

## EMPIRICAL LINKAGE BETWEEN FOREIGN DIRECT INVESTMENT INFLOW AND AGRICULTURAL SUB-SECTORAL PRODUCTIVITY IN NIGERIA

Akpan<sup>1</sup>, S. B., Udoh<sup>2</sup>, E. J. and Umoren<sup>2</sup>, A. A.

### ABSTRACT

<sup>1</sup>Department of Agricultural Economics and Extension, Akwa Ibom State University, Ikot Akpaden, Mkpato Enin, Akwa Ibom state, Nigeria. E-mail: sundayakpan10@yahoo.com; Phone Number: 08036728337

<sup>2</sup>Department of Agricultural Economics and Extension, University of Uyo, Akwa Ibom State, Nigeria

The study determined relationship between foreign direct investment and agricultural sub sector's productivity as well as overall sector's productivity in Nigeria. Time series data were used, and the time frame covered the period 1986 to 2016. Data were sourced from Food and Agriculture Organization (FAO); Central Bank of Nigeria (CBN) and National Bureau of Statistics (NBS). Augmented Dickey-Fuller unit root test was conducted on the specified series to ascertain their stability. Growth analyses revealed that, crop and livestock sub-sectors' productivity have positive exponential growth rates of 0.05% and 0.006% respectively. Also, forestry and fishery sub sectors' productivity grew at the rate of 0.57%. Similarly, exponential growths in overall agricultural sector and FDI stood at -1.33% and -7.056% respectively. The empirical result showed that, crop sub sector's productivity has a significant positive relationship with FDI in the long run; while livestock sub sector productivity showed negative relationship. There was no significant relationship between FDI and fishery as well as forestry sub-sectors' productivity in Nigeria. The result also revealed significant positive relationship between agricultural sector productivity and FDI both in the short and long run periods. Furthermore, the volume of credit to agricultural sector, unemployment rate and demand capacity impacted significantly on the sub sectorial productivities and the overall agricultural sector's productivity in Nigeria. Mainstreaming Global best Practices in the domestic policy environment to create internationally acceptable environment for FDI to flourish and achievement of stability of microeconomic fundamentals would be sensible policy option.

**Keyword:** Foreign direct Investment, Agricultural growth, Agricultural Policy, Nigeria

### INTRODUCTION

The agricultural sector in Nigeria is entangled with several challenges. Among notable constraints are; low level of irrigation development, limited adoption of research findings and technologies, high cost of farm inputs, poor access to investible funds, inefficiency in fertilizer procurement and distribution, inadequate storage facilities and poor access to markets as well as low mechanization of farms (Udoh and Akpan, 2007; IFPRI, 2008 Aya and Akpan, 2009; Eze *et al.*, 2010; Aniefiok *et al.*, 2016; Akpan *et al.*, 2016). Over the past 20 years, statistics on Nigeria has shown that, value-added per capita in agriculture in the country was less than one percent per annum. The Federal Ministry of Agriculture and Rural Development in 2008, revealed that, food (crop) production growth rate was far below the population growth, resulting in rising food imports and declining levels of national food self-sufficiency. The report also asserted that, except for poultry production, the domestic production of animal products is less than half the demand for beef, mutton and goat meat; while for milk and pork products, it is less than one quarter of the total demand in the country. However, low investment in the agricultural sector as a result of the dominance resource poor smallholder farmers particularly in most developing countries over the past 30 years has resulted in low productivity and dwindling agricultural production. The recent increase in food import bills and food price spikes have exposed the insufficiency of agricultural production in the country. Hence, achieving agricultural production growth rate that sufficiently matches the population growth rate in a sustainable manner that preserves natural resources and being conducive to long-term development plan will require even more capital especially in Nigeria.

