External Sector Variables and the Performance of the Real Sector in Nigeria: The Case of Agriculture

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Abstract

This study examines the impact of some external sector variables on agriculture in Nigeria between 1981 and 2016. Time series data were obtained from CBN database and Swift Data Manager for the period under review. The Ordinary Least Square (OLS) multiple regression technique was employed to analyze the data. The Philip-Perron (P-P) and Granger Causality tests were carried out for stationarity and direction of causality of the regressors. The variables BOP, EXR, EXD were found to be statistically significant except ODA. While TAQ and ODA; and EXR and EXD were found to have feedback effects which created trade imbalance within the period under review. It was also found that BOP, EXR and EXD promoted agricultural output within the period under review. Therefore, the study suggests among other things that agriculture should be promoted through agricultural policy measures that are aggressively and effectively sustainable without political bias; government should be cautious in her external borrowing behavior and should promote export-led industrialization strategy as it has the ability and potential to translate into positive multiplier effects in the economy.

Keywords: External Sector Variables, Agriculture and Performance.

Introduction

All modern economies in the world are described as "open" by economists. The concept of open implicitly denotes allowance for international trade. International trade stands as the synergistic economic interactions between two or more economies. This interaction stems from the Ricardian factor-endowments among countries. No economy is "an island" in itself; neither is any economy self-sufficient, self-sustaining and independent.

The external sector captures exports and imports. Exports and imports are a network of economic transactions between the residents of an economy and the rest of the world. A sustainable economic growth of a country is ensured to a reasonable extent by a strong external sector, which is stable and maintains equilibrium over time.

The performance of the external sector is determined by the performance of its fundamental indicators which include balance of payments (BOP), exchange rate, foreign exchange earnings, external debt and official development assistance. Appreciable economic growth has been achieved by several countries through strategic export-led models (Tanjudeen, 2012). Such countries include inter-alia: Singapore, South Korea and Hong-Kong. Obadan and Okojie (2010) exposed that Nigeria's relatively large domestic market cannot on its own enhance sustainable growth at the desired rates to impact on the development of the economy, without availing herself the viable opportunities of the world market through external trade. Consequently, Nigeria has depended on foreign markets in order to sell its produce. The structure of the external sector of Nigeria has relatively remained the same since pre-independence era. Evidently, the export sector has been characterized by the dominance of one export product or commodity, crude oil (Mordi, Englama and Adebusuyi, 2010). According to them, between 1981 and 1985, crude oil export accounted for about 93% of the total exports in 1986 through 1998 while the share of non-oil exports fell from an average of 7.0% from between 1970 and 1985 to 4% in 1986 and dropped further to 2.4% from 1999-2006.

No doubt, the emergence and discovery of oil in 1958 in commercial quantity brought distortions in the Nigerian economy. The non-oil exports from agriculture and manufacturing dropped significantly due to neglect. This changed the structure of the external trade and thus creating imbalance in the economy. The form and trend of international trade and Balance of Payments (BOP) position suggest the country's overdependence on oil and its exposure to external shocks. It is for this reason that when oil price dropped in the early 1980s, all sectors of the economy experienced a spiral effect which led to a recession in the Nigerian economy by the mid 1980s. The need to revamp the economy led to the introduction of the Structural Adjustment Programme in 1986, to diversity the real sector or productive base of the economy in order to reduce dependence on the petroleum sector and importations.

Applauding the Structural Adjustment Programme (SAP) era, Ernest Shonekan, the then Head of Government, in his budget speech in 1993 said: The economy seemed to respond positively to the structural adjustment measures. This is best illustrated by the overall growth of the economy, improved sector performance and reduced pressure on the external sector.

After a slow growth rate of 0.3% in 1987, real output (GDP) at 1984 factor cost stood at 7.0% in 1988. An average growth rate of 5.0% was maintained between 1989 and 1991 (Tajudeen, 2012).
Obviously, the SAP period recorded some gains. In spite of these gains, certain macroeconomic problems continued to persist till now. These problems are high inflation, depreciation of the exchange rate of the naira, volatile interest rate and poor performance of the real sector. It is against this background of inconsistent growth pattern in the economy that this study was carried out to examine the impact of external sector variables on the performance of the real sector in Nigeria between 1981 and 2016 with particular attention on agriculture.

Objective of the Study

The main objective of this study is to empirically assess the performance of the external sector variables on agricultural output in Nigeria from 1981 to 2016. The study specifically examined the following:

1. the effect of Balance of Payments on total agricultural output in Nigeria.
2. the impact of external debt on total agricultural output in Nigeria.
3. the impact of foreign exchange rate on total agricultural output in Nigeria.
4. the effect of official development assistance on total agricultural output in Nigeria.

