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Effect of Land Grabbing on Agricultural Productivity in Nigeria: A Vector Error Correction Approach

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Abstract

The growing incidence of land grabbing and the threat it poses to agricultural growth and food security in developing countries including Nigeria is a of grave concern. This study investigated the effect of land grabbing on agricultural per capita gross domestic product, agricultural productivity of investment and food security in Nigeria. Secondary data used for the study were gathered from the Central Bank of Nigeria bulletin, the Food and Agriculture Organization of the United Nations and the National Bureau of Statistics spanning 36 years (1980-2015). The Per Capita Agricultural Domestic Product ($PCAGDP_t$), the Area of Land Used by Foreign Investors ($AALUFI_t$) which was a proxy for land grabbing. The parsimonious vector error correction model was used to estimate the effect of land grabbing on Per Capita Agricultural Gross Domestic Product (PCAGDP) and show the short run and long run relationships, which exit. The result of the parsimonious vector error correction model showed that $AALUF_{It}$ was significant ($p<0.01$), negative and caused 38% and 21.3% decrease in $PCAGDP_t$ in the long run and short run respectively. $LnDIA_{t-1}$ and $LnGCEA_{t-1}$ were significant ($p<0.01$), negative and caused a decrease of 70% and 15% respectively in $PCAGDP_t$ in the long run. The study recommended effective government monitoring and protection of growth and productivity in the agricultural sector by ensuring the Country's agricultural land resources are not inordinately acquired by foreign investors whose activities do not add value to national productivity.

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Introduction

Large-scale acquisition of land for agricultural purposes in developing countries is not a new phenomenon. The practice has been ongoing in the global south in general and Africa in particular for centuries. The dispossession of smallholder farmers, pastoralists, indigenous peoples and rural communities of their land in Africa has been a continuous process over centuries of foreign and internal colonization as well as post-independence land grabbing [1]. Large amount of Foreign Direct Investment (FDI) is used annually to acquire land in Africa for the production of food and agro fuels by Transnational Corporations (TNCs) originating from Europe and other industrialized regions of the world. Investment in the agricultural sector, which was hitherto driven by domestic investors, has witnessed a steady rise in the amount of foreign investment being ploughed in. However, it has been observed that agricultural FDI in sub-Saharan Africa is mainly land based and FDI coming into the agricultural sector, which is mainly for the acquisition of land for production purposes, has been on the rise in those countries that are targets of Large Scale Land Acquisitions (LSLAs) [2,3]. Benefits arising from agricultural FDI should include capital inflows, technology transfers, leading to domestic productivity and production, quality improvement, employment creation, and forward and backward linkages as most of these foreign investments in agriculture are used for the acquisition of land and farm machinery and equipment used for production and processing of produce from the farms [4]. However, Productive activities on the land acquired are driven by the desire to produce for the home country of the investors. Furthermore, foreign investors gain access to natural resources such as land and water and most often the proceeds are repatriated to foreign lands thereby depriving the host nations land for increased production. So, even though the local farmers are dispossessed of their land, the output from such land still does not contribute much to the total agricultural output in the host nation [5]. Moreover, foreign investors with the active connivance of indigenous governments on the continent pay so little to acquire such large expanse of land. Table 1.1 shows the show the inflow of foreign direct investment into the agricultural sector as well as domestic investment in agriculture and government capital expenditure and agricultural gross domestic product in Nigeria from 1980 to 2015.

Table 1: Agric. FDI, Total domestic investment, government capital expenditure in agriculture and agric. Gross domestic product 1980-2015 (Million Naira).

Year	Agric Foreign Direct Investment	Total domestic investment to agriculture	Government Capital Expenditure in Agric.	Agriculture Gross Domestic Product
1980	25.95	2.85	17.14	18.69
1981	18.72	3.14	13.03	19.53
1982	48.25	3.73	14.8	22.56
1983	35.15	3.84	12.77	26.44
1984	27.71	4.53	15.66	33.78
1985	27.05	5.01	20.36	38.24
1986	56.34	7.19	892.5	39.93
1987	61.33	7.13	365.1	57.58
1988	68.6	9.18	595.7	86.58
1989	56.31	11.63	981.5	120.06
1990	334.41	12.94	1758.5	122.23
1991	173.92	15.82	551.2	144.7
1992	222.88	20.49	763	217.42
1993	767.25	38.6	1820	350.05
1994	133.08	62.39	2800	528.95
1995	559.99	85.94	4691.7	940.3
1996	56.73	120.97	3892.8	1,275.75
1997	90.04	226.02	6247.4	1,445.15
1998	259.48	233.46	8876.6	1,600.58
1999	32.28	299.05	6912.6	1,704.82
2000	131.63	200.65	5761.7	1,801.48
2001	39.5	431.62	57879	2,410.05
2002	62.92	466.01	32364.4	2,847.11
2003	94.72	473.21	8510.9	3,231.44
2004	140.45	639.9	48047.8	3,903.76
2005	1199.85	812.02	79939.4	4,752.98

