Bulgarian Journal of Agricultural Science, 23 (No 5) 2017, 689–697
Agricultural Academy

THE IMPACT OF AGRICULURAL FOREIGN AID ON AGRICULTURE IN NIGERIA

NAHANGA VERTER
Mendel University in Brno, Faculty of Regional Development and International Studies, 613 00 Brno, Czech Republic

Abstract

Verter, N., 2017. The impact of agricultural foreign aid on agriculture in Nigeria. *Bulg. J. Agric. Sci.*, 23 (5): 689–697

There is a continued debate over the implication of foreign aid to the receiving countries. The pro- aid, argue that the assistance complement the limited domestic funds for growth and development in underdeveloped countries, while the anti- aid opine that such external resource flow impedes growth as the resources are mostly diverted to other things, notably individual personal use. Against this backdrop, this contribution assesses the effect of foreign aid on agriculture in Nigeria. Using OLS regression, Granger causality and VDA approaches, the OLS results signify that foreign assistance to agricultural related activities has a positive effect on crop performance in the country. Similarly, the Granger causality shows a unidirectional causality running from foreign aid to crop production in Nigeria.

In the spirit of global partnership for development, donors should continue to provide aid to Nigeria to stimulate domestic producers to expand their farms for maximum production. The inflows of foreign assistance in agriculture should be promoted by the world organizations and the donors. Finally, the Nigerian government and donors should ensure that foreign aid is effectively and efficiently utilized for agricultural related activities to boost crop production in the country.

Key words: agricultural ODA; aid; crop production; finance; loans

Introduction

In 1970, advanced countries agreed at the UN World Summit to give 0.7% of their gross national income (GNI) as official development assistance (ODA)[1] to underdeveloped countries. However, there is a long-standing debate on the effectiveness foreign aid, and its relationship with growth. The proponents of foreign aid argue that the inflow of foreign assistance is a vital tool of economic performance in countries that are poised to grow. Many scholars argue that foreign aid might be effective as it complements the limited local funds in the recipient countries to stimulate economic growth and development (Chenery and Strout, 1966; Beck et al., 2000; Levine, 2001; Bonfiglioli, 2008; Stojanov and Strielkowski, 2013; Juselius et al., 2014), especially when the recipient country implements sound policies (Burnside and Dollar, 2004; Dalgaard et al., 2004; Chatterjee and Turnnovsky, 2007; Kaya et al., 2012; Fasanya and Onakoya, 2012). Pro- aid maintains that donors' intentions must be beyond political gains or rent seeking, otherwise, for aid may not achieve its intended set objectives. In the same spirit, aid effectiveness to be insured, recipients must use the money for what it is given to experience meaningful growth and development.

Theoretically, some notable economists (Chenery and Bruno, 1962; Chenery and Strout, 1966) argue that domestic skilled labour supply is sufficient as well as the transfer of technical know-how could stimulate economic growth. Nevertheless, capital is a keybottleneck to higher productivity and growth, which has been the case for underdeveloped economies, thus, substantially rely on foreign resources to boost their per capita income. They identified two gaps: savings and trade balance (foreign exchange) as constraints to

[1] Aid is an official development assistance (ODA) offered by developed countries to developing countries to facilitate their trade for economic growth and socioeconomic development. Despite the UN MDGs goal 8: develop a global partnership for development, most developed economies failed to meet the aid target of 0.7% of their GNI to developing countries

**E-mail:* nahanga.verter@mendelu.cz

production and growth. They stress that foreign capital (i.e. ODA, net export) bridges the gaps of limited domestic capital in developing countries, such as Nigeria.

On the contrary, others are of the view that such external resource might not stimulate growth and development (Mosley, 1980; Mosley et al., 1987; Boone,1996; Easterly, 1999; Easterly et al., 2003) but rather, it impedes growth as the funds are mostly diverted to other things, leading to the so called, aid ineffectiveness. Still, others stress that the effects of ODA markedly different– while one type may boost growth, the other one may not stimulate growth and development in receiving countries (Sender, 1999; Ram, 2004). For instance, Easterly, Levine and Roodman (2003) conclude that the question of aid effectiveness is still inconclusive.

Limited studies have attempted to determine the effect of foreign aid on agriculture in the receiving countries (Pack and Pack, 1990; Dewbre et al., 2007; Akpokodje and Omojimite, 2008; Islam, 2011; Kaya et al., 2012; Alabi, 2014). Even though there are many studies about the effect of foreign aid on economic growth, in general, research on the effect of aid on agriculture, especially in Nigeria is still scanty. The present contribution intends to fill this vacuum. Against this background, this study an attempt to determine the effect of agricultural ODA on crop production in Nigeria.

