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# SECTORAL ANALYSIS OF THE EFFECTIVENESS OF FOREIGN AID IN NIGERIA

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***Abstract***
*This paper examines the effectiveness of foreign aid on the agriculture and industrial sectors in Nigeria using the ARDL and the ECM approach as well as data covering the period 1980 to 2010. While all the variables used were found to be I(1), one cointegration relationship exists between the dependent and the independent variables in the estimations. A major policy implication of the results is that foreign aid should be invested into the agricultural sector rather than the industrial sector as this will further boost the overall economic growth in Nigeria through improved agricultural output.*

**Key words: Agriculture, ARDL, ECM, Foreign Aid, Industry**

## Introduction

Most developing countries are bedeviled by high poverty level, massive unemployment, low capacity utilization in industrial industry, labour-intensive production, and low agricultural output, among others. The resources or inputs required to aid production in, say, the agricultural and the industrial sectors are capital-intensive and therefore require assistance from development partners in the form of foreign aid. Kargbo (2012) opines that the much needed capital to boost economic growth and welfare is largely

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inadequate domestically, which consequently warrants the need for external capital. Theoretically, foreign aid is meant to bridge the savings - investment gap that poor and emerging economies face. The effectiveness of foreign aid has been the subject of much debate in economics. Most of the previous studies of aid-growth nexus have produced ambiguous results and have been criticized for methodological shortcomings. Another reason is that most studies are based on cross-country regressions, which lump together countries of heterogeneous characteristics and size; hence, they cannot be used for country-specific policy. Gomanee, Girma & Morrissey (2001) argue that aid may not influence all policies and, therefore, it is difficult to assess the impact of foreign aid on policy at least in a cross-country framework.

Studies on the aid-growth nexus for Nigeria are mainly cross - country studies (e.g. Adamu & Ighodaro, 2012; Uneze, 2011), and even the country specific studies focus on the impact of foreign aid on the overall economy, as exemplified by the studies of (Fasanya & Onakoya, (2012), Bakare (2011), Abidemi, Abidemi & Olawale, (2011). These studies did not consider the effectiveness of foreign aid on sectoral growth. The present study fills this gap by empirically considering the effectiveness of foreign aid in Nigeria as it relates to the agricultural and industrial sectors. Following section 1, section 2 reviews some relevant literature, theoretical framework and model specification are considered in section 3, while section 4 dwells on presentation and interpretation of results. Section 5 provides policy implications of results and our conclusion.

## Effectiveness of Foreign Aid

The focus on foreign aid and its effectiveness can be traced back to the two-gap model (Chenery & Strout, 1966). This remains the most influential theoretical underpinning of the foreign aid effectiveness literature. Foreign aid flows are meant to fill the gap between investment needs and domestic savings. Bacha (1990) and Taylor (1994) also recognize that the governments of some developing countries simply do not have the revenue raising capacity to cover a desired level of investment, hence the need for foreign aid.

Using cross -country data, Adamu & Ighodaro (2012) attempted to ascertain the impact of foreign aid on economic growth in ECOWAS countries using panel data for 14 countries covering the period 1999 through 2009. Their study found language and country effects which were significant. Foreign aid has a significant and positive effect on growth among the ECOWAS countries, with effect stronger in the French- speaking countries. Uneze (2011) on his part tested the impact of foreign aid and aid uncertainty on private investment in West Africa using an unbalanced panel data from 1975 to 2004. The results show that multilateral aid affects private investment positively but not bilateral aid. On the contrary, uncertainty has a negative impact on private investment. Mallik (2008) examined the effectiveness of foreign aid on economic growth using a cointegration and the ECM for the period 1965-2005 in the six poorest highly aid dependent African countries (Central African Republic, Malawi, Mali, Niger, Sierra Leone and Togo). The empirical result estimated for each country shows that in the five out of the six countries, foreign aid has a significant negative long run effect on economic growth, the only exception was Togo. Foreign aid has a long run positive impact on growth in Togo. In the short run, aid has no significant effect on economic growth per capita for most of the countries except for Niger.

