ESTIMATION RESULTS

```
endogenous variables:     lnGDp lnAgric lnIndus
exogenous variables:
deterministic variables:  CONST
endogenous lags:          10
exogenous lags:           0
sample range:             [1970, 2011], T = 42

modulus of the eigenvalues of the reverse characteristic polynomial :
|z| = ( 1.0577   1.0577   1.0402   1.0402   1.0149   1.0149   1.1586   1.1586   1.0192   1.0192
1.3439   1.3439   1.1128   1.1128   1.0415   1.0415   1.1619   1.1619   1.3484   1.3484
1.0429   1.0429   1.0403   1.0403   1.0327   1.0327   1.0085   1.0085   4.3788   1.1878   )
Legend:
=======
              Equation 1    Equation 2  ...
-----------------------------------------
Variable 1 | Coefficient        ...
           | (Std. Dev.)
           | {p - Value}
           | [t - Value]
Variable 2 |         ...
```

<table>
<tr><td>Lagged endogenous term:
=======================
lnGDp lnAgric lnIndus</td><td>Lagged endogenous term:
=======================
lnGDp lnAgric lnIndus</td></tr>
<tr><td>--
lnGDp (t-1) | 0.949 -0.126 0.801
| (0.809) (0.905) (1.320)
| {0.241} {0.889} {0.544}
| [1.172] [-0.139] [0.607]
lnAgric(t-1) | 0.075 1.103 -0.214
| (0.363) (0.405) (0.591)
| {0.836} {0.007} {0.718}
| [0.207] [2.721] [-0.362]
lnIndus(t-1) | -0.360 0.016 -0.164
| (0.406) (0.454) (0.662)</td><td>lnGDp (t-6) | 0.707 0.566 0.508
| (0.802) (0.897) (1.308)
| {0.378} {0.528} {0.698}
| [0.881] [0.631] [0.388]
lnAgric(t-6) | -0.330 -0.160 -0.223
| (0.414) (0.463) (0.675)
| {0.426} {0.730} {0.741}
| [-0.796] [-0.346] [-0.330]
lnIndus(t-6) | -0.411 -0.242 -0.375
| (0.449) (0.501) (0.731)
| {0.359} {0.630} {0.608}</td></tr>
</table>

