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Full Length Research Paper

Econometrics analysis of impact of insecurity on agricultural growth and transformation in Nigeria (1960 – 2017)

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Sustainable agricultural growth has been a contentious issue in Nigeria agricultural transformation agenda towards economic development. This study examined the impact of insurgence on agricultural growth and transformation in Nigeria using secondary time series data from 1960-2017. Data used were sourced from National Bureau of Statistics (NBS); Central Bank of Nigeria (CBN) and were analyzed using the Vector Error Correction Model (VECM) after testing for stationarity, co-integration and lag selection using the Augmented Dickey-Fuller (ADF), Johansen and the Schwarzs Bayesian Information Criterion (SBIC) Statistic respectively. The results from the econometrics analysis showed that Gross Domestic Product (GDP) is affected directly by food production level and government agricultural expenditure, while insurgency such as Boko-Haram, Niger-Delta, Herders/Farmers and ethno-religious crisis affects GDP negatively. A unit change in these variables affects GDP by 5.37, 4.25, - 12.65, - 16.34, - 11.25 and -19.40% respectively. In the food production equation, insurgence of Boko-Haram, Herders/Farmers and Ethno-religious crisis negatively impact food production level by -12.11, - 4.90 and 2.37% respectively, while in the government agricultural expenditure equation; GDP, food production level, positively affects government expenditure on agriculture by 0.25 and 0.039% respectively, Boko-Haram, Niger-Delta, Herders/Farmers and Ethno-religious crisis negatively affects government agriculture expenditure by -0.35, -0.78, -6.20 and -3.51% respectively. Based on the study, it was recommended that public spending on agriculture should be project and farmers target specifically for efficiency and effectiveness while proactive counter-insurgency measures should be adopted by security agencies.

Keywords: Transformation, insurgency, growth, impact, econometrics

INTRODUCTION

Agriculture contributes immensely to the Nigerian economy in various ways, such as the provision of food for the increasing population; supply of adequate raw materials to a growing industrial sector; a major source of employment; generation of foreign exchange earnings; and, provision of a market for the products of the industrial sector (NBS, 2011; Akinyosoye, 2005). Until the 1970s, the Nigerian economy was predominantly agricultural. However, with the discovery of crude petroleum in commercial quantities in the early 1970s, Mining and Quarrying sub-sector has since become a major contributor to the country's foreign exchange earnings and the main source of revenue for the economy. Nonetheless, agriculture still remains the mainstay of the Nigerian economy: directly, in terms of volume of employment opportunities it offers (IFAD, 2010; Soludo, 2009; Onu and Okunmadewa, 2008; World Bank, 2008; Sanusi 2010; Daniel, 2010; Oni *et al.,* 2009; Oksana, 2005).

Abu and Usman, (2010) submits that in the 1960's agriculture in Nigeria contributed up to 64% of the total GDP, this was due to heavy investment from both public and private organizations to agricultural sector, however, over the years, public and private spending in agriculture

in Nigeria has witnessed decreases in relation to current events, for instance, in the 1970s agriculture contribution to GDP declined from 65% to 48%, in 1995 to 20% and 19% in 2005 and 2008 respectively. Evidence has shown that the root of the crisis is the poor funding to major drivers of agricultural growth that led to this poor contribution of agriculture to GDP (Apata et al., 2013; World Bank, 2006). Various agricultural performance indicators provide evidence of the relative deterioration of the agricultural sector. For instance, the total agricultural production per capital and the food production per capital index fell particularly in the 2000s (World Bank, 2007). This partly explains the rampant food shortages that the country has witnessed, with consequent increases in domestic food prices and the dramatic increases in agricultural imports that have been observed since the 2000s (World Bank, 2010). Could these scenarios be attributed to other militating factors? Nigeria was one of the relatively secured nations in West African sub-region until recently, when the nation suddenly metamorphosed into an abode of serial bombing, hostage-taking, armed robbery, cold-blooded killings and ethno-religious conflicts traceable to militant groups with conflicting ideological, socio-economic, political and religious agenda (Akhuemonkhan et al., 2012). Fwatshak and Larab, (2004) clearly posit that since independence, not a single decade has passed without at least one major cataclysmic crisis in Nigeria. It experienced the Western Region political crisis in 1960s while the last three to four decades also witnessed some of the worst civil and sectarian crisis. Case in point include incessant military coups, and a fratricidal civil war between 1967 and 1970, the Maitasine riots, starting in Kano and spreading to most parts of Northern Nigeria in the 1980s; ethno-religious crisis in Kafanchan and Zango Kataf both of Southern Kaduna in 1987 and 1992, and the June 12th, 1993 post-election crises, the Niger-Delta insurgence, Bakasi Boys, O'odua People's Congress and the current Boko-Haram (Darmer, 2004; Albert, 2005; Tella, 2012).