## Theoretical Framework and Model Specification

Consider a generalized neoclassical aggregate production function augmented with exports as below:

$$Y_t = A_t F(K_t, N_t, X_t) \qquad (1)$$

where $Y_t$ is the aggregate output, $K_t$ is capital inputs, $N_t$ is population, $A_t$ is Total Factor Productivity (TFP) and $X_t$ are exports.

The production function, equation (1) is the export growth model originally proposed by Ballasa (1978). To introduce foreign aid in the form of Official Development Assistance (ODA), we follow Burke & Ahmadi-Esfahani (2006) with the assumption that capital can be decomposed into domestic savings and foreign aid. The "savings

gap" is the idea behind disaggregating capital into savings and foreign aid. According to Chenery & Strout (1966), foreign aid can be used to solve the problem of domestic savings which could be directed to investment and for the purpose of this study, investment into the agricultural and the industrial sectors. $K$ in equation (1) can be decomposed into foreign aid and savings. Equation (1) can be rewritten as:

$$Y_t = A_t(S_t, FA_t, N_t, X_t) \qquad \textbf{(2)}$$

Where $S_t$ is gross domestic savings; $FA_t$ is foreign aid (ODA) and other variables are as earlier defined apart from the dependent variables which are taken to be output of the agricultural and industrial sectors represented as $Y_{AGR}$ and $Y_{IND}$ in the estimated equations. To know the contribution of each of the variable to the output of the agricultural and the industrial sector, equation **(2)** can be rewritten as:

$$Y_t = A_t(S_t^{\alpha}, FA_t^{\beta}, N_t^{\delta}, X_t^{\gamma}) \qquad \textbf{(3)}$$

Where $A_t$ is technological trend, though held constant hereafter.

To interpret the coefficients as elasticities, we take the logarithms of both sides of equation **(3)**, resulting in:

$$L(Y_t) = \alpha L(S_t) + \beta L(FA_t) + \delta L(N_t) + \gamma L(X_t) \qquad \textbf{(4)}$$

*A priori*, it is expected that $\alpha, \beta, \delta, \gamma, \succ 0$. The major interest here is to know the sign of the parameter $\beta$.

## Econometric Procedure

### a. The Stationarity Test:

This paper uses the Augmented Dickey-Fuller unit root test with trend and intercept as below:

$$\Delta x_t = \gamma_0 + \gamma_1 t + \rho x_{t-1} + \phi \sum_{t-1}^{k} \Delta x_{t-k} + \mu_t \qquad \textbf{(5)}$$

The expression of the variables of interest in equation (5) is $x_t$, that is $x_t = [Y_t, S_t, FA_t, N_t, X_t, A_t]$.

### b. Johansen Cointegration Test

The Johansen (1988) cointegration method was used to test for long run relationship among the variables used for the estimation. For simplicity, consider an unrestricted order one Vector Autoregression (VAR) system of the variables of interest put in a compact form as:

$$Z_t = Z_{t-1}A_1 + A_0 + \varepsilon_t \qquad (6)$$

In general, the unrestricted VAR system can be expressed in order of lag 5Ø]Ü terms and can be expressed as:

$$Z_t = A_0 + Z_{t-1}A_1 + Z_{t-2}A_2 + \ldots + Z_{t-p}A_p + \varepsilon_t \qquad (7)$$

where the lag order can be determined by the model which minimizes the Akaike Information Criterion (AIC) and Schwarz Bayesian Information Criterion (SBIC). Suppose the appropriate lag order has been found then the expression in equation **(7)** can be rewritten in its Vector Error Correction (VEC) form as:

$$\Delta Z_t = A_0 + Z_{t-1}\Pi + \Delta Z_{t-1}\Gamma_1 + \Delta Z_{t-2}\Gamma_2 + \ldots + \Delta Z_{t-p+1} + \varepsilon_t \qquad (8)$$

Where $\Gamma_i = -\sum_{j=i+1}^{p} A_j$ and $\Pi = \sum_{j=1}^{p} A_j$. Johansen (1988) showed that the coefficient matrix $\prod$ conveys the information concerning the long-run relationship between the $Z_t$ variables. The rank of the matrix indicates the number of cointegrating relationships existing between the variables in.