Theoretical Framework

This study relied on the factor-endowment model of trade also known as Heckscher-Ohlin model. This model or theory was first put forward by two renowned Swedish economists, Eli F. Heckscher (1870–1952) and Bertil Ohlin (1899-1979), in 1919 and 1933 respectively. It was later modified by the popular American monetarist, Paul Samuelson in 1948. The theory holds that the capital-rich country will have the comparative advantage in the capital-intensive good, and the labour-rich country will have the comparative advantage in the labour-intensive good, (Solderstein and Reed, 1994:59). In other words, the theory says that economies have relative advantage when they are richly endowed with particular or abundant resource(s), in the production of goods of which the endowments or the particular abundant resource(s) is (are) used. For instance, economies with abundant agricultural resources can generally produce agro-based goods inexpensively/cheaply; hence they have relative or comparative advantage in agricultural production. Implicitly, the theory points that it is international difference in relative factor endowment that explains differences in relative or comparative cost and forms the basis for international trade, and hence its relevance and adoption in this study.

Empirical Literature

Empirical literature is scanty on the relationship between the external sector variables and the performance of the agricultural real sector. Some of the works reviewed were basically concerned with the relationship between EXR and economic growth, BOP and economic growth; financial sector and real sector growth, external debt and economic growth; imports and economic growth. Evidently, David, Umeh and Umeh (2010) examined the effect of exchange rate changes on the Nigerian manufacturing sector, 1986-2005. The work reveals that the coefficients of the parameters showed both positive and negative signs, Some of the parameters were all statistically significant. They recommended that the link between agriculture and the manufacturing sector should be strengthened through local sourcing of raw materials in order to reduce reliance of imports of production inputs to barest level.

Idowu (2005) investigated the long-run causality between exports and economic growth in Nigeria, using co-integration and Granger causality tests and found that significant feedback (bilateral) causality between exports and economic growth in Nigeria exist and that the model has a long-run relationship given the co-integration result. The policy implication of the result was that government should pursue exports promotion or outward-oriented industrial strategy in order to accelerate the pace/level of economic growth.

Yaqub (2010) examined the impact of EXR changes on output of different sectors between 1970 and 2010 in Nigeria, using the modified IS-LM model or framework to estimate the behavioural equations as a system by applying the unrelated regression estimation technique, exposed that EXR had significant contractionary impacts on agricultural and manufacturing sectors and expansionary effect on services sector. The study concluded that the existing structures in the economy could not, within the period under review, support an expansionary depreciation argument in the basic sectors.

Adaramola (2011) looked into the inter-relationship between industrial productivity and money supply (used as proxy for the real and financial sectors in Nigeria. Using Vector Auto-Regression (VAR) Structure to test for causality, revealed that Nigeria between 1970 and 2005, has a uni-directional causality running from the financial sector to the real sector growth. This implies that the economy still operates in the short-run and it should have advantage of long-run changes in technology, taking factor productivity seriously.

Abdullahi, Aliero and Abdullahi (2013) using the unit root co-integration and granger causality test to analyze the relationship between EXD and economic growth in Nigeria, found a non-existence of long-run relationship between EXD and economic growth in Nigeria. This indicates that increase in external debt profile can result in decrease in gross domestic product (GDP). Their recommendation was that government should strengthen policies that will better external debt management.

Afagha and Oluwatobi (2012) investigated the impact of foreign trade on economic growth in Nigeria, using ordinary least square (OLS) technique showed that the regressors: exports, imports, foreign exchange rate consumer price index (PCI) act as engines of economic growth. Atique and Malika (2012) x-rayed the impact of domestic and external debts on the economic growth of Pakistan. Applying the OLS technique, found that external debt and economic growth have an inverse link. They argued that external debt slows down economic growth relative to domestic debts. They suggested the need for efficient external debt management.

Hua (2011) examined the economic and social effects of real exchange rate, evidence from the Chinese provinces. Using one step General Movement Model (GMM) and table data with GDP, real exchange rate, capital intensity, share of employment, education level, export share in the coastal provinces, as regressors, found that exchange rate appreciation had a negative impact on economic growth and was higher in the coastal provinces relative to the inland provinces and real exchange rate has a negative effect on employment.

Methodology

This study employed the ordinary least squares (OLS) technique to analyse the time series data obtained from various editions of Central Bank of Nigeria (CBN) Statistical Bulletin.

The Model Specification

The model for this study is specified on the premise that the real sector (agricultural output) is dependent on the external sector. Hence, agricultural sector performance is proxied by total agricultural output (TAQ) and the external sector is proxied by balance of payments (BOP), external debt (EXD), foreign exchange rate (EXR) and official development assistance (ODA).