The resultant loss of lives and properties, rising budgetary spending on security, and destruction of valuable government facilities portend devastating consequences for sustainable economic development in the country.

Generally most of the discussion that follows are more or less qualitative in nature, thus there is need for empirical studies for effective policy directions. Consequently, the reviewed of past studies have thrown searchlight on these issues theoretically and help to facilitate the conceptual framework for this study. Could low agricultural production be connected to these and dysfunctional government spending in the agricultural sector over the years? What possible effects have all these on agricultural growth and transformation? In this regards, there is a need therefore to empirically study the impacts of insecurity on agricultural growth and transformation in Nigeria between 1960 and 2017.

METHODOLOGY

Study area

Nigeria is the study area, the country is located in Western part of Africa and is bordered by Cameroon and Chad in the east, Benin in the West, Niger in the North, Lake Chad in the northeast and Gulf of Guinea in the South. Nigeria is located between latitudes 4°N and 14°N and Longitudes 2°E 15°E covering a geographical area of 923, 768 square kilometers. The population according to NPC, (2006) census was 150,003,542 million. More than 70% of the farming population in Nigeria consists of smallholder farmers, each of whom owns or cultivates less than 5 ha of farmland.

The average per capital income estimated by the World Bank in 2006 was US$300 per annum (Ogunlela and Ogungbile, 2006). Nigeria has a diverse geography, which support a wide range of agricultural production and wildlife. The climate is semi-arid in the north and becomes increasingly humid in the south. Rainfall is one of the important climatic factors influencing agriculture and three broad ecological zones are commonly distinguished; the northern Sudan savannah (500 – 1000 mm), the guinea savannah zone or middle belt (1000 – 1,500mm and the southern rainforest zone (1,500 – 4,500 mm).

Generally, rainfall patterns are marked by an alteration of wet and dry seasons of varying duration.

In addition to vegetation that supports agriculture, Nigeria has abundant natural resources, notably large deposits of petroleum and natural gas (Ogen, 2007). There are 36 states including Federal Capital Territory-Abuja. There are numerous tribes including majorly Hausa, Yoruba, Ibo, Ijaw, Urhobo, Efik, Ibikio, Tiv, etc. The official language however, is English – Nigeria being a former British protectorate.

Methods of data collection

The data employed in this work were time series yearly data spanning from 1960 – 2017 assembled using several sources on annual Gross Domestic Product (GDP), Food production level (FPL) and Government Agricultural Expenditure (GAE) as the measures for foreign exchange earnings ability, capital formation, food security and well-being respectively.

The data were derived from Central Bank of Nigeria (CBN, 2018) statistical bulletin and annual reports (various issues) (2018), National Bureau of Statistics (NBS, 2018), Ministry of Agriculture, Agricultural Development Project (ADP) and Food and Agriculture Organization (FAO) year books. The period used for the study was chosen based on the historical development of Nigeria agricultural transformation after independence and the discovery of crude oil in the 1970s till date.

Model specification

The study adopted and modified the work of Fan et al., (2000) to model the security challenges and an examination of agricultural growth and public spending. The Augmented Dickey – Fuller (ADF) unit-root test was used to test for non-stationarity, co-integration techniques were used to establish valid relationship among the endogenous variables while the relationship was tested using Johansen co-integration test (Hai et al., 2004), while number of lag was selected using the Schwarz's Bayesian Information Criterion (SBIC) lag selection criterion. The dynamic model underlying the equation was written, in generic form, as a Vector Error correction Model (VECM), with three equations, one for each of the endogenous variables as for the given periods:

$$\Delta Zt = \Sigma_{j=1}\ \alpha_j \Delta Zt - j + \gamma^{*} Zt\text{-}1 + Xt + \mu t \qquad (1)$$