### c. The Error Correction Model (ECM)

The acceptance of cointegration between two series implies that there exists a long-run relationship between them, meaning that an Error Correction Model (ECM) exists. The Error Correction model to be estimated is:

$$\Delta Y_t = \eta + \sum_{i=1}^{j} \lambda \Delta S_{t-i} + \sum_{i=1}^{k} \pi \Delta FA_{t-i} + \sum_{i=1}^{l} \sigma \Delta N_{t-1} + \sum_{i-1}^{m} \tau \Delta X_{t-1} + \psi ecm(-1) + \mu_t \qquad (9)$$

where: $\Delta$ is lag operator

$ecm(-1)$ is one period lag of the residual

$\eta$ is the constant term

$\lambda, \pi, \sigma, \tau, \psi$ are respective parameters

$\mu_t$ is the error term

The Autoregressive Distributed Lag (ARDL) method developed by Pesaran and Pesaran (1997) is applied to establish cointegration relationships among the variables using the Microfit 4.0.

**Table 1: Result of ADF Unit Root Test**

| Variables | ADF Lag | ADF Test Statistics | 95% value for the ADF Statistic | Remark |
|---|---|---|---|---|
| LNFA | 1 | -5.5704 | -3.5796 | Stationary |
| LNN | 1 | -5.2058 | -3.5796 | Stationary |
| $LNY_{IND}$ | 1 | -5.3941 | -3.5796 | Stationary |
| LNS | 1 | -4.0393 | -3.5796 | Stationary |
| $LNY_{AGR}$ | 1 | -4.3222 | -3.5796 | Stationary |
| LNX | 1 | -3.8776 | -3.5796 | Stationary |

**Note: Dickey – Fuller regression includes an intercept and a linear trend**

## Cointegration Results

The Johansen cointegration results (Maximum Eigenvalue and Trace Tests) are reported in Tables 2 to 5 below.

**Table 2: Cointegration LR Test Based on Maximal Eigenvalue of the Stochastic Matrix**

29 observations from 1982 to 2010. Order of VAR = 2.

List of variables included in the cointegrating vector:

| $LNY_{AGR}$ | LNS | LNFA | LNN | LN |
|---|---|---|---|---|
| Null | Alternative | Statistic | 95% Critical Value | 90% Critical Value |
| r = 0 | r = 1 | 56.2411 | 37.8600 | 35.0400 |
| r<= 1 | r = 2 | 21.5916 | 31.7900 | 29.1300 |
| r<= 2 | r = 3 | 20.1746 | 25.4200 | 23.1000 |
| r<= 3 | r = 4 | 13.0959 | 19.2200 | 17.1800 |
| r<= 4 | r = 5 | 6.0293 | 12.3900 | 10.5500 |

Use the above table to determine r (the number of cointegrating vectors).

**Table 3: Cointegration LR Test Based on Trace of the Stochastic Matrix**

Cointegration LR Test Based on Trace of the Stochastic Matrix

29 observations from 1982 to 2010. Order of VAR = 2.
List of variables included in the cointegrating vector:
$LNY_{AGR}$ LNS LN FA LNN LNX

| Null | Alternative | Statistic | 95% Critical Value | 90% Critical Value |
|---|---|---|---|---|
| r = 0 | r>= 1 | 117.1326 | 87.1700 | 82.8800 |
| r<= 1 | r>= 2 | 60.8915 | 63.0000 | 59.1600 |
| r<= 2 | r>= 3 | 39.2998 | 42.3400 | 39.3400 |
| r<= 3 | r>= 4 | 19.1253 | 25.7700 | 23.0800 |
| r<= 4 | r = 5 | 6.0293 | 12.3900 | 10.5500 |

Use the above table to determiner (the number of cointegrating vectors).