Foreign Direct Investment (FDI) constitutes one of the fundamental exogenous sources of capital available to several developing economies especially in the Sub-Saharan Africa (Dabour, 2000). It represents a viable channel through which issues like increasing poverty incidence; low capital accumulation, low savings and relatively weak capital and money markets are ameliorated in poverty stricken region like the Sub-Saharan Africa (Iddrisu, *et al.*, 2015). Developing countries, emerging economies and countries in transition, due to advantages related to FDI have liberalized their FDI regimes and followed the best policies to attract external investment in form of FDI (Kurtishi-kastrati, 2013). Foreign direct investment is believed to contribute immensely to financing of agricultural projects and dissemination of technologies among farmers in developing economies (Msuya, 2007). According to De Mellor, (1997), inward FDI has potentials to stimulate domestic investments through links in the

production chain. In developing economies, experts have asserted that, foreign capital inflow supplements investible funds in the recipient country thereby stimulating domestic capital formation. According to Liu *et al.* (2001), Oyatoye, (2011) and Keho, (2015), inward FDI can also increase the host country's export capacity causing it to increase its foreign exchange earnings. Following FAO suggestion, the developing economies need an annual net investment of USD 83 billion in primary agriculture and necessary downstream activities in order to meet food requirements by the year 2050 (Hallam 2009 and Heumesser and Erwin, 2012). In line with the current increase volatility in crude oil prices, the Sub-Saharan African needs additional source of funding to stimulate growth in a critical sector such as Agriculture.

Agricultural sector is one important area FDI has proven effective in tackling the fundamental issues facing Africa. Increase in the agricultural productivity and growth is critical for reducing poverty and enhancing sustainability and food self-sufficiency in the developing world (Msuya, 2007). Agricultural development needs modern and sophisticated technologies and a huge capital investment. In addition, lending by commercial banks to agriculture has fallen across developing nations with sub-Sahara African countries recording commercial lending to agriculture of less than 10% of the total credit. For example in Nigeria, only 3.0% of the total volume of credit in the economy was allocated to agricultural sector in 2014 and 2015 (FAO, 2016 and CBN, 2016). Additionally, the issue of collateral and the moratorium period attached to agricultural borrowing as well as the volume of capital required to boost the agricultural sector makes borrowing from microfinance and other specialized financial institutions unsuitable either (Akpan *et al.*, 2013). Worse still, the development assistance that is directed to agricultural sector in developing countries sometimes does not meet the critical need of beneficiaries and is often tight to project of interest to the donor rather than the recipient state. The Maputo Declaration on Agriculture and Food Security and the 10 percent national budget allocation to agricultural and rural developments, implementable within five years was an illusion to many African countries including Nigeria. Following these shortfalls in funding agricultural sector in developing society such as Nigeria, the need for alternative sources of funding with less stringent condition became overwhelmingly necessary.

FDI plays an important role in promoting economic growth and in reducing poverty by providing capital, stimulating market competition and efficiency, generating useful jobs, technology spillovers, human capital formation support, enhancement of competitive business environment, contribution to international trade integration and improvement of enterprise development (Bennett, 2005). Moreover, further than economic benefits FDI has also help the improvement of environment and social condition in the host country by relocating 'cleaner' technology and guiding to more socially responsible corporate policies (Kurtishi-kastrati, 2013). These investments have the potential to contribute to food production on a global scale and to increase food security in home and host countries. In consonance with this assertion, several researchers have investigated the empirical link between FDI and agricultural sector productivity in developing economies. For instance, Oloyede (2014) found positive relationships between FDI and agricultural productivity in both short and long run periods in Nigeria. In Ghana, Djokoto (2011) reported neutral relationship between these two variables. In the same vein, Akande and Biam (2013) also carried out an empirical investigation to establish the causal relations between foreign direct investment in agriculture and agricultural output in Nigeria. The results revealed that no long run equilibrium relationship exists between FDI in agriculture and agricultural output in Nigeria both in the presence of inflation shock and in its absence. However, the short run causal influence flows from FDI in agriculture to agricultural output, no short run influence runs from the latter to the former with inflation playing negative role on the short run influence of FDI in agriculture on agricultural output. Izuchukwu *et al.* (2014) examined the impacts of FDI, trade and its effects on agricultural sector development in Nigeria between the periods of 1980-2009. Using VAR model, they discovered that there was no Granger causality between FDI and agricultural output in Nigeria. Iddrisu *et al.* (2015) in Ghana found negative relationship between FDI and agricultural sector productivity in the long run but with positive relationship in the short run.