2006	1232.58	984.47	15176.8	5,940.24
2007	1299.06	1,823.08	22518.58	6,757.87
2008	1956.07	2,877.77	23644.51	7,981.40
2009	1262.48	3,729.08	24826.73	9,186.31
2010	14758.54	2,052.54	26068.07	13,048.89
2011	15499.61	1,834.69	27371.47	14,037.83
2012	15828.17	1,990.34	28740.05	15,816.00
2013	15880.92	2,333.54	32619.96	16,816.55
2014	19410.01	2,480.55	38165.35	18,018.61
2015	21115.86	2,928.70	348.7	19636.97

Compiled by the author from CBN Reports, NBS reports and FAOSTAT.

The large inflow of FDI into the agricultural sector also removes income opportunities from local farmers thereby plunging them into severe poverty. This is because the vast areas of land that is acquired, which may have seemed to be waiting for development are often providing important economic and social benefits for local communities. Thus, it is not just about bringing land into production but also the disruption of the livelihood and social structure of traditional communities who have for decades relied on their land for sustenance [6,7].

The global demand for agricultural land in 2008 was just about 4 million Hectares (Ha). This figure rose within a space of one year to about 56 million hectares in 2009 with 70 percent of the increase from Africa alone. The Food and Agriculture Organization (FAO) of the United nations also estimates that between 2009 and 2010, 20 million hectares have been acquired by foreign interests in Africa with many land deals involving more than 10,000 hectares and several more than 500,000 hectares. As at 2012, 134 million hectares of land had already been grabbed in sub-Saharan Africa alone [8-10]. also reported that investors from countries in Europe including Italy, Norway, Germany, Denmark, the United Kingdom, and France form the bulk of those investing in agriculture. These are joined by emerging economies in Asia. A large proportion of large scale land acquisition occurs in Africa and the Continent accounts for 70% of global large scale land acquisitions in 2011 being on the continent [11,12].

It appears that huge amount of FDI is being used to acquire large swathes of arable land for the purpose of agricultural production to meet the growing needs of the developed and a few newly emerging economies. Furthermore [11], posited that land grabbing undermines the contribution of agriculture to the GDP in countries where the practice is prevalent. Thus, the import of this practice on the growth and development of these countries, especially Nigeria is dire. The practice undermines the policy of government that focuses on agriculture as a key sector for economy recovery and growth and carries a number of inherent risks including that of underdevelopment Also, the practice of land grabbing erodes the productivity of the smallholder farmer and poses a threat to food output and national food security [2].

The abnormal land demand by the TNCs is exerting intense pressure on the local smallholder farmers the effect of which is counterproductive. Evidence can be seen in the disproportionate size of farmlands of these foreign investors compared to the relatively small farm holdings of the smallholder farmer. The land acquired by the foreign investors is usually prime land and tend to be among the best ones, with good soil quality, high production potential, irrigation and proximity to infrastructure and markets [13]. So, the smallholder farmers not only loose access to farmland but much more importantly, they are dispossessed of rich and fertile agricultural land. This has become a major challenge because it is these smallholder farmers that produce a larger proportion (about 80%) of the food consumed in a country like Nigeria [1]. Dispossessing them of their agricultural land in Nigeria therefore portends grave consequences including food deficit, malnutrition and general food insecurity. One may ask then, is the case of increasing herdsmen and farmers clashes and rising food prices not an indirect consequence of land gabbing in the Country? The issue of land grabbing is therefore a relative threat to increase agricultural output of the farmers in Nigeria.

In this study, we investigate the short-and long- run relationship between land grabbing and agricultural productivity in Nigeria over the period 1980-2015, using the Vector Error Correction Model (VECM). The test for co-integration was first carried out using the Johansen test before

Methodology

The study was conducted in Nigeria. The country is situated in tropical Sub-Saharan Africa along the Gulf of Guinea and is one of the largest countries on the continent. Nigeria lies between latitudes 4° and 14° north of the Equator and between longitudes 3° and 15° east of the Greenwich Meridian [14]. Nigeria has a total land area of 923,768.622 km^2 or about 92.4 million hectares, made up of land: 910,768 sq km and water: 13,000 sq km. The influence of foreign investors in primary agricultural production in the Country is evident by their presence in all the six geopolitical zones. The most visible is the American Rice Farmers in the North east, Zimbabwean and Israeli farmers in the North central, American and Chinese Vegetable farmers in the Southeast and South zones.