Use the above table to determine r (the number of cointegrating vectors).

**Table 4: Cointegration LR Test Based on Maximal Eigenvalue of the Stochastic Matrix**

Cointegration LR Test Based on Maximal Eigenvalue of the Stochastic Matrix

29 observations from 1982 to 2010. Order of VAR = 2.
List of variables includedn the cointegrating vector:
$LNY_{IND}$ LNS LNFA LNN

| Null | Alternative | Statistic | 95% Critical Value | 90% Critical Value |
|---|---|---|---|---|
| r = 0 | r = 1 | 36.0506 | 23.9200 | 21.5800 |
| r<= 1 | r = 2 | 16.6703 | 17.6800 | 15.5700 |
| r<= 2 | r = 3 | 6.0914 | 11.0300 | 9.2800 |
| r<= 3 | r = 4 | .7495E-4 | 4.1600 | 3.0400 |

Use the above table to determine r (the number of cointegrating vectors).

**Table 5: Cointegration LR Test Based on Trace of the Stochastic Matrix**

Cointegration with no intercepts or trends in the VAR

29 observations from 1982 to 2010. Order of VAR = 2.
List of variables included in the cointegrating vector:
$LN_{IND}$ LNS LNFA LNN

| Null | Alternative | Statistic | 95% Critical Value | 90% Critical Value |
|---|---|---|---|---|
| r = 0 | r>= 1 | 58.8124 | 39.8100 | 36.6900 |
| r<= 1 | r>= 2 | 22.7617 | 24.0500 | 21.4600 |
| r<= 2 | r>= 3 | 6.0915 | 12.3600 | 10.2500 |
| r<= 3 | r = 4 | .7495E-4 | 4.1600 | 3.0400 |

Use the above table to determine r (the number of cointegrating vectors).

The results show that there is a long-run relationship between agricultural output and the independent variables (Tables 2 and 3) as well as between industrial output and the independent variables (Tables 4 and 5).

An examination of the results in Table 6 below shows that though domestic savings is not significant in the determination of agricultural output in Nigeria, it has a positive relationship with agricultural output. Also, the exposure of the country to foreign aid has positive and significant impact on the growth of the agricultural sector. This implies that higher foreign aid has been associated with higher agricultural output. Population is positively signed implying that a higher level of population is associated with higher growth of agricultural output. This finding shows that the consequence of population on Nigeria's economic growth will manifest directly through increases in agricultural output. The coefficient of total exports is negatively signed, though significant in the determination of agricultural output in Nigeria. The model has a good fit. It explains about 98.6 percent of the systematic variations in the dependent variable. The F – statistic value of 258.5183 shows the existence of a significant relationship between the dependent variable and the regressors. The DW statistic value of 1.67 indicates the absence of any serious problem of autocorrelation in the residual.

## Table 6: ARDL (1,2,0,0,0) selected based on Akaike Information Criterion

**Table 6: ARDL (1,2,0,0,0) selected based on Akaike Information Criterion**

Dependent variableis $LNY_{AGR}$
29 observations used for estimation from 1982 to 2010

| Regressor | Coefficient | Standard Error | T-Ratio[Prob] |
|---|---|---|---|
| $LNY_{AGR}(-1)$ | .44568 | .16988 | 2.6235[.016] |
| LNS | .018011 | .12477 | .14435[.887] |
| LNS(-1) | -.21490 | .20313 | -1.0579[.302] |
| LNS(-2) | .39004 | .16825 | 2.3182[.030] |
| LNFA | .055159 | .025198 | 2.1890[.039] |
| LNN | .27063 | .084584 | 3.1996[.004] |
| LNX | -.077316 | .030077 | -2.5706[.017] |