Materials and Methods

The data used for this article are mainly secondary in nature. Time series data for the period between 1981 and 2014 were obtained from Food and Agriculture Organization of the United Nations (FAO), and Central Bank of Nigeria statistical bulletins. Statistical Software, Gretl and EViews, are used for the empirical analysis. To determine the effect of foreign aid on agricultural (crop) production in Nigeria, multiple regression model is mathematically specified as follows:

$$NAP = \beta_0 + \beta_1 ODAA + \beta_2 TDCLA + \beta_4 FER + \beta_4 CC + \varepsilon \quad (1)$$

where: NAP is the net agricultural (crop) production (constant 2004-2006, 1000 US$) in Nigeria, measured as the performance of crop production. Agriculture and crop production or output are used interchangeably in this present study. ODAA is the official development assistance (actual disbursement flows, US$) to support agricultural production to address food security issues, farmers' income and the general wellbeing of producers in Nigeria. ODAA is also called agricultural ODA in in this article; TDCLA denotes the natural log of growth rate of total domestic commercial loans to agriculture (%) given to farmers by Commercial Banks in Nigeria; FER stands for fertilizer consumption (tonnes); CC denotes climate change (CO_2eq emissions) on agricultural soils, measured in gigagrames; β_1 ….. β_4 are coefficients of each variable in the model; and e represents the error term. All the variables except climate change are expected to have positive effects on crop production in the country.

To avoid reporting spurious regression findings, a unit root test, called Augmented Dickey-Fuller (ADF) coined by Dickey and Fuller (1979) for testing for a stationary time series data is used. The unit root test determines whether the series is stationary at the level, first or second difference. The standard ADF test is carried out by estimating after subtracting from both sides of the equation as follows:

$$\Delta y_t = \alpha y_{t-1} + x'_t \delta + \varepsilon_t \quad (2)$$

Finally, Granger causality test will be run after the unit root test. Before the Granger causality, anunrestricted vector autoregression (VAR) model will be performed. The VAR model is typically used for forecasting systems of interrelated multivariate time series data and for analysing the dynamic impact of random disturbances to the system. The mathematical representation of a VAR is as follows:

$$y_t = A_1 y_{t-1} + ... + A_p y_{t-p} + \beta x_t + \varepsilon_t \quad (3)$$

Where: y_t is a k of vector of endogenous variables, x_t is a d vector of exogenous variables, while A_1, …. A_p and B are matrices of coefficients to be estimated in the model, and ε_t is a vector of unobservable or white noise. The most common approach for testing if there is a causal relationship between two variables is Granger causality. The model was proposed by Granger (1969) to answer the question of whether x causes y and see how much of the current y could be explained by previous values of y and then to see whether adding lagged values of$x$ could improve the explanation. The mathematical representation of Granger causality is as follows:

$$y_t = \alpha_0 + \alpha_1 y_{t-1} + ... + \alpha_l y_{t-l} + \beta_1 x_{t-1} + ... + \beta_l x_{t-l} + \mu_t \quad (4)$$

$$x_t = \alpha_0 + \alpha_1 x_{t-1} + ... + \alpha_l x_{t-l} + \beta_1 y_{t-1} + ... + \beta_l y_{t-l} + \mu_t, \quad (5)$$

for all possible pairs of (x, y) time series in the group in the Granger equation. The reported F-statistics are the Wald statistics for joint hypothesis:

$$\beta_1 = \beta_2 = ... = \beta_l = 0, \quad (6)$$

for the equation. The null hypothesis is that x does *not*-Granger-cause y in the first regression and that y does *not* Granger-cause in the second regression. For this study, agricultural ODA and other variables in the model are expected provide any statistically significant information about crop production in the presence of lagged crop production. If not, agricultural ODA and other variables in the model do not Granger-cause crop production, as the case may be.

Foreign Aid and Domestic Loans to Agriculture

Credit is an integral element in agricultural production networks. It enables producers to satisfy the financial needs stimulated by the production cycle, which is a hallmark of crop production. For instance, land preparation, cultivation, weeding, and harvesting of the crops are normally carried out over a period of months in which meager cash revenue is earned, while expenditures on purchasing inputs, and consumption are largely made in cash. Cash revenue is received a short time after the harvest. The availability of credit permits both greater consumption and purchased inputs use and hence boost farmers' welfare (Feder et al., 1990; Verter and Bečvářová, 2015).

Given that most underdeveloped countries lack the needed funds to finance agricultural production for growth and development, the importance of foreign aid to these countries cannot be overestimated. Even though investment in agriculture has been identified as one of the most significant and effective strategies for a sustainable economic growth, poverty reduction, and improved wellbeing in rural areas where the substantial number of the world's poor live (FAO, 2017), finance has been a major challenge to many farmers in countries.

Table 1 shows investments (i.e. credit, government expenditure, gross capital formation) in agriculture and agricultural GDP in the share of total GDP in Nigeria and

Table 1
Investments in agriculture (US$ millions), and agricultural value added (%), 2001-2014