From the literature so reviewed, there are contradicting results concerning the relationship between FDI and agricultural productivity in developing countries including Nigeria. Since agricultural sector consists of several sub-sectors, the relationship between these sub-sectors and FDI has not received sufficient survey and attention among researchers in developing economies. Again, following the revenue diversification drive in Nigeria; crude oil price volatility; high priority accorded agricultural sector and shortage of investible fund in the sector as well as declining Gross Domestic Product (GDP) in Nigeria, it becomes imperative to empirically establish these relationships in a bid to fine-tune policies related to FDI. In addition, investigation of agricultural sub-sectors productivity correlation with FDI inflow to the economy is limited in Nigeria. This study is therefore designed to bridge these lacunae in the literature and provides useful information to policy makers on the impact of FDI on sub - sectoral productivity and agricultural sector in Nigeria. Premised on this, the study specifically analyzed the trend in FDI and agricultural productivity and also determined the impact of FDI on agricultural sub sectors on

one hand and agricultural sector on the other hand in Nigeria. In addition, some macroeconomic variables were incorporated in the model to also investigate their impact on agricultural productivity in Nigeria.

**RESEARCH METHODOLOGY**

**Study Area:** The study was conducted in Nigeria; the country is situated on the Gulf of Guinea in the Sub Saharan Africa. Nigeria lies between 4<sup>0</sup> and 14<sup>0</sup> North of the Equator and between longitude 3<sup>0</sup> and 15<sup>0</sup> East of the Greenwich. The country has a total land area of about 923,769km<sup>2</sup> (or about 98.3 million hectares) with 853km of coastline along the northern edge of the Gulf of Guinea and a population of over 140 million people (NPC, 2006). Nigeria is bounded by the Republics of Benin in the west, Chad and Cameroon in the east and Niger to the north.

**Data Source:** Secondary data were used for the study and were sourced from several publications of Central Bank of Nigeria (CBN), National Bureau of Statistics, Food and Agricultural Organization (FAO) and World Bank data base website. Data covered the period 1986 to 2016.

**Analytical technique**

**Trend analysis of variables**

The study analysed the nature of growth rate in agricultural sub sector’s productivity and foreign direct investment by employing the exponential trend equation as specified below:

$$CRG_t = b_0 e^{bt} e^{ut} \dots \dots \dots (1)$$

$$\log_e CRG_t = \log_e b_0 + b_1 t + U_t \dots \dots \dots (2)$$

Where exponential growth rate is calculated as (r) = (e<sup>b1</sup> - 1) \* 100 ..... (3)

Variables used in the trend analysis include:

- CRG<sub>t</sub> = Crop sub- sector’s productivity (%)
- LSG<sub>t</sub> = Livestock sub sector’s productivity (%)
- FRG<sub>t</sub> = Forestry sub sector’s productivity (%)
- FSG<sub>t</sub> = Fishery sub sector’s productivity (%)
- TAG<sub>t</sub> = Agricultural sector’s productivity (%)
- FDIt = Foreign direct investment in agriculture expressed as (FDI/GDP) in (%)

Note that sub sectors’ productivities were measured by dividing the respective sub sector’s contribution in agricultural GDP by the total GDP derived from agriculture. The exponential trend equation was adopted because, several literature have supported undulated pattern of agricultural growth and foreign direct investment in Nigeria (Akpan et al, 2012). Hence, it was assumed that, changes in these variables should be investigated using non-linear model approach.