| | | | |
|---|---|---|---|
| R - Squared | .98601 | R-Bar -Squared | .98220 |
| S.E. of Regression | .072947 | F-stat. F( 6, 22) | 258.5183[.000] |
| Akaike Info. Criterion | 31.7793 | Schwarz Bayesian Criterion | 26.9937 |
| DW-statistic | 1.6739 | Durbin's h -statistic | 2.1745[.030] |

Table 7 below shows that domestic savings impact positively and significantly on the country's industrial output even at one period lag value. It suggests that the impact of domestic savings has been more beneficial to the industrial output of the country. The empirical result further indicates that the exposure of the country to foreign aid impacts negatively, though significantly, on the industrial output of the country. The Population variable has a positively signed coefficient. It suggests that a higher level of population is associated with higher industrial output. The model has a good fit. It explained about 95.6 percent of the systematic variations in the dependent variable. The F – statistic value of 80.88 is a pointer to the existence of a significant relationship between the dependent variable and the regressors. The DW statistic value of 2.1 indicates the absence of any serious problem of autocorrelation in the residual.

**Table 7: ARDL (1,2,0,0,0) selected based on Akaike Information Criterion**

**Table 7: ARDL (1,2,0,0,0) selected based on Akaike Information Criterion**
Dependent variable is $LNY_{IND}$
29 observations used for estimation from 1982 to 2010

| Regressor | Coefficient | Standard Error | T-Ratio[Prob] |
|---|---|---|---|
| $LNY_{IND}(-1)$ | .65302 | .16573 | 3.9403[.001] |
| $LN_{IND}(-2)$ | -.091691 | .045611 | -2.0103[.057] |
| LNS | .52888 | .12041 | 4.3922[.000] |
| LNS(-1) | -.44589 | .12008 | -3.7133[.001] |
| LNFA | -.051791 | .024314 | -2.1301[.045] |
| LNN | 12.6370 | 5.3209 | 2.3750[.027] |
| LNN(-1) | -12.4106 | 5.3563 | -2.3170[.030] |

| | | | |
|---|---|---|---|
| R-Squared | .95663 | R-Bar-Squared | .94481 |
| S.E. of Regression | .071407 | F-stat. F( 6, 22) | 80.8833[.000] |
| Mean of Dependent Variable | 11.6705 | S.D. of Dependent Variable | .30394 |
| Residual Sum of Squares | .11218 | Equation Log-likelihood | 39.3980 |
| Akaike Info. Criterion | 32.3980 | Schwarz Bayesian Criterion | 27.6125 |
| DW-statistic | 2.1224 | | |

Table 8 reveals that all the parameter estimates have the expected positive sign except total exports. They are all significant at one percent level of significance in the determination of agricultural output in Nigeria. The result shows that a 10% increase in domestic savings will increase agricultural output by about 3.48%, while a similar increase in foreign aid will increase agricultural output by about one percent. Surprisingly, increase in total exports by, say, 10% reduces agricultural output by about 1.4%.

**Table 8: Estimated Long-run Coefficients using the ARDL Approach**

ARDL(1,2,0,0,0) selected based on Akaike Information Criterion

Dependent variable is $LNY_{AGR}$
29 observations used for estimation from 1982 to 2010

| Regressor | Coefficient | Standard Error | T-Ratio[Prob] |
|---|---|---|---|
| LNS | .34845 | .057170 | 6.0949[.000] |
| LNFA | .099507 | .032253 | 3.0852[.005] |
| LNN | .48823 | .0097193 | 50.2325[.000] |
| LNX | -.13948 | .043040 | -3.2407[.004] |

Table 9 reveals that all the parameter estimates have the expected positive sign except foreign aid that has a negative relationship with industrial output in the long run. This implies that foreign aid, though significant, has a negative impact on industrial output in Nigeria contrary to expectations. The result further reveals that increase of domestic savings, say by 10%, will increase industrial output by about 2%, while the same increase in foreign aid will reduce industrial output by about 1%. The result also shows that the impact of population is more on the industrial sector than on the agricultural sector in the long run.