Country	Indicator	2001	2005	2010	2012	2013	2014
Bulgaria	Central Govt Exp.	93	290	203	652	635	638
	Total Credit	64	283	717	917	996	1053
	GCF	177	283	287	330	344	338
	Value added (%)	10.6	7.2	4.3	4.6	4.6	4.5
Czechia	Central Govt Exp.	567	1583	2463	2287	2077	2310
	Total Credit	487	1007	1747	2239	2379	2318
	GCF	544	817	1267	1982	1858	1751
	Value added (%)	3.0	2.2	1.5	2.4	2.4	2.5
Egypt	Central Govt Exp.	n.a	808	1386	1880	1904	1778
	Total Credit	1335	1115	1140	1027	905	n.a
	GCF	1240	477	716	468	425	469
	Value added (%)	12.0	13.7	13.3	13.9	13.9	13.9
Kenya	Central Govt Exp.	121	144	301	432	470	470
	Total Credit	291	437	526	680	681	853
	Value added (%)	24.0	20.9	24.8	26.1	26.4	27.3
	GCF	215	305	655	909	973	1116
Malaysia	Central Govt Exp.	726	1130	1984	2039	2417	2533
	Total Credit	n.a	887	1915	2307	2280	2438
	GCF	1127	1471	3386	4777	4779	4857
	Value added (%)	7.9	8.3	10.4	10.0	9.3	9.1
Mexico	Total Credit	n.a	1924	2662	3803	4152	4214
	GCF	992	1348	1213	1344	1665	1700
	Value added (%)	3.7	3.1	3.2	3.2	3.2	3.1
Nigeria	Central Govt Exp.	n.a	584	707	614	609	n.a
	Total Credit	502	370	854	2009	2185	3020
	GCF	1379	3865	8422	9640	10 369	11 024
	Population	25.6	25.5	23.5	21.8	20.8	20.0
South Africa	Central Govt Exp.	330	789	1287	1179	1075	1070
	GCF	555	1127	1488	1617	1514	1552
	Value added (%)	3.2	2.4	2.4	2.2	2.1	2.2

Source: FAO, 2017
Note: GCF = gross capital formation to agrarian sector; n.a = data not available; Value added (%) denotes agricultural GDP (% of total GDP)

other selected economies. Although, the population[2] and value of agriculture in the GDP of Czechia and Bulgaria are minimal, their total credit to the sector has been substantially relative to other economies during the period under scrutiny. Also, Czechia's central government (about $2.1 billion) investment in agriculture in 2013 was more than double Nigeria ($609 million) and Kenya combined ($470 million). Implying that investments in agriculture in some African countries (South Africa included) have been below expectations. As shown in Table 1, low investment in agrarian related activities in Nigeria might have partly militated the development of the sector. Because the majority of smallholder farmers are poor, they suffered from limited access to credit and loan packages, which have partly constrain farm expansion and output (Verter and Bečvářová, 2015; Izuogu and Atasie, 2015).

Lack of adequate provision of agricultural loans to producers has constrained a sustainable cultivation in the country. This issue is partly attributed to the risk in agriculture, the difficulty of estimating returns on investment, and the inability of many producers to provide the required collateral securities (Phillip et al., 2009; Verter and Bečvářová, 2015) although in some cases, the perceived risk is more than the actual risk of lending to farmers.

The financial institutions in Nigeria, always demand high-interest rates and collateral security, which screen out most of the smallholder rural farmers. Also, affordable loans to agriculture are often short term, with fixed repayment periods; these most times do not suit annual cropping (Phillip et al., 2009). Global competitiveness reported for 2016-2017 by the World Economic Forum (2016) shows that even though financial market development in Nigeria (ranked 89/138, scored 3.7/7), where commercial banks are rated as relatively sound, food and agricultural producers and traders' access to loans (ranked 129/140, scored 2.6/7), and affordability of financial services (ranked 132/138, scored 2.5/7) remain problematic in the country.

Owing to the fact that, finance remains a bottleneck to farmers in underdeveloped countries, such as Nigeria, foreign aid disbursed to these countries (Table 2) might cushion the effects, albeit if only effectively disbursed to farmers that needed it and efficiently utilised by them. Apart from the financial aid that goes to the agrarian sector as presented in Table 2, the aid provided to other sectors, such as transport and storage, policy and regulations, energy generation and supply in Nigeria also are indirectly related to agricultural development in the country and other recipient countries. The annual growth rate of total aid disbursed to Nigeria, Kenya, Cote D'voire and Ghana have fluctuated over time. Arguably, it might be difficult for the aid beneficiaries to depend on the amount of money given to them to plan ahead of time, as uncertainty has been associated with aid flows. Also, agricultural aid (% of total aid) has remained low (below 10%) in Nigeria between 1996 and 2014. There is a need for donors to provide information on future and increase aid disbursements to the agricultural sector of the economy in countries needed.

Major donors to Nigeria are International Development Association (IDA), the UK, USA, Japan, African Development Fund (AfDF) and France. These donors have contributed substantial finance to support Nigeria's efforts aimed at improving agricultural production, food security, and exports. Thus, strengthening the competitiveness of producers and further integrating into the global economy for growth and development (OECD and WTO, 2015).

Empirical Results and Discussion

Because time series data are subject to spurious regression findings; ADF unit root test, coined by Dickey and Fuller (1979) was used to avoid reporting spurious regression results. Similarly, to avoid reporting invalid Ordinary Least Squares (OLS) regression findings, diagnostic tests for the OLS were run, and the results indicate that all the checklist tests were satisfied (Table 3). Given that all the classical assumptions were fulfilled, the OLS estimation result is presented in Table 4. Also, based on the information criteria, an unrestricted Vector Auto- Regression (VAR) model was used before the Granger causality estimation. To ensure the validity of the Granger test, VAR residual tests were also carried out, and all the diagnostic tests were satisfied.