Where Z is a column vector of three variables and Xt represents the exogenous variables. The αj[j = 1;…..;(P – 1)] are a set of (3 x 3) matrices of parameters on the dynamics terms of the model; where the present lag-length of the model is P. Attention was focused on the long-run part of the VECM; where γ^{**} is the co-integrating vectors respectively and Y is the n x r matrices to reflect the reduced rank of the system; where it was implicitly assumed that there are r < n co-integrating vectors in the model; μt as a vector of white-noise error terms; with μt ~ N (0;σ) and where αj = Σ_i – j+1 A_i and $-\gamma^{**}_p$ = 1- Σ_j = 1 Ai; j = 1;2;……; P -1 from the corresponding VAR process of finite order P; given as $Z_t = \Sigma_j = 1\ A_j\ Z_t - j$ + x_t + μt. the vector error correction model was used because the time series were not stationary in their levels but are in their first difference and co-integrated.
The VECM was explicitly written as:

$$\Delta GDP_t = \alpha_1 GDP_{t1} + \beta_1 \Delta FP_{t-1} + \beta_2 \Delta GAE_{t-1} + \beta_3 \Delta BH_t + \beta_4 \Delta ND_t + \beta_5 \Delta FH_t + \beta_6 \Delta WR_t + \beta_7 \Delta ER_t.$$

Where

GDP = Agricultural Gross Domestic Product
FPL = Food Production Level
GAE = Government Agricultural Expenditure
BH = Boko - Haram Insurgency
ND = Niger Delta Crisis
FH = Farmers/Herders Clashes
WR = Civil War
ER = Ethno- Religious Crisis

National insecurities as exogenous variables were dummied for the different insurgencies in the country since 1960. The insurgencies were dummied with value 1 for the year they occurred and 0 otherwise.

RESULTS AND DISCUSSION

Unit Root Tests: Using Augmented Dickey – Fuller Statistic

Table 1 showed the first step involved by subjecting the variables under consideration to unit root test. This was to verify the variables for stationarity.

The Augmented Dickey-Fuller (ADF) test trust on not accepting the null hypotheses of unit root test (non-stationarity) and accepting the alternative hypotheses of stationarity. The study made use of ADF to ascertain if the data of the variables were stationary with respect to time.

The stationarity level was evaluated after comparing ADF against the Mackinnon Critical value at 5% levels. However, the ADF statistic value for the variables at first difference was greater that the critical values at 5% so that the null hypothesis that it has a unit root at level is not rejected.

Augmented Dickey-Fuller (ADF) test indicate that all variables are non-stationary at levels but stationary at first difference. This indicates that the variables were integrated of order one 1(1) and any attempt to specify the equation in the level of the series will be inappropriate and may lead to the problem of spurious regression.

Test of Co-integration using Johansen Trace statistic test and Maximum Eigen likelihood test

Table 2 showed the results of the Johansen co-integration test on the variables.

The result showed that the trace values at both none and at most one of 64.32 and 47.83 respectively were higher than their corresponding critical values at 5% level of significance.

This implies that the null hypothesis of no co-integrating relationship can be rejected at 5% level of significance for GDP; food production level and government agricultural expenditure in Nigeria.

Trace test indicated 2 co-integrating equations at the 5% level. Similarly, the Johansen Maximum Eigen at both none and at most 1 of 31.48 and 23.72 respectively were higher than their corresponding critical values at 5% level of significance.

Maximum Eigen – value test also indicated 2 co-integrating equations at the 5% level.

This also implied that the null hypothesis of no co-integrating relationship can be rejected at both the 5% level of significance for GDP, food production level and government agricultural expenditure in Nigeria. Implying that a form of equilibrium relationship exist among GDP, food production level and government agricultural expenditure in Nigeria and are integrated at order 1(2). This also implies that long-run movements of the variables are determined by one equilibrium relationship.

Table 1. Augmented Dickey – Fuller (ADF) Unit Root Test.

Variables	Augmented Dickey – Fuller				
	With intercept		With trend		
	Level	First difference	Level	First difference	Decision
GDP	-1.3654	-7.3408[x]	-0.8941	-7.3571[x]	1(1)
FPL	2.3163	-4.8731[x]	-1.3347	-5.4310[x]	1(1)
GAE	2.7431	-6.4537[x]	-3.0279	-7.2473[x]	1(1)
ND	-0.9374	-3.7924[x]	-2.5371	-4.2351[x]	1(1)
FH	-1.4533	-5.2043[x]	-1.4962	-6.5032[x]	1(1)

[x]That the null hypotheses that the series contain a unit root were rejected at 1%, 5% and 10% significance levels respectively. Source: Authors Computation, 2019.

Table 2. Unrestricted co-integration rank test (Trace and Maximum Eigen-Value).