**Table 9: Estimated Long-run Coefficients using the ARDL Approach**

ARDL(2,1,0,1) selected based on Akaike Information Criterion

Dependent variable is $LN_{IND}$
29 observations used for estimation from 1982 to 2010

| Regressor | Coefficient | Standard Error | T-Ratio[Prob] |
|---|---|---|---|
| LNS | .18919 | .055522 | 3.4075[.003] |
| LNFA | -.11806 | .063884 | -1.8481[.078] |
| LNN | .51591 | .050475 | 10.2211[.000] |

The results of the error correction representation of the models are presented in Tables 10 and 11 below.

**Table 10: Error Correction Representation for the selected ARDL Model**

ARDL(1,2,0,0,0) selected based on Akaike Information Criterion

Dependent variable is $dLNY_{AGR}$
29 observations used for estimation from 1982 to 2010

| Regressor | Coefficient | Standard Error | T-Ratio[Prob] |
|---|---|---|---|
| DLNS | .018011 | .12477 | .14435[.886] |
| dLNS1 | .39004 | .16825 | -2.3182[.030] |
| dLNFA | .055159 | .025198 | 2.1890[.039] |
| dLNN | .27063 | .084584 | 3.1996[.004] |
| DLNX | -.077316 | .030077 | -2.5706[.017] |
| ecm(-1) | -.55432 | .16988 | -3.2630[.003] |

**Table 11: Error Correction Representation for the selected ARDL Model**

ARDL(2,1,0,1) selected based on Akaike Information Criterion

Dependent variable is $dLNY_{IND}$
29 observations used for estimation from 1982 to 2010

| Regressor | Coefficient | Standard Error | T-Ratio[Prob] |
|---|---|---|---|
| $dLNY_{IND}1$ | .091691 | .045611 | 2.0103[.056] |
| DlNS | .52888 | .12041 | 4.3922[.000] |
| dLNFA | -.051791 | .024314 | -2.1301[.044] |
| Dlnn | 12.6370 | 5.3209 | 2.3750[.026] |
| ecm(-1) | -.43867 | .18780 | -2.3358[.028] |

As expected, the Error Correction variable ecm(-1) has a negative sign and is statistically significant in both estimations (Tables 10 and 11). The coefficient (-0.55432) as in Table 10 suggests that the adjustment process is good and 55% of the previous year's disequilibrium in agricultural output from its equilibrium path will be corrected in the current year. For the industrial sector's output, as shown in Table 11, the coefficient (-0.43867) suggests that about 44% of the previous year's disequilibrium in industrial output is corrected in the present year.

## 5. Conclusion and Policy Implications of Results

The paper attempted to investigate sectoral analysis of the effectiveness of foreign aid in Nigeria as it affects the agricultural and the industrial sector in Nigeria. The result reveals that increase in domestic savings in both the short run and the long run impacts positively on the agriculture and the industrial sectors in Nigeria. Also, foreign aid is beneficial to the agricultural sector in Nigeria in both the short run and the long run, while its impact on the industrial sector was contrary to expectations. Population impacts positively on the agricultural sector and industrial sector in the long run while total export impacts negatively on the agricultural sector in the long run. The size of the absolute value of the error- correction coefficient indicates that the speed of restoration to equilibrium in the event of any temporary displacement of the variables of interest is rather moderate. A major policy implication of the results is that foreign aid received should be channeled into investment in the agriculture sector rather than in the industrial sector as this will further boost the overall economic growth in Nigeria through increased agricultural output.

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