The result of the OLS regression analysis indicates that the *F*-ratio is statistically significant at the 1 percent level of significance (Table 4). This signifies that estimated agricultural production function was adequate for use in prediction and analysis. The OLS results further indicate a robust positive relationship between agricultural ODA and crop performance in Nigeria. This implies that holding other factors constant; foreign assistance may well supplement the limited resources for farmers to expand their farms and boost annual output. The result tallies with works of Pack and Pack (1990); Akpokodje and Omojimite (2008); Kaya et al. (2012); Alabi (2014)

[2] Population (in millions) of some selected countries in 2015 as estimated by the UNDESA (2017): Bulgaria (7.2); Czechia (10.6); Malaysia (30.7); Kenya (47.2); South Africa (54.3); Egypt (93.); Mexico (125.9); Nigeria (181.2)

Table 2
Foreign aid to agriculture in Nigeria and some economies, 1995-2014

	Agricultural ODA (% of total ODA disbursement) by all donors				Disbursed agricultural ODA (US$, millions, current) by all donors				Growth rate of agricultural ODA Disbursement (%) by all donors			
Year	Nigeria	Cote D.	Ghana	Kenya	Nigeria	Cote D.	Ghana	Kenya	Nigeria	Cote D.	Ghana	Kenya
1995	17.3	3.2	3.6	25.0	6.2	8.2	7.4	55.9	78.2	473.4	106.7	48.8
1996	6.6	8.8	3.4	22.2	0.9	13.8	7.2	34.3	-85.9	68.8	-2.4	-38.6
1997	0.3	19.4	6.1	16.6	0.0	11.8	6.0	17.8	-95.5	-14.7	-17.5	-48.2
1998	0.5	7.2	4.3	12.3	0.1	12.1	1.9	21.1	50.0	2.7	-68.2	19.0
1999	0.6	12.2	6.3	13.7	0.1	9.8	9.0	21.1	50.0	-19.5	373.7	0.0
2000	3.2	6.6	7.1	11.9	3.9	17.0	26.4	45.3	4.277.8	73.7	193.3	114.3
2001	5.6	7.0	6.7	8.7	6.3	14.4	33.6	35.6	59.9	-14.9	27.4	-21.4
2002	2.7	7.0	3.9	6.6	3.1	73.8	20.5	24.7	-50.3	412.0	-38.9	-30.7
2003	1.3	5.4	4.5	6.5	5.3	19.8	36.0	38.1	70.6	-73.2	75.1	54.5
2004	1.4	1.7	2.1	4.8	8.5	3.9	39.1	33.0	58.2	-80.5	8.6	-13.6
2005	0.3	1.1	4.5	3.4	16.3	2.6	63.0	26.1	92.4	-33.9	61.2	-20.8
2006	0.4	4.1	1.1	7.2	44.9	13.7	60.2	74.8	176.1	436.9	-4.4	186.4
2007	1.2	1.9	6.8	6.3	28.0	5.3	68.2	91.1	-37.6	-61.7	13.1	21.7
2008	1.9	8.9	10.1	6.9	27.8	93.3	115.4	104.7	-0.7	1.677.3	69.3	15.0
2009	2.4	2.3	11.2	5.6	44.8	62.4	182.9	112.6	60.9	-33.1	58.4	7.5
2010	3.7	6.8	15.0	7.7	83.4	47.5	244.8	125.7	86.3	-23.9	33.9	11.6
2011	4.9	3.4	13.2	6.1	102.7	53.3	242.1	159.6	23.1	12.2	-1.1	27.0
2012	4.4	0.4	11.1	5.1	92.5	17.7	210.3	156.2	-9.9	-66.8	-13.1	-2.1
2013	4.2	2.1	9.3	5.3	131.0	42.9	139.2	183.0	41.7	142.5	-33.8	17.1
2014	6.2	5.8	11.8	5.8	208.0	78.5	147.9	176.3	58.7	83.0	6.3	-3.7

Source: Author's compiled from FAO, 2017

who also find out that foreign aid spurs agricultural performance in countries.

Similarly, the OLS results reveal an ample positive relationship between the lagged total domestic commercial loans to agriculture (TDCLA) and crop production in the country (Table 4). Finance is among the major factors of crop production. However, it has remained a bottleneck for many decades as many farmers in Nigeria do not have access to both public and commercial loans to finance their farm-related activities in the country (Verter and Bečvářová, 2015). Historically, agricultural policy in the country included concessional interest rates, credit guidelines by the Central Bank of Nigeria (CBN); rural banking schemes; direct lending; and agricultural credit guarantee schemes. Nonetheless, these policies have failed to yield desired results in the country, partly because banks have not been ready to grant loans to smallholder farmers and exporters. Sadly, interest rates for loans are still high (about 25%). As a consequence, the high cost of capital has continued to pose a constraint to agricultural production in the country.

