International Journal of Financial Economics
Vol. 1, No. 2, 2013, 48-60

RESEARCH ACADEMY OF SOCIAL SCIENCES

# Nexus between Oil Revenue, Non-oil Export and Industrial Output in Nigeria: An Application of the VAR Model

**Hodo B. Riman[1], Emmanuel S. Akpan[2], Amenawo I. Offiong[3], Cornelius M. Ojong[4]**

**Abstract**

The study had set forth to explore the intertwining relationship that exist between oil revenue shock, non-oil export and industrial output in Nigeria. In achieving this objective the study utilized data spanning the period 1970-2010. This period captured the major era of regime shift (changes in governance) and policy administration in Nigeria. Vector Autoregressive (VAR) model and cointegration technique were used to examine the long run relationship, while the Vector Error Correction Model (VECM) was used to analyze the short-run behavior of the variables. The Johansen cointegration analysis suggests that a long run behavior exist between oil revenue shock, non-oil export, policy/regime shift and industrial output in Nigeria. The short-run result showed that the speed at which industrial output will converge towards long-run equilibrium after experiencing shock from oil revenue is very slow. It therefore would take a very slow process for industrial output to recover from shock arising from variation in oil revenue. The long run result shows that oil revenue shock and policy/regime shift had negative impact on industrial output and non-oil export. The impulse response function and variance decomposition analysis suggest that the major drivers of industrial development in Nigeria are non-oil export, regime shift and oil revenue. Thus innovations from these variables impact severely on industrial growth in Nigeria. The study therefore suggest among other things that the panacea to industrial growth in Nigeria rest on diversifying the economy away from crude oil export and ensuring a stable government in Nigeria that will endure long enough to sustain industrial and other economic policies.

**Key words:** Structural Adjustment Programme, Industrial Production, Non-oil export, Economic growth, Co-integration, Oil revenue shock.

## 1. Introduction

Nigeria has been adjudged the 6th largest exporter of crude oil in the world with the USA as her biggest trading partner. Crude oil export accounts for the greatest revenue earner for the country. The dependency of the country on crude oil revenue is amplified by the usual budgetary estimate based on forecast from the expected crude oil prices. The Nigerian economy, like other oil exporting countries, is constantly exposed to oil price shocks since oil contributes over 90% of the total revenue. The dependency of the country on crude oil revenue is amplified by the usual budgetary estimate based on forecast from the expected crude oil prices. Shortfall on oil revenue occasioned by fluctuations in international oil prices had often led to deficit in the country's budget. Fluctuations in international crude oil prices have often exerted concurrent level of fluctuations in the revenue receipt from crude oil export. In such instances where there is a fluctuation in oil revenue, the country's Economic and Finance advisers have to resort to either external borrowings, domestic borrowings or adjustment in budgetary allocation to sectors in other to continue to steer the economic to the path of growth.

Quite recently, the Coordinating Minister for the Economy and Minister of Finance, Prof Ngozi Okonjo-Iweala raise a critical concern on Nigeria's overdependence on crude oil and the dwindling fortune from oil revenue. She further painted a gloomy picture of the economy and hinted that there was an urgent need for "stringent budgetary measures" to arrest the downward slide; otherwise, the country might be heading for an economic crisis if the situation is quickly addressed. Her assertive comments prompted the country's National Assembly to caution her over her utterances which they claim was unguided. The truth of the matter is that the country is suddenly awakening to the reality that continued dependence on crude oil as the major revenue earner is hurting the economy.

[1] Department of Banking and Finance University of Calabar, Nigeria
[2] Department of Banking and Finance University of Calabar, Nigeria
[3] Department of Banking and Finance University of Calabar, Nigeria
[4] Department of Banking and Finance University of Calabar, Nigeria

But what was the situation before now? As at 1970, non-oil export was the dominant revenue earner for the country. Non-oil export accounted for over 74 percent of total revenue earned by the country while oil revenue accounted for a paltry 26 percent, (see table 1 at the appendix). Within the same year the total output of major agricultural commodities was at 6,461,000 tons while index of industrial production was 41.3. By 1985, the contribution of oil revenue to total revenue earned by the country increased to 73 percent while the contribution of non-oil export revenue to total revenue dropped to 23 percent. This situation which then called for urgent attention ushered in the adoption of the Structural Adjustment Programme (SAP), which was seen as a remedy to the poor performance of the agricultural and industrial sector. SAP was aimed at promoting and re-engineering the growth of non-oil exports. Policies were formulated that will revive the ailing industries and increased agricultural out in the country.

Given the need to revamp the economy and evade the impending doom for the industrial sector, various governments at different times introduced industrial policies that would correct the imbalances in the sectorial allocation of funds to industrial and agricultural sectors (otherwise, termed as priority sectors). The first national development plan that was launched in 1962 (post-independence) had the motive to diversify the economy and give more credence to the agricultural sector. This was to be achieved through increasing investment rate to 15 per cent, promote rapid development in education and health sector. However, this lofty policy was truncated by the civil war. The second development plan that was launched soon after the war was geared towards restoring the productive capacity, achievement of self-reliance and generation of employment. The fulcrum that was to drive this policy was the indigenization policy of 1972. While implementing this policy, the quantum leap in export revenue gained from rising crude oil export relegated the indigenization policy to the background. The poor implementation of the third development plan resulted to the initiation of import substitution industrialization (ISI) strategy packaged in the SAP policy of the fourth development plan which began in 1986.