Hypothesize	Eigen- Value	Trace Statistics	0.05 Critical	Prob. [xx]	Max-Eigen Statistics	0.05 Critical	Prob.[xx]
None x	0.638313	64.32413	47.23941	0.0006	31.48215	23.23157	0.0237
At most 1	0.324357	47.83524	20.39623	0.0078	23.72537	14.82782	0.0065
At most 2	0.129347	5.432852	15.82637	0.3726	7.301573	13.35431	0.3276
At most 3	0.003724	0.432723	6.349837	0.7468	0.378319	6.349837	0.7468

[x]Denotes rejection of the hypothesis at the 0.05 level; [xx] Mac-Kinnon-Haug-Michelis (1999) P-Value. Authors Computation from E-Views 9.0; 2019.

Effects of Selected Variables on Agricultural Growth Indices (Vector Error Correction Model Parameters)

Table 3 showed the Vector Error Correction Model Parameters and their associated standard errors and t-statistics.

The result showed that in co-integrating equation 1 and 2, only food production level and government agricultural expenditure were statistically significant at 5% and 1% levels respectively in each of the equations. In the Gross Domestic Product (GDP) equation, food production level, government agricultural expenditure, Boko Haram, Niger-Delta Crisis, Herders/Farmers clashes and Ethno-religious crisis with respective coefficients of 5.37, 4.25, -12.65, - 16.34, - 11.25 and -19.40 statistically affected the share of agriculture to GDP at 1%, 1%, 1%, 1%, 1% and 5%, levels of significance. This means that a unit change (increase) in previous year food production level would increase the share of agriculture to GDP by 5.37 percent and vice versa, and a unit increase in government agricultural expenditure would increase GDP by 4.25 percent. While a shift from non-insurgence to insurgence in any year or an increase in the activities of the insurgences of Boko Haram, Niger-Delta Militants, Herders/Farmers clashes and Ethno-religious crisis would reduce the GDP by -12 .65%, -16.34%, -11.25% and – 19.40% respectively.

However, these results are in conformity with the findings of Eboh, (2014) which shows vividly the impacts of security challenges on food production and gross domestic product (GDP) in Nigeria. The study further expresses the ravaging effect of security budgeting on the total budget of Nigeria and the consequences of a declining agricultural sector budget. The effect of the change in previous year food production level on share of agriculture on GDP which is negative could be attributed to the reduction on food production occasion by insurgences.

In the equation explaining food production; Boko Haram, Herders/Famers crisis and Ethno-religious crisis among the insecurity challenges statistically had significant effects on the change in food production. The coefficients of Boko Haram, Herders/Farmers and Ethno-religious crisis were -12.11,-4.90 and -2.37. This mean that a unit changes in the number of time of occurrence of these insurgences would reduce food production by-12.11%, -4.90% and -2.37% metric tons on average respectively.

The result is in conformity with *a priori* expectation which posit a negative relationship between insurgences and agricultural food production. According to Albert (2005), since independence, not a single decade has passed without at least one major insurgency which has reduced agricultural production and productivity. Other authors such as Tella, (2012), Darmer, (2004) and Fwatshak and Larab, (2004) also share this view.

In the equation explaining the change in government agricultural expenditure, a unit change in the immediate past year GDP and food production level as endogenous variables significantly affected government agricultural expenditure positively while Boko Haram, Niger-Delta, Herders/Farmers and Ethno-religious insurgences significantly affected government agricultural expenditure negatively. The coefficient of GDP and food production were 0.25 and 0.039 respectively while Boko Haram, Niger-Delta, Herders/Farmers and Ethno-religious

Table 3. Estimates of the vector error correction model and associated errors and T-Statistics.