Table 3
Diagnostic test (classical assumptions)

Test	P. value
Non-linearity test (squares)	0.537
Ramsey's RESET (squares and cubes)	0.577
White's test for heteroskedasticity	0.133
Breusch-Pagan test for heteroskedasticity	0.652
Test for normality of residual	0.129
Breusch-Godfrey test for first-order autocorrelation	0.736
Test for first-order autocorrelation- Ljung-Box Q'	0.759
Test for ARCH of order 1	0.627

Table 4
Some determinants of crop production in Nigeria, 1987-2014

Variable	Coefficient	Std. Error	t-statistics
Const.	2.306	0.6948	2.431**
ODAA_1	3.982	1.597	2.493**
TDCLA_1	0.025	0.008	3.004***
FER	0.026	0.010	2.688***
CC_1	−0.511	0.241	−2.124**
R-squared	0.543	Adjusted R^2	0.456
F(4, 21)	11.251	P-value(F)	0.000
Durbin-Watson	1.857		

Source: Author's computation
Note: ** and *** Significant at 5% and 1%

There is also an ample positive connection between fertilizer application and production in the country (Table 4). Given that soil has lost manure, timely application of fertilizer to farms could increase yields and the overall crop output in Nigeria, holding other factors constant. This result also corresponds to the works by Kaya et al. (2008); Ayinde et al. (2009); Ammani et al. (2010); Verter and Bečvářová (2015) who also find out that fertilizer consumption spurs agricultural performance in Nigeria and other countries across the globe.

On the contrary, the results show an inverse connection between lagged climate change (CC) and crop production in Nigeria (Table 4). The increasing climate variability has been led to increase weather situations, global warming, and drought that may have had implications for crop production in the country. Studies by Seguin and de Cortazar (2005), Berli et al. (2008), Mendelsohn (2008), van Leeuwen and Darriet (2016) show that climate change shocks might substantially reduce yields and total output from rain-fed agriculture in some countries.Mendelsohn (2008) proposes irrigation as a vital tool for reducing or mitigating the effect of climate change on some crop production. Underdeveloped countries have been relying more on farming (a sensitive sector), many farms are located in places that are already too dry or hot and poor smallholder farmers are less able to adapt. Thus, global warming causes the highest harm to agricultural production in developing countries, mainly because many farms in the low latitudes have been already endured climates that are too hot.

As earlier stated, Granger causality and VDA approaches are run after unit root tests. Similarly, diagnostic checklist tests for the VAR was done, after the lag selection order was determined (Table 5), and all the traditional assumptions, such as normality and autocorrelation tests were fulfilled. The findings from the Granger causality approach is presented in Table 6. The results show that there are a unidirectional causality emanating from agricultural ODA, and commercial loans to crop production in Nigeria. The results correspond to the works by Alabi (2014) who also finds a unidirectional causality emanating from agricultural bilateral aid to agricultural productivity in Sub-Saharan African countries.

Table 6
VAR Granger Causality/ block exogeneity Wald test, 1981-2014

Equation	Excluded	χ2- statistic	Df	Prob.
DLNAP	DODAA	8.3232	4	0.0804*
	DLTDCLA	18.7009	4	0.0009***
	DFER	19.7477	4	0.0006***
	DCC	11.4703	4	0.0218**
	All	67.0455	16	0.0000***
DODAA	DLNAP	7.0674	4	0.1324
	DLTDCLA	2.3238	4	0.6764
	DFER	2.2337	4	0.6929
	DCC	1.7285	4	0.7855
	All	9.7659	16	0.8786
DLTDCLA	DLNAP	4.7039	4	0.3191
	DODAA	0.7892	4	0.9399
	DFER	1.8901	4	0.7560
	DCC	10.7146	4	0.0300**
	All	18.2251	16	0.3109
DFER	DLNAP	11.2978	4	0.0234**
	DODAA	3.8026	4	0.4334
	DLTDCLA	4.2625	4	0.3716
	DCC	12.4077	4	0.0146**
	All	68.4848	16	0.0000***
DCC	DLNAP	11.0218	4	0.0263**
	DODAA	5.7474	4	0.2188
	DLTDCLA	6.3388	4	0.1752
	DFER	15.1507	4	0.0044***
	All	37.1594	16	0.0020***

Source: Own analysis based on FAOSTAT
Notes: The asterisks ***, ** and * indicate the rejection of the null hypothesis at 0.01, 0.05 and 0.10 significance level respectively; Original sample size: 1981-2014. Included obs: 29 after adjustments

Similarly, the findings show a bidirectional relationship running from fertiliser consumption, and climate change to crop production in the country. The result further signifies that all the variables (agricultural ODA, domestic loans, fertiliser consumption, and climate change) in the model jointly Granger-cause crop production in Nigeria. Also, a bidirec-

Table 5
VAR Lag Order Selection Criteria

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-507.789	NA	1.57e+09	35.365	35.601	35.439
1	-486.436	33.870	2.08e+09	35.616	37.031	36.059
2	-449.923	45.327	1.12e+09	34.822	37.415	35.634
3	-410.988	34.907	6.98e+08	33.861	37.633	35.043
4	-326.099	46.836*	38382279*	29.731*	34.682*	31.281*

Note: The asterisks * indicates lag order selected by the criterion

tional causality running from climate change to fertilizer application in Nigeria (Table 6). The result further signifies that all the variables in the model jointly Granger- cause fertilizer application and climate change in the country.