However, despite all the policies so far introduced to improve industrial performance in Nigeria, the country's GDP was still observed to be on the downward trend. It is however sad to observe that the contribution of industrial production to GDP rather than improve fell from 45.83 percent in 1995 to 41.53 percent in 2005. The contribution of manufacturing sub-sector and non-oil export also reduced from 7.44 and 1.14 percent in 1995 to 2.89 and 0.7 percent in 2005 respectively. Oil revenue still continued to account for the sum of total revenue. for instance, as at oil revenue accounted for a record high of 89 percent while non-oil export revenue accounted for 11 percent of the country's total revenue. Adejugbe (1980) in a reaction to the poor performance of the industrial sector stated that Nigeria industrial policies, objectives, and strategies were often subject to modifications, neglect or even total abandonment. He further attributed the Nigeria's poor industrial programs to frequent muddling of policies by incumbent government and abrupt modifications and interruptions of existing and ongoing industrial programs and strategies established by previous government. Each government that comes into office will recklessly abandon existing programs and begin a new program, thus truncating the growth process. . Thus, such situation can never promote an unequivocal growth in the country's GDP

Furthermore, some researchers have blamed the dwindling performance of the industrial sector viz-a-viz non-oil exports to the huge attention accorded to the crude oil export which thus serves as the major revenue earner to the nation. How does the crude oil pricing affect industrial production? According to Schneider (2005) in the wake of oil price increase supply suffers as production costs rise. Given substitution between production factors, relative price changes result in a reallocation of the means of production. However, these intersectoral reallocations also generate costs (training expenses, irreversible investments, etc.) Thus, the actual impact on investment essentially depends on the expectations about the stability of oil price changes, which tend to vary over time. On the demand side, oil price shocks drive up the general level of prices, which translates into lower real disposable incomes and thus reduces demand. Aliyu (2009) had opined that consumption and investment is said to be affected due changes in the demand side. Consumption is affected indirectly through its positive relationship with disposable income while investment is adversely affected indirectly because such increase in oil price also affects firms' input prices and thereby increasing their costs

Questions are rift as to why the industrial sector in Nigeria has not responded correspondingly to the numerous policies and funding so far expended on the sector. Does the industrial sector in Nigeria drive the country's GDP? Does policy shift and governance affect the level of industrial production in Nigeria (particularly, since different administration pursue different industrial policy regimes in Nigeria)? And finally, what would be the future effect of the current trend in industrial production hold for the country if the dismal trend is unabated? These are the questions this research work seeks to address.

This study is an extension of a previous paper on Industrial Production and Non-oil Export; Assessing the Long-run Implication on Economic Growth in Nigeria (Riman, Akpan, Duke and Mboto; 2012) wherein the paper introduces a new insight and understanding into the problem of industrial production in Nigeria by first, studying the impact of the

variable using an extended time period to 2012, secondly, by introducing governance variable into the model to capture the effect of regime shift on industrial production, and thirdly, by using the VAR methodology to study the long-run effect of oil revenue shock on non-oil export and industrial output in Nigeria

## 2. Literature Review

Industrialization is the period of social and economic change that transforms a human group from an agrarian society into an industrial one. It is a part of a wider modernisation process, where social change and economic development are closely related with technological innovation, particularly with the development of large-scale energy and metallurgy production. It is the extensive organisation of an economy for the purpose of manufacturing.

Industrialization has come to be seen as the necessary route to the economic and social development of any nation. A country's wealth, development and advancement is normally judged by its level of industrialization. The industrial sector in Nigeria had continued to witness retarded growth since after the introduction of the Structural Adjustment Programme (SAP) introduced in 1986.

Unimpressively, the highest contribution of industrial sector to the nations GDP was noticed in 1995. Within that year the sectors contribution to GDP stood at 45.83 percent, while manufacturing sub-sector and non-oil export contribution to GDP was 7.44 and 1.14 percent respectively. Ikeze, Soludo and Elekwa (2001) observed that industrialization in Nigeria ascended during the oil boom era (1973-81, with manufacturing share of GDP reaching 11 percent) this performance was not however sustained as the sector experienced abrupt decline to five percent in 2000. The industrial sector had failed to record appreciable improvement after then.

What could have been responsible for this dismal performance noticed in the industrial sector in Nigeria? In an attempt to answer this question, Adejugbe (1980) responded that Nigeria industrial policies, objectives, and strategies are often subject to modifications, neglect or even total abandonment. He further opined that industrial policies and practice in Nigeria are pursued on ad-hoc basis and in a most uncoordinated manner. This according to Adejugbe partly explains the reason for the concentration of Nigeria's few industries in major cities like Lagos, Kano, Ibadan, and Port Harcourt.

The poor performance of the sector had also been attributed by other researchers to poor electricity supply situation in the country. Adeniran ( 2005 ) and Onyeonoru (2003) in their research observed a unidirectional causality that runs from GDP to Electricity consumption in Nigeria. In their separate work, they both observed that electricity production in Nigeria was sub-optimal and below the installed capacity utilization. They concluded their research by adding that sufficient electricity production was necessary for increasing industrial production in Nigeria.

Enang (2010) investigated the joint interaction between industrialization, electricity supply and economic growth in Nigeria within the framework of auto-regressive distributed lag (ARDL) bounds proposed by Presaran et al (2001). The paper found a feedback causality between GDP and Electricity supply. However, only a unidirectional relationship was observed between capital employed and GDP. The research finally confirmed that electricity supply, technology and capital employed were necessary for industrial and GDP growth in Nigeria.

Ajayi (2007) in describing the industrial trend in Nigeria observed that there is no significant relationship between the volume of production subcontracting and the size and structural characteristics of contracting firms. He observed that industrial production subcontractors were concentrated in Lagos, Ikorodu, Sagamu and Ibadan in the Southwest; Jos, Kaduna, Zaria, Kano, and Sokoto in the north; and a few other locations such as Benin, Owerri, Port-Harcourt (in the south) and Ilorin (middle belt). According to Ajayi, this spatial disparity in the distribution of manufacturing activities has often explained the reason for the dismal performance of the sector. He thus emphasize the need for the valorization of raw agricultural products or the treatment of raw materials for export, or through the principle of import substitution adopted by the Nigerian governments as their industrial planning strategy.

Alao (2010), using an error correction model observed that manufacturing sub-sector has been hindered by high interest rates, particularly the interest rate spread (IRS) which is the difference between lending and borrowing rates. It is also alleged that this rate is partly responsible for high cost of production in the Nigerian manufacturing sub-sector Adebiyi (2001), Adebiyi and Babatope-Obasa, 2004), and Babawale et al (1996)

Chimobi (2010) while estimating the relationship between Economic growth, Investment and Export in Nigeria observed that industrial production has the ability to increase investment which ultimately will lead to the production of more good, which eventually will yield growth in the domestic economy. Investment will lead to enhanced development in projects such as electricity supply, good road network, good medical care and host of other projects.