The functional and the multiplicative form of the model are as stated below.

$$TAQ = f(BOP, EXD, EXR, ODA) \quad (1)$$

$$TAQ = BOPs^{\phi 1} EXD^{\phi 2} EXR^{\phi 3} ODA^{\phi 4} \Psi \quad (2)$$

Where:

TAQ = Total agricultural output
f = function of
BOP = Balance of payments
EXD = External debts
EXR = Exchange rate
ODA = Official development assistance

} Regressors

Equation (1) Transformed into linear form is:

$$TAQ = \phi_0 + \phi_1 BOP + \phi_2 EXD + \phi_3 EXR + \phi_4 ODA + \Psi \quad (3)$$

Equation (2) in linear form is:

$$\text{Log } TAQ = \phi_0 + \phi_1 \text{Log } BOPs + \phi_2 \text{Log} EXD + \phi_3 EXR + \phi_4 \text{Log} ODA + \Psi \quad (4)$$

Where ϕ_0, ϕ_1, ϕ_2, ϕ_3 and ϕ_4 = Parameters/Coefficients to be estimated and Ψ = white noise; log = logarithm of.

The a-priori expectations:

$$\frac{\partial TAQ}{\partial BOP} = \phi_1 < 0, \frac{\partial TAQ}{\partial EXD} = \phi_2 < 0, \frac{\partial TAQ}{\partial EXR} = \phi_3 < 0 \text{ and } \frac{\partial TAQ}{\partial ODA} = \phi_4 > 0 .$$

Presentation of Result and Analysis

The regression estimation result of the model, equation 4, in this study and the various tests results from the data (all being outputs from E-view 9.0 statistical software package) are shown and explained accordingly below in tables **1**, **2**, **3**, **4**, **5**, **6** and **7**.

Tables (**1**) and (**2**) take care of the ADF and Philip-Perron (P-P) tests for the Unit Root Test. Tables (**3**) and (**4**) contain the Trace and Max-Eigen tests for co-integration among the variables in the model. Table **5** shows the regression result, table **6** depicts the correlation/diagnostic matrix and table **8** embodies the Granger causality test result.

Table 1: Unit Root Test Result (Philip-Perron (P-P)

Variables	Level			First Difference			Order of Integration
	P-P Statistics	Test Critical Value (5%)	Remark	P-P Statistics	Test Critical Value (5%)	Remark	
TAQ	1.210283	-3.544284	NS	-5.144890	-3.548490	S	1(1)
BOP	-2.572823	-3.548490	NS	-6.336220	-3.552973	S	1(1)
EXD	-5.051726	-3.544284	S	-	-	-	1(0)
EXR	-2.000918	-3.548490	NS	-5.021425	-3.552973	S	1(1)
ODA	-5.338898	-3.544284	S	-	-	-	1(0)

Source: Author's Computation using E-view 9.0

In **Table 1**, the P-P test root result indicates that EXD and ODA were stationary at levels while TAQ, BOP and EXR did not attain stationarity at levels but rather became stationary at their first differences. The essence of these tests was to determine the stationaraity of the input data for the study since the data is time series. From the **Tables (1)** and **(2)**, the variables are not integrated of the same order as evidenced by orders 1(0) and 1(1). This however,, invalidates the condition under which ECM test could be conducted or ran in order to check the speed of adjustment of the variables in the model. Consequently, the result ushers in the co-integration tests (The Trace and Max-Eigen) in **Tables (3)** and **(4)** respectively to establish the existence of a possible long-run relationship between dependent and independent variables. Though, the P-P unit root test was solely relied upon for the co-integration tests, because, the P-P test is relatively adjudged superior to the ADF test.

Table 2: Co-Integration Test Result, Trace.

Unrestricted Cointegration Rank Test (Trace)

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.766849	98.87732	79.34145	0.0008
At most 1	0.493767	50.82709	55.24578	0.1159
At most 2	0.353609	28.36206	35.01090	0.2151
At most 3	0.282066	13.96247	18.39771	0.1870
At most 4	0.087646	3.027008	3.841466	0.0819

Trace 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

From **Table 2** above, the Trace statistics depict the existence of only one –co-integrating equation among the variables used in the model at the 5% level of significance. This presence or existence of co-integration among the variables reveals that there is a clear long-run equilibrium relationship between the variables under investigation, in conformity with or application of the decision rules that: For variables to have long-run equilibrium relationship there must be at least one co-integrating equation. The Trace Statistics therefore showed the existence of a long-run equilibrium relationship among the variables in the model.