The Variance Decomposition (VDA) results for the selected variables over a 10-year horizon is presented in Figure 1. In this study, short run means in the fourth period or year, while long run means in the tenth period or year. The results show that in the short run, the impulse to crop production accounts 65% variation in the fluctuations to its own shock. Similarly, innovation to agricultural ODA (17%), domestic loans (4%), fertilizer consumption (1%), and climate change (12%) can cause the fluctuation in crop output in the short run. In the long run, the results further suggest that innovation to crop production steadily reduces to 24%, while shock to agricultural ODA (17%), loans (35%), fertilizer consumption (4%), and climate change (20%) can cause fluctuation in crop output. This implies that finance and climate change are the major determinants of crop production in Nigeria.

The results show that in the short run, the impulse to agricultural ODA accounts 79% variation in the fluctuations to its own shock. Similarly, innovation to crop production (7%), commercial loans (3%), fertilizer consumption (10%), and climate change (0.6%) can cause fluctuation in crop output in the short run. In the long run, the results further suggest that innovation to sluggishly reduce to 61%, while shock to crop production (22%), commercial loans (9%), fertilizer consumption (8%), and climate change (0.6%) can cause fluctuation in agricultural ODA (Figure 1). This VDA result suggests that even though agricultural production explains the variation in ODA, it is still minimal as ODA substantially accounts for its own shock in the long run.

The results show that in the short run, the impulse to commercial loans account 64% variation in the fluctuations to its own shock. Similarly, innovation to crop production (7%), agricultural ODA (17%), fertilizer consumption (7%), and climate change (6%) can cause fluctuation in commercial loans in the short run. In the long run, the results further suggest that innovation to commercial loans steadily reduces to 46%, while shock to crop production (9%), agricultural ODA (22%), fertilizer consumption (15%), and climate change (7%) can cause fluctuation in commercial loans (Figure 1).