The main sources of data are from the Central Bank of Nigeria (CBN) and National Bureau of Statistics and FAOSTAT. The time period of the study is over the years 1980 to 2015.

The VECM as specified by Khumalo and Mosiane [15] is as follow:

$$\Delta \ln PCAGDP_t = \log\beta_0 + \beta_1 \Delta \log AALUFI_t + \beta_2 \Delta \log GEA_t + \beta_3 \Delta \log DIA_t + \beta_4 \Delta \log AFDI_t + \beta_5 ECT_{t-1} + v_t$$

Where PCGDP is per capita agricultural gross domestic product, AALUFI is the area of land used by foreign investors, which is proxy for land grabbing; AFDI is agricultural foreign direct in-

vestment, DIA is total domestic investment in agriculture and GCEA is government capital expenditure on agriculture.

The a priori expectation is stated mathematically as:

GEA_t, DIA_t, $AFDI_t$ >0; $AALUFI_t$ < 0.

Results and discussion

To show the long run and short run relationships between the independent variables in the model and the dependent variable, the vector error correction model was estimated. First Johanson cointegration test was conducted. The result is presented in Table 2.

The endogenous variables were LOG (PCAGDP) LOG (AALUFI) LOG (AFDI), LOG (DIA) and LOG(GCEA). Sample ranged from 1980: 2015 and the included observations were.

Table 2: VAR lag order selection criteria.

Lag	Log L	LR	FPE	AIC	SC	HQ
1	-129.2904	NA	0.006080*	9.075904*	10.19823*	9.458648*
2	-109	28.64917	0.008677	9.352776	11.59742	10.11827

*: Indicates Lag Order Selected by the Criterion; LR: Sequential Modified LR Test Statistic (each test at 5% level); FPE: Final Prediction Error; AIC: Akaike Information Criterion; SC: Schwarz Information Criterion; HQ: Hannan-Quinn Information Criterion.

The optimum lag length based on the selection of lag order criteria using sequential modified LR test statistic (LR), and Final Prediction Error, Schwarz information criterion (SC), Hannan-Quinn information criterion (HQ) and Akaike Information Criterion (AIC) respectively is "1". Lag of 1 was appropriate since the lag order selection result fell on one. Therefore, LR: sequential modified LR test statistic each was test at 5 percent level of significance, FPE: Final prediction error, AIC: Akaike information criterion, SC: Schwarz information criterion and HQ: Hannan-Quinn information criterion all confirmed that three period lag is most appropriate for the analysis. With this optimal lag length, the Johansen procedure was carried out to ascertain if any co-integration (long-run) relationships exists among variables. The null hypotheses of no co-integrating relationship was tested against an alternative hypotheses that there was at least 1 co-integrating vector for the maximum Eigen value and trace statistic respectively. The null hypothesis of no co-integrating vector was rejected and the alternative hypothesis of co-integrating vectors was accepted and in this study. Hence in estimating the error correction model, we utilize a lag length of 1. Thereafter, the results of the Johansen co-integration test based on the optimal lag length chosen by the lag selection criteria were presented below.

Having confirmed the order of integration and lag order of the variables for this study, we proceeded to confirm the existence of a long-run relationship among these variables. The result in Table 3 shows the Johansen cointegration test. The trend assumption is linear deterministic trend and the series is LOG (PCAGDP) LOG (AALUFI) LOG (AFDI) LOG (DIA) LOG (GCEA), Lags interval (in first differences): 1 to 2

Table 3: Johansen Cointegration Test.

Hypothesized No, of CE (s)	Eigenvalue	Trace Statistics	0.05 Critical Value	Prob.**
None *	0.663	86.574	69.819	0.001
At most 1 *	0.473	50.634	47.856	0.027
At most 2	0.400	29.509	29.797	0.054
At most 3	0.284	12.665	15.495	0.128
At most 4	0.048	1.623	3.841	0.203

Trace test indicates 2 cointegrating eqn(s) at the 0.05 level; * denotes rejection of the hypothesis at the 0.05 level; **MacKinnon-Haug-Michelis (1999) p-values [16].

Table 4: Unrestricted Cointegration Rank Test (Maximum Eigenvalue).