Despite the problems burdening the industrial sector in Nigeria, its contribution to GDP cannot be over emphasized. The industrial sector has been described as the engine that drives the economy of any nation. Diaz-Bautista (2003) empirical results indicate that industrial sector and overall economy are co-integrated and have a long run relationship in Mexico. The Granger causality test shows evidence that there exists a two way causal relationship between industrial growth and GNP thus supporting the findings that industrial output causes the overall economic growth for Mexico during the period under consideration.

Some researchers have also opined that the quality and level of governance also determine the extent a country achieves industrialization. Governance is generally understood as a broad process affecting the collective decision-making roles and procedures, management and authority relationships of social and economic agents involving multiple jurisdictions and domains. Governance is about governing and therefore cannot be isolated from political responsibility in all areas in which delegated authority makes decisions.

What actually would be the effect of governance on industrial production viz-a-viz economic growth? Kilvits and Purju (2008) observed that governance is a very important factor in determining the value of human and social capital. As a matter of fact, the level and systems of governance in place strongly determines the achievement of economic growth of any nation. Two systems of governance had been identified in literature, democratic governance and the military system of governance. Each of these systems of governance impact on the economy in different ways, particularly, as they relate to policies formulation. For instance, Jensen (2009) attempted to explore the effect of democratic governance on the inflow of Foreign Direct Investment. His result suggest that democratic political institutions are associated with higher levels of FDI inflows since it attracts as much as 70 percent more FDI as a percentage of GDP than their authoritarian counterpart. This result also collaborates the result obtained by Kilvits and Purju (2010) who both observed that democratic governance has been associated with improved and effective industrial policies, innovation policy, FDI, labour relations and support to local companies to improve in their value chain. As noted by Kilvits and Purju, Multinational corporations create spillover effects between private enterprises located within or outside the national borders. Alongside the transfer of technology inside large trans-national enterprises (TNE), Coeurderoy and Murray (2005) have demonstrated that countries whose system of governance encourage internalization and globalization of entrepreneurship would benefit from increasing trade, capital mobility and wide spread diffusion of technology transfer.

While exploring the effect of Military expenditure on domestic economies, Looney (20010 noted that rent seeking behavior of communities adversely affect industrial growth. Comparing the nature of growth in the midst of rent seeking attitude, the author observed that military regimes create an environment where military expenditure tend to have positive overall impact on economic growth, while civilian regimes having less control over rent seeking groups do not appear to be able to combine rent seeking activities and military expenditures in a manner conducive to overall economic growth.

On the causal effect of oil revenue on industrial production Ojapinwa and Ejumedia (2010) using the VAR impulse response function analysis concluded that reacted significantly to oil price, inflation and exchange rate. However, industrial output did not react significantly to changes in money supply. Furthermore, Aworawo (2011) also opined that the problem of irregular power supply has been compounded by the acute shortage of refined product which has become major feature in Nigeria's energy sector since 1993. The consequence is that it has become increasingly difficult to secure petroleum products to run generating set when there is power outage from government power source. Even when the petroleum product is available, the cost has been so high that owners of industry. All these has left the industrialist more confused.

KomainJiranyakul (2006) further asserted that a rise in oil price affected supply of the petroleum product, (especially for oil import dependent countries) and hence makes it more costly for firms to produce goods since energy and capital are complemented, which implies that firms that uses more of refined petroleum product experience higher cost of running their machines except they purchase new energy-efficient machines. The profit of firms stuck with less fuel-efficient machines suffers, and they may alternatively invest in labour intensive method of production, which of course has a backwards production effect on the firms.

Rodriguez (2007) analysed the response of manufacturing industries to oil price shock in four EMU countries namely, France, Germany, Italy and Spain, the US and the UK the latter being oil importing countries. The result indicated that oil price lowers the level of aggregate manufacturing output in all countries under study, although the responses differ between and amongst countries.

What could possibly be the long run effect of export earnings on industrial growth? Uddin and Norman (2002) using the Granger causality tests to find the direction of causality between exports and industrial production index in

Bangladesh observed that there exists bi-directional causality between exports and industrial activities in Bangladesh. Thus, the authors summarized that a viable industrial sector was necessary to drive Bangladesh external trade. Mamun and Nath (2005) had showed that though industrial production and export were co-integrated at the long run, there exists a uni-directional causality running from export to economic growth in Bangladesh. Kemal et al (2002) also found a positive association between export growth, industrial production and economic growth for India as well as other South Asian economies.

Ferda (2007) estimated a multivariate causality analysis of export and growth in turkey. Empirical evidence from the bounds co-integration test indicated that there existed only one long-run relationship between the variables in which real industrial production index is the dependent variable. Augmented Granger causality tests suggested that changes in real exports and terms of trade through the error correction term precede changes in real industrial index in the long-run. In the short-run, there is a uni-lateral causation running from changes in real exports to real industrial production index.

## 3. Methodology

The study uses annual data for 1970-2010 obtained from the Central Bank of Nigeria Statistical bulletin. The study applied the Vector Autoregresion (VAR) model developed by Klien (2010) although with some modifications to include some endogenous variables such as industrial output, policy or regime shift and national income. According to Klien (2010) the advantage of the VAR approach is that it does not require any a priori assumtions on the direction of the feedback between variables in the model. This study therefore adopts the VAR specification adopted by Klien (2010).

$$Y_{It} = \Gamma_0 + \sum^{N}\Gamma_t Y_{t-1} + \varepsilon_{it} \text{ where } Y_{It} = \begin{pmatrix} OILP \\ NOEXP \\ INDP \\ GDP \\ DUM \end{pmatrix}$$

Where $Y_{it}$ is a vector of the four endogenous variables (NOEXP, INDP, OILP, GDP, DUM). The variable INDP is the index of industrial production, OILP represent revenue receipt from oil export, GDP represent National income, NOEXP represent Non-oil exports, and DUM represent the variable for regime shift which takes the value of 0 for the era of military regime and 1 for the era of democratic regime. The variables of OILP and NOEXP appear as a ration of percentages of GDP. The framework of this study will allows for the application of the impulse response function and variance decomposition. Impulse response function traces the direct effects from oil to non-oil sectors and also identifies the indirect effects that work through industrial production.