	{0.376}	{0.971}	{0.804}
	[-0.886]	[0.036]	[-0.248]
lnGDp (t-2)	-0.589	-1.304	-0.288
	(0.820)	(0.917)	(1.337)
	{0.473}	{0.155}	{0.830}
	[-0.718]	[-1.422]	[-0.215]
lnAgric(t-2)	0.261	0.073	0.603
	(0.418)	(0.467)	(0.682)
	{0.532}	{0.875}	{0.377}
	[0.625]	[0.157]	[0.884]
lnIndus(t-2)	0.172	0.641	-0.053
	(0.388)	(0.434)	(0.633)
	{0.657}	{0.140}	{0.933}
	[0.444]	[1.476]	[-0.084]
lnGDp (t-3)	-0.763	0.061	-1.628
	(0.872)	(0.974)	(1.421)
	{0.381}	{0.950}	{0.252}
	[-0.875]	[0.063]	[-1.146]
lnAgric(t-3)	0.071	-0.004	0.169
	(0.393)	(0.440)	(0.641)
	{0.857}	{0.993}	{0.792}
	[0.180]	[-0.009]	[0.264]
lnIndus(t-3)	0.491	-0.069	0.869
	(0.395)	(0.442)	(0.645)
	{0.214}	{0.876}	{0.178}
	[1.242]	[-0.156]	[1.347]
lnGDp (t-4)	-1.078	-0.096	-1.303
	(0.876)	(0.979)	(1.428)
	{0.218}	{0.922}	{0.361}
	[-1.231]	[-0.098]	[-0.913]
lnAgric(t-4)	0.683	0.504	0.631
	(0.350)	(0.392)	(0.571)
	{0.051}	{0.198}	{0.270}
	[1.950]	[1.286]	[1.104]
lnIndus(t-4)	0.455	-0.078	0.686
	(0.395)	(0.441)	(0.643)
	{0.249}	{0.860}	{0.286}
	[1.154]	[-0.176]	[1.066]
lnGDp (t-5)	-1.287	-1.543	-1.129
	(0.901)	(1.007)	(1.469)
	{0.153}	{0.125}	{0.442}
	[-1.429]	[-1.533]	[-0.769]
lnAgric(t-5)	0.518	0.357	0.573
	(0.419)	(0.468)	(0.683)
	{0.216}	{0.446}	{0.401}
	[1.236]	[0.762]	[0.839]
lnIndus(t-5)	0.791	0.961	0.625
	(0.417)	(0.466)	(0.679)
	{0.058}	{0.039}	{0.358}
	[1.897]	[2.063]	[0.919]
	[-0.917]	[-0.482]	[-0.513]
lnGDp (t-7)	-1.075	-0.206	-2.052
	(0.752)	(0.841)	(1.227)
	{0.153}	{0.806}	{0.094}
	[-1.429]	[-0.245]	[-1.673]
lnAgric(t-7)	0.622	0.606	0.823
	(0.398)	(0.445)	(0.649)
	{0.118}	{0.173}	{0.205}
	[1.563]	[1.362]	[1.268]
lnIndus(t-7)	0.442	0.077	0.826
	(0.403)	(0.450)	(0.656)
	{0.272}	{0.865}	{0.208}
	[1.099]	[0.170]	[1.259]
lnGDp (t-8)	-1.188	-0.686	-2.139
	(0.821)	(0.918)	(1.339)
	{0.148}	{0.455}	{0.110}
	[-1.447]	[-0.748]	[-1.598]
lnAgric(t-8)	0.906	-0.268	2.087
	(0.436)	(0.487)	(0.710)
	{0.038}	{0.582}	{0.003}
	[2.079]	[-0.551]	[2.938]
lnIndus(t-8)	0.634	0.428	1.198
	(0.423)	(0.473)	(0.690)
	{0.134}	{0.365}	{0.082}
	[1.498]	[0.906]	[1.737]
lnGDp (t-9)	-1.107	0.332	-1.928
	(0.914)	(1.022)	(1.490)
	{0.226}	{0.745}	{0.196}
	[-1.212]	[0.325]	[-1.294]
lnAgric(t-9)	0.476	0.424	0.359
	(0.552)	(0.617)	(0.900)
	{0.388}	{0.492}	{0.690}
	[0.862]	[0.686]	[0.398]
lnIndus(t-9)	0.505	-0.315	0.771
	(0.484)	(0.541)	(0.789)
	{0.297}	{0.560}	{0.329}
	[1.044]	[-0.582]	[0.977]
lnGDp (t-10)	0.102	-0.515	0.104
	(0.921)	(1.029)	(1.501)
	{0.912}	{0.617}	{0.945}
	[0.111]	[-0.501]	[0.069]
lnAgric(t-10)	0.150	0.084	0.389
	(0.580)	(0.648)	(0.946)
	{0.796}	{0.897}	{0.681}
	[0.259]	[0.130]	[0.411]
lnIndus(t-10)	-0.037	0.257	0.152
	(0.504)	(0.563)	(0.821)
	{0.941}	{0.648}	{0.854}
	[-0.074]	[0.457]	[0.185]

Deterministic term:

	lnGDp	lnAgric	lnIndus
CONST	10.525	5.911	15.277
	(4.162)	(4.652)	(6.785)
	{0.011}	{0.204}	{0.024}
	[2.529]	[1.271]	[2.251]

Table 15: VAR MODEL STATISTICS

sample range: [1970, 2011], T = 42

Log Likelihood: 1.668839e+02
Determinant (Cov): 7.100720e-08

Covariance:	2.348922e-02	1.576304e-02	3.351853e-02
	1.576304e-02	2.934218e-02	1.221183e-02
	3.351853e-02	1.221183e-02	6.243152e-02

Correlation:	1.000000e+00	6.004260e-01	8.752834e-01
	6.004260e-01	1.000000e+00	2.853202e-01
	8.752834e-01	2.853202e-01	1.000000e+00