Table 3: Co-Integration Tests Result, Max-Eigen.

Unrestricted Co-integration Rank Test (Maximum Eigen value)

Hypothesized No. of CE(s)	Eigen value	Max-Eigen Statistic	0.05 Critical Value	Prob.**
None *	0.766849	48.05023	37.16359	0.0020
At most 1	0.493767	22.46503	30.81507	0.3654
At most 2	0.353609	14.39959	24.25202	0.5513
At most 3	0.282066	10.93547	17.14769	0.3168
At most 4	0.087646	3.027008	3.841466	0.0819

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

Similarly and evidently too, in **Table 3** above, the maximum-Eigen Statistic indicates only one co-integrating equation at 5% level of significance. This denotes the rejection of the null hypothesis of zero co-integrating relationship. This is confirmed by the Max-Eigen statistic value greater than the critical value at the 5% level of significance. Therefore, there is a long-run equilibrium relationship between BOP, EXD, EXR, ODA and TAQ during the period under review.

Both the Trace and Max-Eigen Test statistics justify the presence of a long-run equilibrium relationship between the variables and the hypothesized fundamentals for the period under review.

Table 4: Regression Result

Dependent Variable: LOG(TAQ)
Method: Least Squares
Date: 08/05/17 Time: 20:54
Sample (adjusted): 1981 2015
Included observations: 35 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	12.48629	1.530611	8.157712	0.0000
LOG(BOP)	0.295790	0.086523	3.418636	0.0018
LOG(EXD)	-0.899431	0.351572	-2.558312	0.0158
EXR	0.020300	0.003829	5.302457	0.0000
LOG(ODA)	0.195508	0.157150	1.244083	0.2231

R-squared	0.919089	Mean dependent var	13.76466
Adjusted R-squared	0.908301	S.D. dependent var	2.300984
S.E. of regression	0.696782	Akaike info criterion	2.246874
Sum squared resid	14.56514	Schwarz criterion	2.469067
Log likelihood	-34.32030	Hannan-Quinn criter.	2.323575
F-statistic	85.19423	Durbin-Watson stat	1.809349
Prob(F-statistic)	0.000000		

Table **4** above shows that the TAQ-intercept and the coefficients of EXD and ODA appeared with expected signs. The coefficients of BOP and EXR did not fulfill a priori expectations. This implies that the relationship between TAQ and EXD; TAQ and ODA, all conform with economic theory and that of TAQ and BOP; TAQ and EXR did not agree respectively with economic reasoning.

The TAQ-intercepts stands at 12.48629. This figure implies the TAQ at zero levels of BOP, EXD, EXR and ODA in the economy. Though, BOP's coefficient did not appear with the expected sign, but its results is 0.295790, implying that holding all other variables (EXD, EXR and ODA) constant, 1 percent increase in TAQ increases BOP with about 29.6% or the BOP situation contributes about 29.6% variation in TAQ. The t* value of 3.418636 indicates that BOP is statistically significant at the 5% level of significance relative to its critical value of 2.04. This implies that enough evidence exists to conclude that there is a linear relationship between TAQ and BOP since on the other hand its p-value of 0.0018 is less than the alpha (α) value = 0.05. The coefficient of EXD is -0.899431. This means that 1 percent increase in EXD reduces TAQ by about 89.94%. This suggests a strong linkage between TAQ and EXD and in line with the a-priori expectation. The t* value of -2.1558312 less than t-critical 2.04 indicates that EXD is significant.

The coefficient for EXR is 0.020300 indicating that 1 percent increase in EXR causes 2.03% increase in TAQ or EXR causes 2.03% variation in TAQ. With t* value 5.302457 greater than critical value of 2.04 % level of significance suggests that EXR is statistically significant.

The coefficient of ODA is 0.195508 implying that ODA accounted for about 19.55% variation in TAQ or 1 percent increase in ODA increases TAQ by about 19.55%. With a t* value of 1.244083 relative to t-critical value at 5% means that ODA is statistically insignificant.

The R^2 of 0.919089 in **Table 4** is an indication of about 91.9 percent of the systematic variation in TAQ is accounted for by the regressors (BOP, EXD, EXR and ODA) used in the model. The 8.1 percent is attributed to variables not captured in the model but, however, are taken care of by the "white noise".

The F-ratio is 85.19423 in **Table 4**, showing that the overall regression is statistically significant given F-critical value of 2.92 at 5% level of significance, with degree of freedom $V_1 = 3$ and $V_2 = 32$.