Impulse response further describes the reaction of one variable in the system to innovations in another variable in the system while holding all other shocks at zero. The shocks in the VAR were orthogonized using the Cholesky decomposition, which implies that variables appearing earlier in the ordering are considered more exogenous, while the variables appearing later in the ordering are considered more endogenous. The specification holds that oil revenue is the most exogenous variable since oil prices are determined in the global market following the forces of demand and supply. Industrial production, non-oil export and regime shift are endogenously determined. The assumption in this study is that the industrial sector reacts spontaneously to changes in revenue receipt from the government, and the reaction of the industrial sector has a positive or negative effect on non-oil exports depending on the variability of oil revenue receipt.

The analysis in this study will begin from testing of the stationarity of variables in order to avoid spurious regression estimates. This will be conducted using the Augmented Dickey Fuller and Kwaiatkowski-Phillips tests. Next, the resulting order of integration necessitated applying the Johansen cointegration technique to ascertain the existence of a long-run relationship among the variables.

To check whether the assumptions of our VAR model are met, it is necessary to carefully choose the lag length in the model. The lag length is selected based on the AIC (Akaike's Information Criterion). According to Enders (2003), the model will be misspecified when lag length is too small. The more lags, the more parameters we need to estimate and the less biased our results would be. The model will be over-parameterized if the number of lags is too large. Selecting the lag order is simply to understand that we find p such that $A_i = 0$ for all $i > p$ in the VAR model.

To test the long-run cointegration of four time series, the study will implement the Johansen cointegration test. Consider the following equation.

$$\Delta y_t = \alpha_o + \alpha_{t-1} + \sum_{i=2}^{p} \alpha_i \Delta y_{t-i} + \varepsilon_t$$

$$\text{Where } \alpha = -1 \left[ -\sum_{i=2}^{p} a_i \right], \quad \beta_i = \sum_{i=2}^{p} a_j ,$$

The number of cointegration vectors (r) is determined by the maximum eigenvalue test (Enders,

2003) and the trace test (Enders, 2003). Both tests are based on the likelihood ratio test. When λ trace and λmax conflict, we should choose the number of the cointegration vector based on λmax , because "the λmax test has the sharper alternative hypothesis.

## 4. Empirical Result

### Stationarity Test

Unit root test was performed on all the five (5) variables in the model using the Augumented Dickey-Fuller (ADF) and Kwaiatkowski-Phillips. The ADF result revealed the oil revenue (oilp) and industrial output (lindp) were stationary at levels while log of non-oil export (lnoexp), log of National income (lngdp) and policy/regime shift (dummy) were stationary after first differencing. The KP result showed that log of non-oil export (lnoexp), oil revenue (oilp) and policy/regime shift (dummy) were stationary at their levels, while log of National income (lngdp) and log of industrial production (lindp) were stationary after first differencing. Thus the result in table 2 below confirms that the variables do not contain any unit root.

**Table 2 Result of Unit Root test**

| | ADF with Intercept | | Remarks | Kwaiatkowski-Phillips with intercept | | Remark |
|---|---|---|---|---|---|---|
| Variables | levels | 1st dif | | levels | 1st dif | |
| oilp | -4.6977 | | 1(0) | 0.0821 | | 1(0) |
| lindp | -3.9374 | | 1(0) | 0.7303 | 0.3665 | 1(1) |
| lnoexp | -2.2851 | -4.6561 | 1(1) | 0.3062 | | 1(0) |
| lngdp | -1.1747 | -6.4537 | 1(1) | 0.7346 | 0.1590 | 1(1) |
| dummy | -1.6622 | -6.1354 | 1(1) | 0.3113 | | 1(0) |
| Critical value at 5% | -2.9369 | -2.9411 | 1(1) | 0.4630 | 0.4630 | |

Following the establishment of no unit root amongst the variables the study went forward to establish the existence of long-run cointegration relationship among the variables by using the Johansen full information maximum likelihood method. The Johansen Cointegration test allows us to determine how industrial out reacts in the long run to volatility in oil revenue, non-oil export and policy/regime shift. The result of the Johansen cointegration test is reported in Table 3 and 4 below.

**Table 3 Johansen Trace Test**

Unrestricted Cointegration Rank Test (Trace)

| Hypothesized No. of CE(s) | Eigenvalue | Trace Statistic | 0.05 Critical Value | Prob.** |
|---|---|---|---|---|
| None * | 0.665508 | 76.11427 | 69.81889 | 0.0144 |
| At most 1 | 0.366425 | 33.40368 | 47.85613 | 0.5346 |
| At most 2 | 0.189948 | 15.60497 | 29.79707 | 0.7397 |
| At most 3 | 0.134351 | 7.389364 | 15.49471 | 0.5328 |
| At most 4 | 0.044189 | 1.762595 | 3.841466 | 0.1843 |

Trace test indicates 1 cointegrating eqn(s) at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level

**Table 4 Johansen Maximum Eigenvalue Test**

Unrestricted Cointegration Rank Test (Maximum Eigenvalue)

| Hypothesized No. of CE(s) | Eigenvalue | Max-Eigen Statistic | 0.05 Critical Value | Prob.** |
|---|---|---|---|---|
| None * | 0.665508 | 42.71059 | 33.87687 | 0.0034 |
| At most 1 | 0.366425 | 17.79871 | 27.58434 | 0.5119 |
| At most 2 | 0.189948 | 8.215602 | 21.13162 | 0.8900 |
| At most 3 | 0.134351 | 5.626769 | 14.26460 | 0.6614 |
| At most 4 | 0.044189 | 1.762595 | 3.841466 | 0.1843 |

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

Table 3 and 4 shows the summary result of the Johanson's Maximum Likelihood co-integration test. The test relations were estimated with intercept and linear tend in Vector Auto Regression (VAR) model of order one (1) with a lag length of one (1), which was found to be most parsimonious for the data series. The λ-trace statistic rejects the null of $r \leq 0$ but cannot reject $r \geq 1$ and also, the λ-max statistic rejects the null of $r = 0$ but fails to reject $r = 1$ at 5% level. These Eigenvalue tests based on stochastic matrix indicate existence of the cointegrating relationship between industrial outputs, non-oil exports, national income, oil revenue and policy shift.

Since the long-run cointegration relationship is found among the variables, an estimation of the cointegrating vector was employed using the Vector Error Correcting Model (VECM). The result of the short run cointegrating vector is presented below.