Hypothesized No, of CE (s)	Eigenvalue	Trace Statistics	0.05 Critical Value	Prob.**
None *	0.663	35.940	33.877	0.028
At most 1	0.473	21.125	27.584	0.269
At most 2	0.400	16.844	21.132	0.180
At most 3	0.284	11.042	14.265	0.152
At most 4	0.048	1.623	3.842	0.203

Max-eigenvalue test indicates 1 Cointegration eqn(s) at the 0.05 level; * denotes rejection of the hypothesis at the 0.05 level; **MacKinnon-Haug-Michelis (1999) p-values [16].

To consider the Null hypothesis that the variables are not co-integrated (r=0) against the alternative hypothesis of one or more co-integrating vectors (r>0), it is necessary to look at the values of TRACE statistic. The result of the trace statistic indicates the value of TRACE equal to each number of the co-integrating vector: TRACE (0) = 86.754, TRACE (1) = 50.634, TRACE (2) = 29.509, TRACE (3) = 12.665 and TRACE (4) = 1.623. The trace test indicates 2 co-integrating equation at the 0.05 level as denoted by the significant sign (*) on the hypothesized number of co-integration equations at none and at most 1. This implies that the null hypothesis that the variables are not co-integrated (r=0) was rejected at 0.05 level and the alternative hypothesis that there are one or more co-integrating vectors (r>0) was accepted judging from the MacKinnon-Haug-Michelis [16] p-values for none and at most 1 equations.

Similarly, the result of the Maximum Eigen statistic indicates that the value of Maximum Eigen value equal to each number of the co-integrating vector: Maximum Eigen value (0) = 35.394, Maximum Eigen value (1) = 21.125, Maximum Eigen value (2) = 16.844, and Maximum Eigen value (3) =4.699852, Maximum Eigen value (4) = 11.042 and Maximum Eigen value (5) = 1.623. The Maximum Eigen value test indicates one (1) co-integrating equation at the 0.05 level as denoted by the significant sign (*) on the hypothesized number of co-integration equations for none. This implies that the null hypothesis that the variables are not co-integrated (r=0) was rejected at 0.05 level and the alternative hypothesis that there are one or more co-integrating vectors (r>0) was accepted judging from the MacKinnon-Haug-Michelis [16] p-values for none equations which were less than 0.05%.

The results of the co-integration tests showed that there was co-integration in the per capita agricultural gross domestic product model with the trace test showing 2 co-integrating variables and the Maximum Eigen value test showing a co-integrating variable. Thus, the trace test and the Maximum Eigen value test showed slightly no disparity in their ability to account for all the outliers on the regression line. Once there is co-integrating vector, a long run relationship is concluded. According to Engle and Granger, when a set of variables are I(1) and are co-integrated then short-run analysis of the system should incorporate Error Correction Term (ECT) in order to model the adjustment for the deviation from its long-run equilibrium. The Error Correction Model (ECM) is therefore characterized by both differenced and long run equilibrium models, thereby allowing for the estimates of short-run dynamics as well as long-run equilibrium adjustments process. This indicates that if the variables are co-integrated then they share a long-run relationship, which error correction model corrects. Therefore, the result of the co-integration test established that there exist a long run relationship among the variables that were co-integrated at order I(1). The models were normalized on the variables in order to obtain the long-run parameter estimates. Since there is a long-run and short-run relationship, we will then proceed to estimate the parsimonious Error Correction Model (ECM).

The Parsimonious Error Correction Model correction was used to estimate the effect of land grabbing on $PCAGDP_t$, showing both the short run and long run effects. The result is presented in Table 5.

Table 5: Result of the Parsimonious Error Correction Model.

Variable	Coefficient	Std. Error	t-statistics
Long run			
Ln(AALUFI(-1)	-0.380	0.071	-5.362***
Ln(AFDI(-1)	0.0005	0.027	0.017
Ln(DIA(-1)	-0.702	0.051	-13.864***
Ln(GCEA(-1)	-0.150	0.0353	-4.276***
Short run			
ECM (-1)	-0.834	0.097	-8.624***
D(Ln(AALUFI(-1)	-0.213	0.058	-3.673***
D(Ln(AFDI(-1)	-0.007	0.041	-0.159
D(Ln(DIA(-1)	0.066	0.172	0.382
D(Ln(GCEA(-1)	-0.063	0.046	-1.369
R-squared	0.804		
Adj. R-squared	0.760		
F-statistic	18.416***		

Source: Generated data from various issues of CBN, NBS and FAOSTAT (1980 -2015); ***: Significant at 1%; **: Significant at 5%; (-1): 1 year lagged.