The Akaike Information criterion (AIC) of 2.246874 and Schwatz Criterion (SCC) of 2.469067 are low. This implies that the model's outcome can be used for policy formulation. Meanwhile the Durbin-Waston (DW) statistic value of 1.809349 approximated to the nearest whole number of 2.0 confirms the absence of positive first order serial auto-correlation in the model.

Table 5: Correlation Interpretation/Diagnostic Matrix Test

Variables	**TAQ**	**BOP**	**EXD**	**EXR**	**ODA**
TAQ	1.00000	0.848071	0.263286	0.854086	0.406940
BOP	0.848071	1.000000	0.173934	0.812268	0.667941
EXD	0.263286	0.173934	1.00000	0.093789	0.030342
EXR	0.854086	0.812268	0.093789	1.000000	0.462532
ODA	0.406940	0.667941	0.0303421	0.462532	1.000000

The correlation matrix as shown on **Table 5** above, indicates that there is a strong positive correlation of about 84.81% between TAQ and BOP. Also a strong positive correlation exists between TAQ and EXR with about 85.41%. On the other hand, the correlation between TAQ and EXD is weak and that of TAQ and ODA is fair accounting for about 26.32% and 40.69% respectively.

Table 6: ECM Result

Dependent Variable: TAQ
Method: Least Squares
Date: 01/16/18 Time: 16:14
Sample (adjusted): 1982 2015
Included observations: 34 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-2726313.	1616591.	-1.686457	0.1028
BOP	2.628432	0.749353	3.507601	0.0015
EXD	61378.63	11035.61	5.561868	0.0000
EXR	-72123.81	33213.25	-2.171537	0.0385
ODA	34456.70	25260.54	1.364052	0.1834
ECM(-1)	-0.718727	0.175056	4.105695	0.0003

R-squared	0.902992	Mean dependent var	4877824.
Adjusted R-squared	0.885669	S.D. dependent var	6232785.
S.E. of regression	2107484.	Akaike info criterion	32.11867
Sum squared resid	1.24E+14	Schwarz criterion	32.38803
Log likelihood	-540.0174	Hannan-Quinn criter.	32.21053
F-statistic	52.12711	Durbin-Watson stat	1.597775
Prob(F-statistic)	0.000000		

The Error Correction Method (ECM) is to find out how the independent variables (BOP, EXD, EXR and ODA) adjust to changes in the dependent variable (TAQ), from the short-run disequilibrium to its long-run equilibrium. Based on the result in **Table 6**, the ECM result is -0.718727. The speed of adjustment or convergence from the short-run disequilibrium to its long-run equilibrium is about 71.9%, approximately 72%. This means a high speed of adjustment needed for the independent variables to adjust to long-run equilibrium.

Findings

This study examined the effects of external sector variables on agriculture between1981–2016. Agriculture is proxied by total agriculture output (TAQ) and external sector variables were: Balance of Payment (BOP), External Debt (EXD), Exchange Rate (EXR) and Official Development Assistance (ODA). Data were compiled from Central Bank of Nigeria (CBN) database and Swift Data manager within the period under review. The P-P test for unit root was applied to test for stationary property of the variables. **Table 1** shows the P-P test results. The tables both depict that the variables, TAQ, BOP and EXR were not stationary at levels but become stationary at their first difference; while EXD and ODA were stationary at levels.

The Granger causality test used to detect the direction of causality between TAQ and BOP, EXD, EXR and ODA, exposed feedback effects between TAQ and ODA; and EXR and EXD. Both the Trace and Max-Eigen statistics indicates only one co-integrating equation which implies the existence of a long-run equilibrium relationship between TAQ and the explanatory variables.

However, the systematic variation in TAQ accounted for by the regressors used in the model, stands at about 91.91% percent, only about 8.09 percent was taken care of by variables not captured in the model, but though subsumed in the "white noise". The AIC and SCC in **Table 4** reveal that the model's outcome may have policy formulation utility.

Conclusion and Policy Implications and Recommendations

The coefficient of determination between TAQ and the regressors is about 91.10%. The relationship between TAQ and ODA attests the fact that agriculture output growth and official development assistance are key aspects of agricultural growth and development in Nigeria. This suggests that agriculture promotion policy measures that would aggressively promote the agricultural sector should be sustainably put in place by the government.

Though, the present "Green Alternative Promotion Policy (GAPP)" of the Federal Government has all what it takes in content and scope but its effective and sustainable implementation remains questionable to be adjudged a good policy for the much needed agriculture growth and development, being "an engine" of overall economic growth and development. Also EXR and EXD have feedback affect and hence government should be cautious with her loans and borrowing habits and focus on export-led industrialization strategy following its positive transmission linkages.

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