Variables	D (GDP)	D (FPL)	D (GAE)
Co-int. Eq. 1	-0.075372	-0.023577	-0.037087
	(0.027381)	(0.007273)	(0.023942)
	[-0.832578]	[-3.793017]^{xxx}	[-3.081471]^{xxx}
Co-int. Eq. 2	0.317265	0.237193	0.371038
	(0.073368)	(0.103730)	(2.113831)
	[1.374392]	[2.375631]^{xx}	[2.113831]^{xx}
D [GDP(-1)]	0.270437	-0.047392	0.259107
	(0.035313)	(0.233473)	(0.713817)
	[1.534071]^{x}	[1.343382]	[-1.930140]^{x}
D [FPL(-1)]	5.378352	-0.573103	0.0394105
	(0.053738)	(0.324932)	(0.340301)
	[-4.932574]^{xxx}	[-2.478393]^{xx}	[-4.280115]^{xxx}
D [GAE(-1)]	4.253007	0.111307	0.345117
	(2.005387)	(2.314703)	(0.723187)
	[6.305328]^{xxx}	[1.338041]	[1.035191]
BH	-12.653819	-12.114830	-0.351372
	(7.381572)	(3.772013)	(2.115832)
	[-3.830742]^{xxx}	[-6.831407]^{xxx}	[4.300712]^{xxx}
ND	-16.344873	0.314973	-0.781532
	(9.708325)	(2.419203)	(0.314383)
	[-5.240311]^{xxx}	[1.039421]	[2.781931]^{xx}
FH	-11.247831	-4.903417	-6.201411
	(0.931873)	(2.341839)	(0.831231)
	[-3.004375]^{xxx}	[3.871205]^{xxx}	[3.34153]^{xxx}
WR	15.037714	-1.430733	-10.341138
	(23.411837)	(2.718334)	(16.811374)
	[0.037135]	[-0.734135]	[0.441378]
ER	-19.401273	-2.374037	-3.514378
	(24.113782)	(4.311032)	(2.002191)
	[-2.230753]^{xx}	[-3.495317]^{xxx}	[4.118792]^{xxx}
R-Square	0.724371	0.534693	0.831872
Adj. R-Square	0.701383	0.512830	0.818311
Sum Sq. Residue	343941.0	1530.3810	6310.341
S.E Equation	73.38742	0.987312	8.670127
F-Statistics	1.321437	1.239303	1.034192
Log Likelihood	-372.83114	-281.03491	-211.38151
Akaike AIC	11.283014	3.810310	4.730415
Schwarz SC	11.381130	3.412017	6.310875
Mean Dependent	31.083172	-5.308472	0.803184
S.D Dependent	98.443215	23.443811	5.031849
Log Likelihood	-576.7826		
Akaike Info. Criterion	39.9803		
Schwarz Criterion	26.8719		

^{x,} ^{xx} and ^{xxx} means significance levels at 10% 5% and 1%; standard error in brackets and t-statistics in parenthesis; D in front of each of the variables implies that the variable is difference once before becoming stationary. Source: Authors Computation from E-Views 9.0; 2019.

insurgence had coefficients of -0.35, -0.78, -6.20 and -3.51 respectively. These means that a unit changes in government agricultural expenditure would increase the share of agriculture in the GDP and food production by 0.25 and 0.4% respectively. But there have been a declining government expenditure on agriculture over the years due to negative effect of insurgence and high level security budget. However, a unit change in government agricultural expenditure had a negative relationship with the insurgences. This means that a unit change in government agricultural expenditure will increase by 0.35%, 0.78%, 6.20% and 3.51% respectively in the rate of occurrence of Haram, Niger-Delta, Herders/Farmers and Ethno-religious insurgences. These results are in agreement with *a priori* expectation and work by Eboh (2014), who reported that due to increase security challenges government expenditure on agriculture have reduced thereby affecting food production and agricultural gross domestic product (AGDP). On government expenditure in agriculture, Apata *et al.* (2011),

Ikpi, (1995), Mogues *et al*. (2008); Saucer, (2012), Akpata *et al*. (2013), Eyo, (2008) reported that public credit/spending to the agricultural sector was positive and statistically significant in explaining agricultural growth and ultimately economic growth and development. Therefore; low agricultural expenditure from public and private sectors will negatively affects food production and the GDP of the country.

Conclusion

The study examined the effect of insurgence on agricultural growth and transformation in Nigeria using secondary time series data from1960-2017. The Vector Error Correction Model (VECM) on Nigerian GDP, Food production level and government agricultural expenditure as proxies for agricultural growth and transformation and on some Boko Haram, Niger-Delta, Herders/Farmers, Civil War, Ethno-religious insurgence. The result indicates that insurgences directly impact on agricultural growth and transformation through their effects on GDP, food production level and government agricultural expenditure. Based on the foregoing, the study recommended that:

(i) Public expenditure in agriculture should be farmers and project target specific towards improve efficiency and effectiveness of public investments and service delivery.
(ii) The security architecture of the country should be developed to include local vigilante for effective security management.
(iii) Provision of physical and social infrastructures and enabling environment for all citizens.
(iv) There should be proactive counter insurgence mechanism and conflict resolution system and
(v) Citizen participation in the development process through formation of appropriate organizations and programmes that will enhance peace and unity.

Authors' declaration

We declared that this study is an original research by our research team and we agree to publish it in the journal.

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