AIC:	-1.203191e+01
FPE:	2.075357e-05
SC:	-8.184216e+00
HQ:	-1.062158e+01

Table 16: Structural VAR Estimation Results using Blanchard-Quah model

Structural VAR is just identified

Identified accumulated long run impact matrix is lower diagonal

Estimated contemporaneous impact matrix:			Estimated identified long run impact matrix:		
0.0249	-0.0226	-0.1495	6.9411	0.0000	0.0000
0.1290	0.0629	-0.0935	7.3931	0.1801	0.0000
0.0259	-0.1516	-0.1969	6.9098	-0.2220	0.0557
Bootstrap standard errors:			Bootstrap standard errors:		
0.0409	0.0345	0.0911	17.5935	0.0000	0.0000
0.0938	0.0412	0.0572	18.8121	0.1154	0.0000
0.0574	0.0997	0.1216	17.4278	0.1450	0.0379
Bootstrap t-values:			Bootstrap t-values:		
0.6078	-0.6549	-1.6414	0.3945	0.0000	0.0000
1.3753	1.5262	-1.6348	0.3930	1.5612	0.0000
0.4515	-1.5214	-1.6188	0.3965	-1.5310	1.4702

Table 17: SVAR AB-Model I

Step 1:
Obtaining starting values from decomposition of correlation matrix...
Iterations needed for correlation matrix decomposition: 11.0000
Vector of rescaled starting values:
-0.6711; -1.7947; 0.5479; 0.1533 ; 0.1370; 0.0947
Step 2:
Structural VAR Estimation Results
ML Estimation, Scoring Algorithm (see Amisano & Giannini (1992))
Convergence after 1 iterations
Log Likelihood: 198.2644
Structural VAR is just identified

Estimated A matrix:
1.0000 0.0000 0.0000
-0.6711 1.0000 0.0000
-1.7947 0.5479 1.0000

Estimated standard errors for A matrix:
0.0000 0.0000 0.0000
0.1379 0.0000 0.0000
0.1192 0.1067 0.0000

Estimated B matrix:
0.1533 0.0000 0.0000
0.0000 0.1370 0.0000
0.0000 0.0000 0.0947

Estimated standard errors for B matrix
0.0167 0.0000 0.0000
0.0000 0.0149 0.0000
0.0000 0.0000 0.0103

A^-1*B
0.1533 0.0000 0.0000
0.1029 0.1370 0.0000
0.2187 -0.0751 0.0947
SigmaU~*100
2.3489 1.5763 3.3519
1.5763 2.9342 1.2212
3.3519 1.2212 6.2432
end of ML estimation

Table 18: SVAR AB-Model II

Step 1:
Obtaining starting values from decomposition of correlation matrix...
Iterations needed for correlation matrix decomposition: 11.0000
Vector of rescaled starting values:
-0.3416 ; -0.4701; -0.1956; 0.0485; 0.1642
0.2499

Step 2:
Structural VAR Estimation Results
ML Estimation, Scoring Algorithm (see Amisano & Giannini (1992))
Convergence after 1 iterations
Log Likelihood: 198.2644
Structural VAR is just identified

Estimated A matrix:
1.0000 -0.3416 -0.4701
0.0000 1.0000 -0.1956
0.0000 0.0000 1.0000

Estimated B matrix:
0.0485 0.0000 0.0000
0.0000 0.1642 0.0000
0.0000 0.0000 0.2499

Estimated standard errors for B matrix
0.0053 0.0000 0.0000
0.0000 0.0179 0.0000
0.0000 0.0000 0.0273

A^-1*B
0.0485 0.0561 0.1341
0.0000 0.1642 0.0489
0.0000 0.0000 0.2499
SigmaU~*100
2.3489 1.5763 3.3519
1.5763 2.9342 1.2212
3.3519 1.2212 6.2432
end of ML estimation

Estimated standard errors for A matrix: 0.0000 0.0456 0.0312 0.0000 0.0000 0.1014 0.0000 0.0000 0.0000	