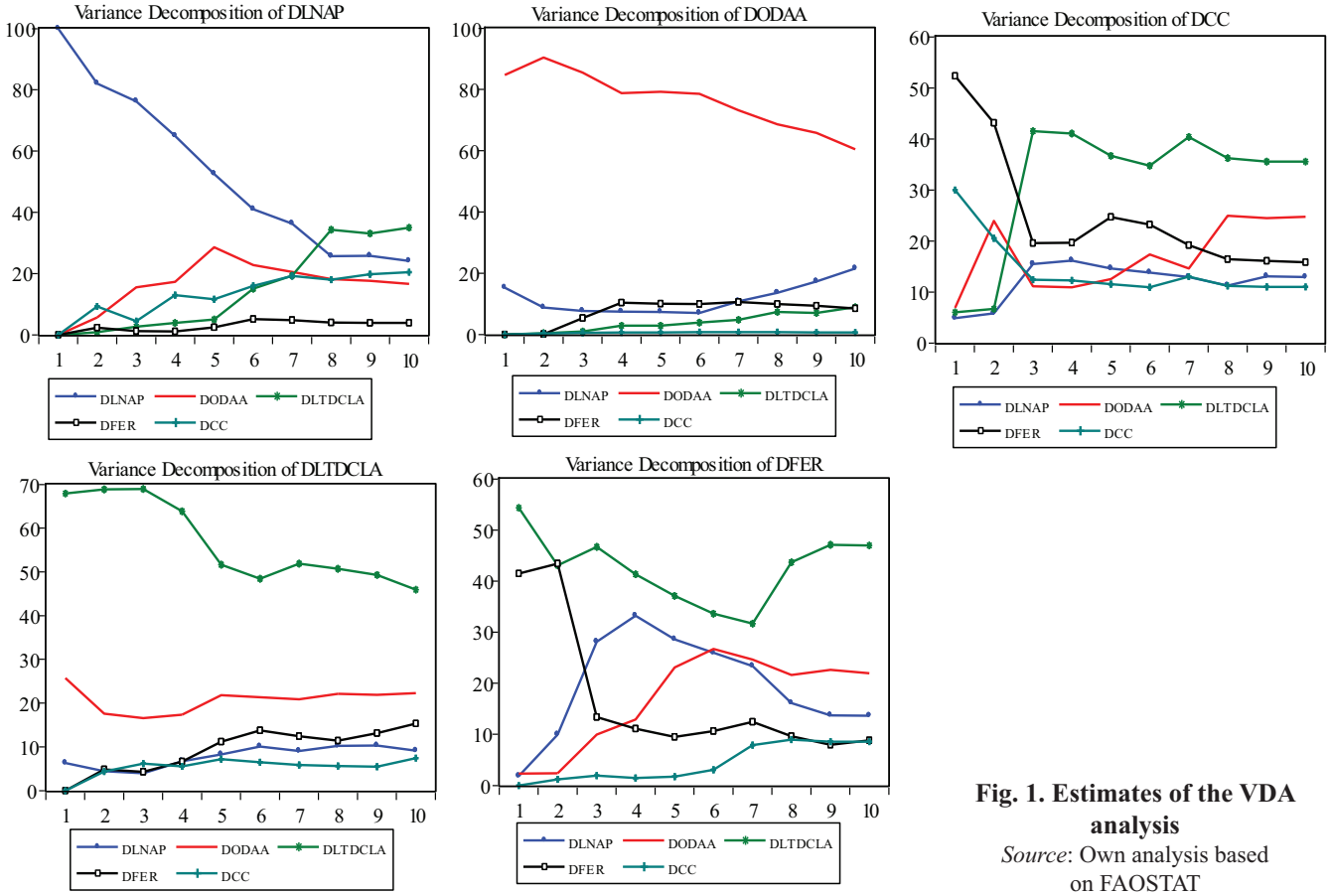

Fig. 1. Estimates of the VDA analysis

Source: Own analysis based on FAOSTAT

Also, the results show that innovation to fertilizer consumption drastically reduces to 9%, while crop production (14%), agricultural ODA (22%), commercial loans (47%), and climate change (9%) can cause fluctuation in fertilizer consumption in the long- run. This implies that finance (ODAA and loans) is a major determinant that drives fertilizer application in Nigeria. In Nigeria, a substantial number of smallholder farmers do not have access to finance needed for fertilizer purchase and application in their farms. The VDA results indicate that impulse to climate change drastically reduces to 11%, while crop output (13%), agricultural ODA (25%), commercial loans (36%), and fertilizer consumption (9%) can cause fluctuation in climate change in the long- run (Figure 1).

By and large, agricultural ODA appears to have a positive effect on crop production, albeit after some variables have been lagged. Future researchers are recommended to use other models to check if, indeed, agricultural ODA has an effect on crop production in Nigeria. Also, primary research is required to verify if agricultural aid has been fully utilized for agricultural related activities in the country.

Conclusions

Nigeria is one among the largest receivers of foreign assistance in Africa, nevertheless, the share of agricultural ODA in the total ODA to the country has remained below 10%. This paper assesses the effect of foreign aid on agricultural production in Nigeria. Using OLS regression, Granger causality and VDA approaches, the OLS results show that agricultural ODA has a positive connection with crop production in Nigeria. Similarly, the results also show that local loans, and fertilizer application are the drivers' of agricultural production in the country. On the contrary, the OLS results show an inverse relationship between climate change and crop production in the country. Similarly, the Granger causality shows a unidirectional causality running from foreign aid to crop production in Nigeria. Also, bidirectional causality is confirmed to be emanating from fertiliser consumption and climate change to crop production in the country.Finally, the VDA results confirm impulse of variables in the model can cause the fluctuation of one another, especially between ODAA and crop output, albeit at a minimal level. The paper concludes that ceteris paribus, ODAA, domestic loans and fertilizer application could boost agricultural production in Nigeria, while climate change could push production to move in the opposite direction.

In the spirit of global partnership for agricultural development, donors should continue to provide technical know-how and financial supports to stimulate farmers in Nigeria. The inflows of foreign aid, loans and general investments in agriculture should be promoted. Finally, the government of Nigeria and donors should ensure that foreign aid is effectively and efficiently utilized for a sustainable crop development in the country.

References

Alabi, R. A., 2014. Impact of agricultural foreign aid on agricultural growth in Sub-Saharan Africa. African Growth & Development Policy Modeling Consortium (AGRODEP Working Paper 0006).

Ammani, A. A., J. F. Alamu and T. M. Kudi, 2010. Effects of fertilizer liberalization on maize production in Nigeria. *Journal of Development and Agricultural Economics*, **2** (11): 401-405.

Akpokodje, G. and B. U. Omojimite, 2008. The effect of aid flows on Nigeria's agricultural growth. *Pakistan Journal of Social Sciences*, **5** (6): 514-520.

Ayinde, O. E., M. O. Adewumi and F. J. Omotosho, 2009. Effect of fertilizer policy on crop production in Nigeria. *The Social Sciences*, **4** (1): 53-58.

Beck, T., R. Levine and N. Loayza, 2000. Finance and the sources of growth. *Journal of Financial Economics*, **58** (1): 261-300.

Bonfiglioli, A., 2008. Financial integration, productivity and capital accumulation. *Journal of International Economics*, **76** (2): 337-355.

Boone, P., 1996. Politics and the effectiveness of foreign aid. *European Economic Review*, **40** (2): 289-329.

Burnside, C. and D. Dollar, 2004. Aid, policies, and growth revisited. *American Economic Review*, **94** (3): 781-784.

Central Bank of Nigeria, 2017. Annual statistical bulletin. http://bit.ly/2vih7od

Chatterjee, S. and S. J. Turnovsky, 2007. Foreign aid and economic growth: The role of flexible labor supply. *Journal of Development Economics*, **84** (1): 507-533.

Chenery, H. B. and A. M. Strout, 1966. Foreign assistance and economic development. *The American Economic Review*, **6** (4): 679-733.