**Bilateral Granger Causality Test on Sub-Sectoral productivities in Agriculture and Foreign Direct Investment in Nigeria**

The Granger causality test is a statistical hypothesis test for determining whether one time series is useful in forecasting another. A time series X is said to Granger-cause Y if it can be shown, usually through a series of t-tests and F- test on lagged values of X (and with lagged values of Y), that those X values provide statistically significant information about future values of Y (Granger, 1969). If a time series is a stationary process, the test is performed using the level values of two (or more) variables. If the variables are non-stationary, then the test is done using first (or higher) differences. The number of lags to be included is usually chosen using an information criterion, such as the Akaike information criterion or the Schwarz information criterion. This test assumes that the information relevant to the prediction of X and Y is contained solely in the time series data on these variables (Gujurati and Dawn, 2009). In this study, the bilateral Granger Causality tests were conducted among variables specify but particular interest on FDI and agricultural sub sectoral productivity as well as the agricultural sector. The primary model in Vector Autoregressive Regression form is represented as thus:

$$\left\{ \begin{array}{l} Y_{1t} = \beta_0 + \beta_1 \sum_{i=1}^n Y_{t-j} + \beta_2 \sum_{i=1}^n X_{t-j} + U_t \dots \dots \dots (4) \\ X_t = \delta_0 + \delta_1 \sum_{i=1}^n X_{t-j} + \delta_2 \sum_{i=1}^n Y_{t-j} + V_t \dots \dots \dots (5) \end{array} \right\}$$

For equations 4 and 5, there is a bilateral Granger causality from X to Y, if  $\beta_2 \neq 0$  and  $\delta_2 = 0$ . Similarly, there is Granger causality from the Y to X if  $\beta_2 = 0$  and  $\delta_2 \neq 0$ . The causality is considered as mutual or bidirectional if  $\beta_2 \neq 0$  and  $\delta_2 \neq 0$ . Finally, there is no link between Y and X if  $\beta_2 = 0$  and  $\delta_2 = 0$ . Where  $U_t$  and  $V_t$  are error terms which are assume to be normally distributed and uncorrelated in any time period.

The impact relationship between sub sectoral productivity in Agricultural sector and FDI inflow in the Nigeria’s economy

Following the result of the unit root test, and an attempt to avoid the tendency of having spurious regression; a time dependent double log multiple regression model representing the long run model and meant to capture the dynamic nature of dependent variables were specified at level for variables used in the models. The model is expressed explicitly as thus:

$$LnTAG_t = \gamma_0 + \gamma_1 \sum_{i=1}^n LnFDI_t + \gamma_2 \sum_{i=1}^n LnCRD_t + \gamma_4 \sum_{i=1}^n LnUEM_t + \gamma_5 \sum_{i=1}^n LnPPI_t + U_t \dots \dots \dots (6)$$

The dependent variables as defined in equation 1 are: CRG<sub>t</sub>, LSG<sub>t</sub>, FRG<sub>t</sub>, FSG<sub>t</sub> and TAG<sub>t</sub>. This implies that, equation 6 was estimated for each of the sub sector and the entire sector's productivity. The explanatory variables are defined below;

- FDI<sub>t</sub> = Foreign direct investment as a ratio of total GDP (%)
- CRD<sub>t</sub> = Credit to Agricultural sector as a ratio of total credit to economy (%)
- UEM<sub>t</sub> = Unemployment rate as a proxy of nature of insecurity (%)
- PPI<sub>t</sub> = Per capita income (Total GDP/Population) as a proxy of demand capacity
- Ln = Natural logarithm

U<sub>t</sub> = Stochastic error term and U<sub>t</sub> ~ IID (0, δ<sup>2</sup><sub>U</sub>).