The result in Table 5 shows that the coefficient of multiple determinations (R^2) value was 0.804, which indicates that the explanatory variables jointly accounted for about 80.4 percent of the variations in the dependent variable $PCAGDP_t$. The value of the F-statistics also indicates the robustness of the model.

The result shows that in the long run, $AALUFI_{t-1}$, $GDIA_{t-1}$ and $GCEA_{t-1}$ were significant ($p<0.01$) and negatively influenced $PCAGDP_{t-1}$. This implies that there is inverse relationship between these variables and $PCAGDP_t$. The result also shows that the value of $PCAGDP_t$ falls by 0.38 percent for every one percent increase in $AALUFI_t$. This is indicative of the profound adverse effect of $AALUFI_t$ on output and growth in the agricultural sector even in the long run. Furthermore, this relationship may be considered from the perspective that foreign large-scale land acquisition has the ability to displace local small holder farmers from their land and thereby reduce their output even in the long run. Limited access to land limits the size and scale of the farm business [17,18]. Land is one of the most important factors of production and has a direct relationship with output. A reduction in agricultural land area available to smallholder farmers who form the majority of producers in the agricultural sector therefore impinges negatively on their output and hence reduces overall output of the agricultural sector.

There is a negative relationship between DIA_t and $PCAGDP_t$ in the long run and this is not in consonance with a priori expectation. A percent increase in DIA_t will lead to 70.2% decrease in $PCAGDP_t$. This relationship may however be ascribed to low returns on investment made in the sector by local investors. Nigeria's agriculture is still rain-fed and therefore very vulnerable to the vagaries of weather as well as attacks by diseases and pests, all of which could increase investment risks and drastically reduce output. According to Nnamerenwa [18] and Ayinde, Ajewole, Ogunlade and Adewumi [19], Nigeria's agriculture is rain dependent and adequate and timely rainfall is necessary for better agricultural output. Processors and other actors in the sector are also exposed to the risks of wide fluctuations in prices of inputs, unavailability of constant power supply, instability and inconsistencies in policies, and low capacity utilization all of which affect output adversely and reduces growth in the sector.

$GCEA_t$ was negatively related to $PCAGDP_t$. This implies that an inverse relationship and a percent increase in $GCEA_t$ will lead to a 15% decrease in $PCAGDP_t$. This again is not in agreement with a priori expectation. A likely reason for this relationship may be massive diversion of funds and corruption which is rife in the public sector of the Country and which usually leads underperformance of Government's funding in almost all sectors of the economy. Also, the effect of the top-down syndrome in planning and implementation of capital projects in the agricultural sector tends to reduce the performance of these projects and hence the output of beneficiaries of such projects.

The model also showed that the parameter estimate of the co-integrating error correction term (ECM (-1) which measures the speed of adjustment of the dependent variables to equilibrium after a deviation has occurred due to a change due to the explanatory variables in the model is 0.833. This is negative and lies between zero and one. Ehirim [20] indicated that an ECM that is negative and significantly different from zero actually justifies long run adjustment with a speed of less than 100%. The result therefore indicates that the stochastic error (residuals) processes generated and their movements with time in the model can be corrected and the speed of adjustment back to equilibrium in the long run was given as 83.3 percent.

Also in the short run, the area of land used by foreign investors $AALUFI_t$ was significant ($p<0.01$) and negatively related to $PCAGDP_t$. The result shows that there is a 21.3 percent fall in PCAGDPt for every one percent increase in $AALUFI_t$ in the short run. This indicates the acuteness of the problem of large-scale land acquisition as it relates to output and growth in the agricultural sector. The coefficients of DIA_t, $AFDI_t$ and $GCEA_t$ were not found to be significant in the short run.

Conclusion and recommendation

Per Capita Agricultural Gross Domestic Product of the Country and agricultural productivity of investment which are indicators of growth and productivity in the agricultural sector are adversely influenced by land grabbing and this adverse effect of land grabbing on growth in the agricultural sector is evident both in the long run and short run. Agricultural foreign direct investment, total domestic investment in agriculture and Government capital expenditure on agriculture boost growth and productivity in the agricultural sector. Total domestic investments in agriculture and government capital expenditure on agriculture also affect per capita agricultural gross domestic product negatively in the long run.

- The negative effect of land grabbing on growth and productivity could be reduced or eliminated by enacting appropriate laws and policies that would stipulate the area of land that may be acquired by foreign investors. This would prevent the in discriminatory acquisition of land by these foreign investors.
- Policies of government that would ensure that some proportion of produce from foreign owned farms are utilized locally should be formulated.
- Foreign owned farms should be encouraged to establish value addition firms that would enhance local industrialization and employment generation in the Country.

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