**Table 5: Short run model**

| Error Correction: | D(LINDP) | D(LOIP) | D(LNGDP) | D(LNOEXP) | D(DUMMY) |
|---|---|---|---|---|---|
| CointEq1 | -0.231610 | 0.813591 | 0.003272 | 0.258159 | 0.004567 |
| | (0.02451) | (0.03956) | (0.01015) | (0.15356) | (0.06609) |
| | [-1.28944] | [ 2.39605] | [ 0.32236] | [ 1.68118] | [ 0.06911] |

It has been established in econometric analysis that the basis for the Vector Error Correction Model is to establish the existence of an adjustment mechanism in the short run model. The coefficient of the error-correction terms in the study carries the correct sign and it is statistically significant at 5 percent, with the speed of convergence to equilibrium (which is often referred to as the ECM) at 3 per cent. The result of the ECM suggest that the speed at which industrial output will converge towards long-run equilibrium after experiencing shock from oil revenue is very slow. The result

put a very strong point on the impact of oil revenue shock on industrial production, especially in the short run. The result signifies that it takes a very slow process for industrial output to recover from shock arising from variation in oil revenue. The result further showed that oil revenue, national income, non-oil export and policy/regime shift reacted positively to industrial output at the short run.

The long run model presented below in table 6 reveal that industrial output reacted negatively to shock from oil revenue, non-oil export and policy/regime shift.

**Table 6 Long-run model**

| : | D(LINDP) | D(LOIP) | D(LNGDP) | D(LNOEXP) | D(DUMMY) |
|---|---|---|---|---|---|
| | 1.000000 | -0.606755 | 1.687984 | -1.332090 | -0.517254 |
| | | (0.16718) | (1.29009) | (0.37347) | (0.29405) |
| | | [-3.62944] | [ 1.30842] | [-3.56683] | [-1.75906] |

In the long run shows that the coefficient of oil revenue has negative relationship with industrial output and is statistically significant at 5 percent. The result shows that a 10 percent variation in oil revenue will reduce industrial output by 61 percent. The coefficient of policy/regime shift is also observed to be negative and also significant at 5 percent. A change in governance though has a positive impact on industrial output in the short run; however, this positive impact is always short lived as in the long run while industrialist are grappling with adjusting to policy changes, further changes in governance results to a negative effect on industrial output. It therefore becomes necessary to have a stable government that will have sufficient time horizon to pursue and see to the completion/accomplishment of policies relating to industrial development in Nigeria. Most worrisome in the result above is the long run negative impact of non-oil exports on industrial output. The possible explanation for this could be that the negative effect of shock to oil revenue and policy/regime shift on industrial output has a collaborating effect on non-oil output.

Figure 1: CUSUM Test

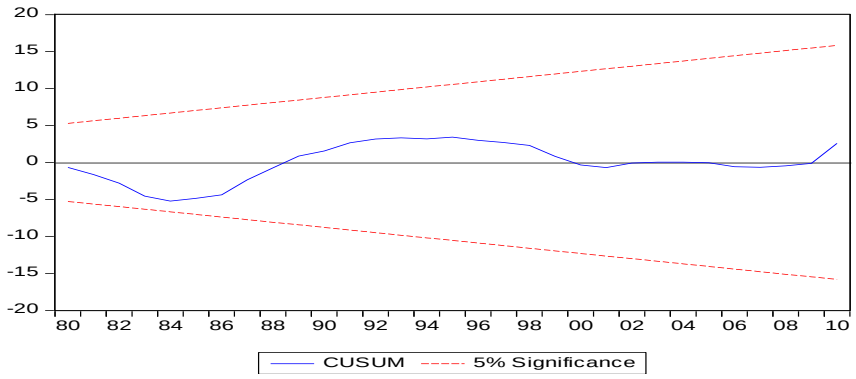
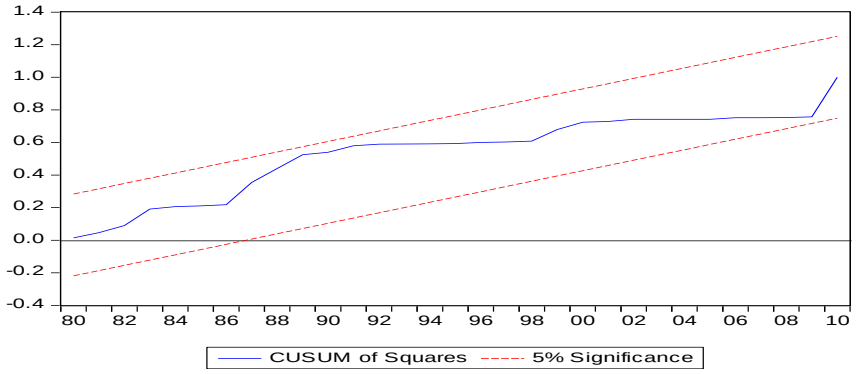