Dalgaard, C. J., H. Hansen and F. Tarp, 2004. On the empirics of foreign aid and growth. *The Economic Journal*, **114** (496): 191-216.

Dewbre, J., W. Thompson and J. Dewbre, 2007. Consistency or conflict in OECD agricultural trade and aid policies. *American Journal of Agricultural Economics*, **89** (5): 1161-1167.

Dickey, D. A. and W. A. Fuller, 1979. Distribution of the estimators for autoregressive time series with a unit root. *Journal of the American Statistical Association*, **74** (366): 427-431.

Easterly, W., 1999. The ghost of financing gap: testing the growth model used in the international financial institutions. *Journal of Development Economics*, **60** (2): 423-438.

Easterly, W., R. Levine and D. Roodman, 2003. New data, new doubts: a comment on Burnside and Dollar's" aid, policies, and growth"(2000) (No. w9846), *National Bureau of Economic Research*.

FAO, 2017. FOSTAT database [Online].

http://bit.ly/NmQzZf (Accessed 10 August 2016)

Fasanya, I. O. and A. B. Onakoya, 2012. Does foreign aid accelerate economic growth? An empirical analysis for Nigeria. *International Journal of Economics and Financial Issues*, **2** (4): 423.

Feder, G., L. J. Lau, J. Y. Lin and X. Luo, 1990. The relationship between credit and productivity in Chinese agriculture: A microeconomic model of disequilibrium. *American Journal of Agricultural Economics*, **72** (5): 1151-1157.

Granger, C. W. J., 1969. Investigating causal relations by econometric models and cross-spectral methods. *Econometrica*, **37** (3): 424-438.

Islam, N., 2011. Foreign aid to agriculture. Review of facts and analysis. *IFPRI Discussion Paper*, **2** (1): 18-25.

Izuogu, C. U. and C. Atasie, 2015. Redefining the Nigerian agricultural extension system for effective agricultural transformation. *Developing Country Studies*, **5** (11): 11-15.

Juselius, K., N. F. Møller and F. Tarp, 2014. The long run impact of foreign aid in 36 African countries: insights from multivariate time series analysis. *Oxford Bulletin of Economics and Statistics*, **76** (2): 153-184.

Kaya, O., I. Kaya and L. Gunter, 2008. The impact of agricultural aid on agricultural sector growth. In: Proceedings of the Southern Agricultural Economics Association Annual Meeting, 2-6 February, 2008, Dallas, USA, pp. 1-14.

Kaya, O., I. Kaya and L. Gunter, 2012.Development aid to agriculture and economic growth. *Review of Development Economics*, **16** (2): 230-242.

Levine, R., 2001. International financial liberalization and economic growth. *Review of International Economics*, **9** (4): 688-702.

Mendelsohn, R., 2008. The impact of climate change on agriculture in developing countries. *Journal of Natural Resources Policy Research*, **1** (1): 5-19.

Mosley, P., 1980. Aid, savings and growth revisited. *Oxford Bulletin of Economics and Statistics*, **42** (2): 79-95.

Mosley, P., J. Hudson and S. Horrell,1987. Aid, the public sector and the market in less developed countries. *The Economic Journal*, **97** (387): 616-641.

OECD and WTO, 2015. Aid for trade at a glance 2015: reducing trade costs for inclusive, sustainable growth. Paris: *OECD* Publishing.

Pack, H. and J. R. Pack,1990. Is foreign aid fungible? The case of Indonesia. *The Economic Journal*, **100** (399): 188-194.

Phillip, D., E. Nkonya, J. Pender and O. A. Oni, 2009. Constraints to increasing agricultural productivity in Nigeria: A review, No. 6. *International Food Policy Research Institute* (IFPRI).

Ram, R., 2004. Recipient country's 'policies' and the effect of foreign aid on economic growth in developing countries: additional evidence. *Journal of International Development*, **16** (2): 201-211.

Seguin, B. and I. G. de Cortazar, 2005. Climate warming: consequences for viticulture and the notion of 'terroirs' in Europe. *Acta Horticulturae*, **689** (1): 61-69.

Sender, J., 2002. Reassessing the Role of the World Bank in Sub-Saharan Africa. In: Pincus, J. and Winters, J. (Eds.), Reinventing the World Bank. London: *Cornell University Press*.

Stojanov, R. and W. Strielkowski, 2013. The role of remittances as more efficient tool of development aid in developing countries. *Prague Economic Papers*, **22** (4): 487-503.

United Nations, Department of Economic and Social Affairs (UNDESA), 2017. World population prospects: The 2017 Revision, DVD Edition.
http://bit.ly/2cnUFD4

van Leeuwen, C. and P. Darriet, 2016. The impact of climate change on viticulture and wine quality. *Journal of Wine Economics*, **11** (1): 150-167.

Verter, N. and V. Bečvářová, 2015. An analysis of yam production in Nigeria. *Acta Universitatis Agriculturae et Silviculturae Mendelianae Brunensis*, **63** (2): 659-665.

World Economic Forum, 2016. The Global Competitiveness Report 2016-2017. Geneva: *WEF*.

Received August, 1, 2017; accepted for printing September, 15, 2017