Figure 2: CUSUMSQ Test



**Parameter Stability Test**

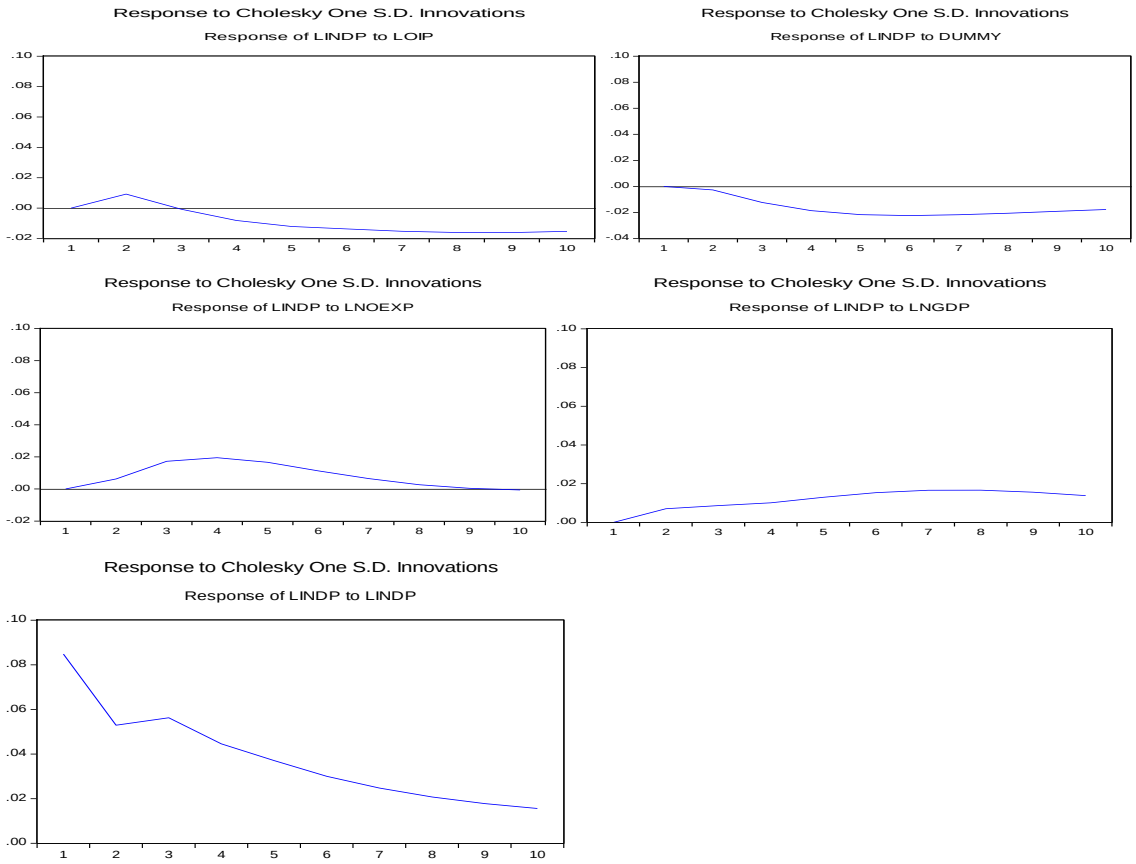
We can observe in the long run result presented in table 6 that the log of GDP and log of Non-oil export were in excess of 1, it is therefore becomes necessary to conduct parameter stability test to ensure that the estimated parameter are not varying over time. As noted by Fowowe (2010) and Hansen (1992) an unstable parameter can result in a misspecification of the model and could lead to biased results. The study utilizes the cumulative sum (CUSUM) and the cumulative sum of squares (CUSUMSQ) test to confirm the parameter stability test. Figure 1 and 2 below present the result of the CUSUM and CUSUMSQ the model specification and parameter consistency test. The pair of the straight line in each figure indicates the 5 percent significance level. The null hypothesis of correct specification and parameter consistency can be accepted if the plotted CUSUM and CUSUMSQ lie inside the straight lines. However, if the CUSUS and CUSUMSQ lies outside the plotted lines, then the null hypothesis will be rejected and it will be concluded that the parameters in the model are not correctly specified.

It can be observed from figure 1 and figure 2 that the CUSUM and CUSUMSQ plotted both lie within the straight lines at 5 percent level of significance. It can therefore be concluded that our equations are correctly specified and the parameters are stable in the model.

**Impulse Response Function Test**

The impulse response function are dynamic simulations showing the response of an endogenous variables to a given shock overtime. Figure 3 below shows that impulse response of an asymmetric effect of industrial output to oil revenue shock and non-oil exports, national income and policy/regime shift in Nigeria. The result shows that each variable respond significantly to its own standard deviation shock.

Figure 3: Impulse Response Function




The result reveal that industrial output respond positively to oil revenue shock in the first quarter and decrease permanently after the 3rd quarter. This result confirms the result obtained in the VECM that the positive impact of oil revenue shock on industrial output is only in the short run and becomes negative in the long run. The result show that as oil revenue receipt increase, probably due to increase in oil prices for oil exporting countries like Nigeria, the windfall is

used to the benefit of industries. However, when such windfalls are short lived, government attention is driven away from the industrial sector to other sectors of the economy, thus leading to the crisis experienced in the industrial sectors. The response of industrial output to policy shift is uncertain in the 1st quarter. However, the response becomes negative permanently after the 2nd quarter. The result above reveals that Industrial output response positively to non-oil export after the 1st quarter. This positive response peaked at the 4th quarter and then decreases and further flattened out after the 8th quarter. The result confirms economic theory that industrial out should, under normal circumstances, increase as non-oil exports increases.

**Variance Decomposition Test**

The variance decomposition (VDC) attempts to answer the question; what is the relative importance of the response of industrial output to oil revenue shocks, non-oil export and policy/regime shift in the VAR? Variance decomposition also attempt to show how much of the variation in industrial out are due to the variations of the included variables in the model. The approach accomplishes this by providing a quantitative measure of the proportion of the shocks to each variable that is accounted for by its own shocks and shocks to other variables.

The VDCs, in what follows are obtained using similar Cholesky orderings as the ones for the impulse response functions (IRF's). Table 7 presents the result for variance decomposition at horizons for 24 months for industrial out, real national income, non-oil exports, oil revenue and policy/regime shift. The result shows that contribution of industrial output to variations in oil revenue shock was 15 percent at the six quarter; this figure decreases as the months go by until it reached 6.8 percent in the 24th quarter.

The variance of industrial output was driven by itself in the first quarter, contributing about 96 percent of the total variations. By the 12th quarter, other variables contributed about 23 percent of total variation in industrial output. Non-oil export which appeared as the second driver of industrial output contributed about 17 percent to the innovations in industrial output by the 6th quarter and thereafter increased marginally to 19 percent in the 12th quarter and 20 percent in the 24th quarter. Thus, the most important variables that are responsible for innovations in industrial output in Nigeria are innovations from itself and those from non-oil export.

Variations in non-oil export were majorly driven by itself, particularly, during the first quarter of the forecast horizon where the share of the variation was 96 percent. By the end of the 18th quarter the share of oil revenue to non-oil exports had risen to 18 percent while other remaining variables contributed about 6 percent. Therefore, the key drives of non-oil export are innovations from itself and oil revenue.

Variance Decomposition of LOIP

| Period | S.E. | LOIP | LINDP | LNOEXP | DUMMY | LNGDP |
|---|---|---|---|---|---|---|
| 1 | 1.267901 | 100.0000 | 0.000000 | 0.000000 | 0.000000 | 0.000000 |
| 6 | 1.810878 | 66.85599 | 15.47208 | 8.621324 | 8.783455 | 0.267154 |
| 18 | 2.487460 | 52.52821 | 8.412588 | 29.63330 | 8.722807 | 0.703093 |
| 24 | 2.759130 | 49.71209 | 6.889937 | 33.76884 | 8.839433 | 0.789699 |

Variance Decomposition of LINDP

| Period | S.E. | LOIP | LINDP | LNOEXP | DUMMY | LNGDP |
|---|---|---|---|---|---|---|
| 1 | 0.091537 | 3.486713 | 96.51329 | 0.000000 | 0.000000 | 0.000000 |
| 6 | 0.246408 | 11.22151 | 68.82409 | 17.03800 | 2.849333 | 0.067063 |
| 12 | 0.356380 | 9.963560 | 67.04977 | 19.23182 | 3.698388 | 0.056457 |
| 18 | 0.439389 | 9.669341 | 66.39941 | 19.95069 | 3.927321 | 0.053236 |
| 24 | 0.508932 | 9.522200 | 66.08212 | 20.30191 | 4.042153 | 0.051613 |

Variance Decomposition of LNOEXP

| Period | S.E. | LOIP | LINDP | LNOEXP | DUMMY | LNGDP |
|---|---|---|---|---|---|---|
| 1 | 0.573387 | 0.527518 | 2.820101 | 96.65238 | 0.000000 | 0.000000 |
| 6 | 1.069448 | 10.03652 | 4.242782 | 82.99560 | 1.934484 | 0.790608 |
| 12 | 1.282040 | 18.07844 | 3.000725 | 76.80463 | 1.452069 | 0.664133 |
| 18 | 1.469796 | 21.87136 | 2.284420 | 74.02507 | 1.220174 | 0.598979 |
| 24 | 1.635542 | 24.22258 | 1.845305 | 72.29859 | 1.074579 | 0.558944 |

The result from National income is most remarkable. The result reveals that 70 percent variation in national income was due to innovations from industrial output, non-oil export and policy/regime shift. For instance, in the first quarter of the horizon, industrial output contributed about 46 percent variation to national income while non-oil export and policy/regime shift contributed 12 each respectively. Innovations from national income accounted for just 29 percent variations in the first quarter. By the end of the 18$^{th}$ quarter, innovations from non-oil export and policy/regime shift had increased to 30 percent and 15 percent respectively. This result shows that the main drivers of variation in national income are industrial output, non-oil exports and policy/regime shift.

Variance Decomposition of LNGDP

| Period | S.E. | LOIP | LINDP | LNOEXP | DUMMY | LNGDP |
|---|---|---|---|---|---|---|
| 1 | 0.037903 | 0.215424 | 46.07065 | 12.19845 | 12.18685 | 29.32862 |
| 6 | 0.070090 | 4.947030 | 25.09775 | 27.75395 | 14.55501 | 27.64626 |
| 12 | 0.090233 | 3.768686 | 21.63722 | 29.44896 | 15.15129 | 29.99384 |
| 18 | 0.106654 | 3.330858 | 19.97377 | 30.23236 | 15.44512 | 31.01789 |
| 24 | 0.120861 | 3.081142 | 19.06592 | 30.64924 | 15.61343 | 31.59026 |

Variance Decomposition of Dummy

| Period | S.E. | LOIP | LINDP | LNOEXP | DUMMY | LNGDP |
|---|---|---|---|---|---|---|
| 1 | 0.246777 | 3.981563 | 19.79111 | 4.344318 | 71.88301 | 0.000000 |
| 6 | 0.760213 | 25.68292 | 29.56203 | 16.54931 | 27.66911 | 0.536625 |
| 12 | 1.059803 | 23.48515 | 28.83257 | 20.30758 | 26.75655 | 0.618143 |
| 18 | 1.292004 | 22.91776 | 28.64093 | 21.34214 | 26.46061 | 0.638555 |
| 24 | 1.488294 | 22.61765 | 28.51549 | 21.89706 | 26.32020 | 0.649600 |

**5. Policy Implications and Conclusion**

The study had set forth to explore the intertwining relationship that exist between oil revenue, non-oil export and industrial output in Nigeria. It is important to understand this crucial relationship in other to direct policy attention to priority sectors that will enhance and accelerate economic growth. The study utilized data spanning the period 1970-2010. This period captured the major era of regime shift (changes in governance) and policy administration in Nigeria.

Vector Autoregressive (VAR) model and cointegration technique were used to examine the long run relationship, while the Vector Error Correction Model (VECM) was used to analyze the short-run behavior of the variables. The short-run result showed that the ECM (which suggests the speed at which industrial output will converge towards long-run equilibrium after experiencing shock from oil revenue) is very slow. The result signifies that it takes a very slow

process for industrial output to recover from shock arising from variation in oil revenue. Furthermore, all the variables responded positively to industrial output in the short run.

The long run result shows that the coefficient of oil revenue had negative relationship with industrial output and was statistically significant at 5 percent. The coefficient of policy/regime shift was also observed to be negative and also significant at 5 percent. It can be understood from the long run result that a change in governance though has a positive impact on industrial output in the short run; however, in the long run changes in governance results to a negative effect on industrial output. The impulse response function and variance decomposition analysis suggest that the major drivers of industrial development in Nigeria are non-oil export, regime shift and oil revenue. Thus innovations from these variables impact severely on industrial growth in Nigeria. The study suggest that the panacea to the dwindling industrial sector in Nigeria is to

Diversify the economy away from crude oil and encourage the growth of Small and Medium Scale Entrepreneurs who are the major drivers of the production of products non-oil export. The paper however appreciates the current effort of the government in providing small funds to the entrepreneur through the Microenterprise Development Agencies (MEDA). However, the study underscores the need to not only monitor the use of these funds but also nurture these medium scale entrepreneurs until full scale growth is achieved.

The implication of the above result is that government policies in tackling the impact of fluctuations in real oil revenues are important source of stabilizing the growth of industrialization. Thus, the Nigerian government should consider this all important relationship between real oil revenue and industrial output in planning and implementation of economic policies.

Continuous change in governance appear as a major distortion to industrialization and non-oil exports in Nigeria. It therefore becomes necessary to have a stable government that will have sufficient time horizon to pursue and see to the completion/accomplishment of policies relating to industrial development in Nigeria.

The issue of corruption and lack of accountability in government and particularly, at the Nigerian National Petroleum Corporation, (NNPC) should be addressed strongly.

**References**

Adebiyi, A, (2001) Trade Liberalisation Policy and Industrial Growth Performance In Nigeria: An Error Correction Mechanism (ECM) Technique. (Online) Available www.*bayoadebiyi.com/Adebiyi Michael Adebayo/trade liberalization policy and industrial growth performance in Nigeria*

Adejugbe, M.O.A, (1980) Nigeria's industrial Policies and performance in the Military Era, 1966-1979 Proceedings of the annual Conference of the Nigeria Economic Society

Adejugbe, M.O.A, (1997) Stimulating Non-oil Sector through Marketing and Trading Strategies" Central Bank of Nigeria Economic and Financial Review. Vol 35.(4)22-26

Adeniran, O, (2008) Does Energy Consumption cause Economic Growth? An Empirical Evidence from Nigeria. (Online) Available *www.dundee.ac.uk/cepmlp/gateway/files.php?*

Ahmed, J., and Harnhinen, S, (1995) Unit roots and co-integration in Estimating Causality between Exports and Economic growth: Empirical Evidence from The ASEAN countries, Economic Letters, 49

Ajayi, Dare Dickson, (2007) Recent Trends and Patterns in Nigeria's Industrial Development. Africa Development, Vol. (32); 2.

Alao, R.O, (2010) Productivity in the Nigerian Manufacturing Sub-Sector: An Error Correction Model (ECM). European Journal of Economics, Finance and Administrative Sciences. Issue 20, 25-33

Aworawo, D,(2011) Costly Neglect: Technology, Industrialization and the Crisis of Development in Nigeria. The Journal of International Social Research. 4(17)

Awoseyila, A.P, (1997) Appraisal of past and Present Policy Measures for Reviewing Nigeria's Non-oil Sector and Policy Implications for the future. Central Bank of Nigeria Economic and Financial Review. 35. (4)

Babawale, T. A. et al., (1996) 'Nigeria Beyond Structural Adjustment: Towards a National Popular Alternative Development Strategy', Africa Development, 21 (3)

Balogun, E.D, (1997) Towards Efficient Institutional Arrangements for Non-oil Sector Development in Nigeria. Central Bank of Nigeria Economic and Financial Review. 35 (4)

Chimobi, O.P, (2010) The Estimation of Long-run Relationship between Economic Growth, Investment and Export in Nigeria. International Journal of Business and Management. 5,( 4) 215-219

Díaz-Bautista, A, (2004) Mexico's Industrial Engine of Growth: Cointegration and Causality. (Online) Available www. *ideas.repec.org/p/wpa/wuwpem/0402010.html*

Dickey, D.A and Fuller, W.A, (1979) Distributions of the Estimators for Autoregressive Time Series with a Unit root, Journal of the American Statistical Association, **74**,

Enang,B.U, (2010) Industrial Development, Electricity Crisis and Economic Performance in Nigeria. European Journal of Economics, Finance and Administrative Sciences, Issue 18

Engel, R.F and Granger, C. W, (1987) Co-integration and Error Correction Representation, Estimation and Testing. Econometrica 55 (2) 251-76

Feder, H,. (2007) A Multivariate Causality Analysis of Export and Growth for Turkey" MPRA Paper No. 3565

Fowowe, B, (2010) Financial Liberalisation and Financial Fragility in Nigeria. Central Bank of Nigeria Economic and Financial Review 48(1): 71-92

Hansen, B.E, (1992) Test for Parameter Stability in Regression with 1(1) Processes. Journal of Business and Economic Statistics. 10(3): 321-335

Ikpeze, N, Soludo, C.C and Elekwa, N.N, (2001) Nigeria: The Political Economy of the Policy Process, policy Choice and Implementation" Industrial policy in Africa-Forced Consensus. Chapter 13

Johanson, Soren, (1989) Statistical Analysis of Co-integration Vectors" Journal of Economic Dynamics and Control: 12

Johansen, S. and Juselius, K, (1990) Maximum Likelihood Estimation and Inference on Co-integration- with Applications to the Demand for Money", Oxford Bulletin of Economics and Statistics, 52,

Kemal, A. R., Din, M., Qadir, U., Fernando, L. and Colombage , S, (2002) Exports and Economic Growth in South Asia" A Study prepared for the South Asia Network of Economic Research Institutes.

Klien, N, (2010) The linkage between the Oil and Non-oil Sector: A panel VAR Approach. IMF Working Paper, International Monetary Fund WP/10/118 Available at http/relooney.info/0_NS4053_720.pdf

Mamun, K., Al, A. and Nath, H.K, (2005) Export–led growth in Bangladesh: a time series analysis", Applied Economics Letters,12(6)

Nelson, C.F and Plosser, C.I, (1982) Trends and Random walks in Macroeconomic Time-series-some Evidence and implications," Journal of Monetary Economics, 10

Onyeonoru, I, (2003) Globalization and Industrial Performance in Nigeria', Africa Development, 28(3 & 4)

Ojapinwa, T. V and Ejumedia, P.E, (2010) The industrial impact of oil price shock in Nigeria: (1970-2010) European Scientific Journal. 8(12) 113-126.

Pesaran, M.H., Shin, Y and Smith, R.J, (2001) Bounds testing approaches to the analysis of level relationships" Journal of Applied Econometrics, **16**.

Phillips, P.C. and Perron, P, (1988) Testing for a unit root in a time series regression, Biometrica, 75.

Akpan, E S, Riman, H B, Duke, 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 Finance and Economics, Vol. 4 (2)

Soludo, C.C, (1998) Africa: Industrialisation Strategy in the context of Globalization" In Iqbal and M. khan (Eds) Trade Reforms and Regional Integration in Africa. Washington, DC. IMF

Uddin, M.G.S and Norman, A.M, (2009) Causality between Industrial Production and Exports in Bangladesh. (Online) Available www.gbmf.info/2009/**Causality**_Gazi_salah_uddin.pdf

*Ukpong, G.E, (1997) Production Trend of Selected Non-oil Products in Nigeria.* Central Bank of Nigeria Economic and Financial Review. 35(4)