To validate the existence of the long run stable relationship between agricultural sector productivity and FDI as well as other macroeconomic variables, the study applied the Engle and Granger two-step technique test. Following the Granger Representation Theorem, the Error Correction Model (ECM) for the co-integrating series in the study was specified. The general specification of the Error Correction Model for the sub sectoral and agricultural sector productivity equation in Nigeria is shown below:

$$\Delta LnTAG_t = \beta_0 + \gamma_1 \sum_{i=1}^n \Delta LnTAG_{t-1} + \beta_2 \sum_{i=1}^n \Delta LnX_{t-i} + \beta_3 ECM_{t-1} + U_t \dots (7)$$

The variables are as defined previously in equation 6, and coefficients (β<sub>3</sub>) of the ECM<sub>t</sub> (-1 < β<sub>3</sub> < 0) measures the deviation from the long-run equilibrium in period (t-1).

## RESULTS AND DISCUSSION

### Unit root test for variables used in the analysis

To ascertain the stationarity of variables used in the study, the standard Augmented Dickey–Fuller test for unit root was performed. Table 1 presents the test statistics for each variable in level and first difference involving two sets of ADF equations.

Table 1: Result of the unit root test for variables used in the analysis

	ADF equation with Constant			ADF equation with constant and Trend		
	Level	1 <sup>st</sup> Diff.	OT	Level	1 <sup>st</sup> Diff.	OT
FDI	-1.5850	-7.2642***	1(1)	-2.3354	-7.1574***	1(1)
CRD	-0.9515	-6.3818***	1(1)	-2.3261	-6.2543***	1(1)
UEM	-1.0365	-5.9859***	1(1)	-2.3957	-5.9265***	1(1)
PPI	-3.6095	-3.9489**	1(1)	-0.2271	-5.3392***	1(1)
CUR	-0.6633	-4.0519***	1(1)	-1.5042	-4.0074***	1(1)
CRG	-8.4755***	-	1(0)	-0.9583	-6.5726***	1(1)
LSG	-2.5191	-3.6133**	1(1)	-2.3815	-4.6544***	1(1)
FRG	-4.8902***	-	1(0)	-3.7182	-3.9293***	1(1)
FSG	-2.1208	-4.5408***	1(1)	-2.2291	-4.4622***	1(1)
TAG	-1.2667	-6.1176***	1(1)	-2.1778	-6.3118***	1(1)

Note: OT means order of integration. Critical values (CV) are defined at 1% significant level and asterisks \*\*\* represents 1% significance level. Variables are as defined in equations 6.

Using the ADF equation that contains constant and trend, the test result reveals that at level, all dependent variables were non-stationary but were stationary at first difference, hence integrated of order one. Also, all explanatory variables were non-stationary at level, but stationary at first difference. The unit root result suggests that, the equation involving all dependent variables should be tested for cointegration to avoid incidence of spurious regression (Johansen, 1988 and Johansen and Juselius, 1990).

**Exponential growth rates in agricultural sector and FDI inflow in Nigeria**

The exponential trend equation for each of the sub sector and the overall agricultural sector as well as the FDI is presented in Table 2 and Table 3. The result for the crop sub sector showed that, there was a positive relationship between crop sector's productivity with time in Nigeria (Though the relationship was not statistically significant).

Table 2: Exponential growth rates in specified variables

Variables	Crop sub sector	Livestock sub sector	Forestry sub sector
Constant	4.477 (643.2)***	1.993 (30.78)***	0.881 (10.15)***
Time	0.0005 (1.260)	0.0000557 (0.016)	0.0057 (1.208)
GR (%)	0.05	0.006	0.57
Diagnostic Test			
R <sup>2</sup>	0.0519	9.0E-05	0.0479
F-Cal	1.5872	0.000249	1.4586

Note: Asterisk \*\*\* represents 1% significance level and "GR" represents the growth rate. Variables are as defined in equation (1).

This implies that, the sub sector's productivity increases with time. The exponential growth rate of 0.05% was obtainable from 1986 to 2016 in the country, revealing that, the growth rate in the sub sector was only marginal. For the livestock sub sector, the trend equation revealed a positive insignificant correlation between the sub sector's productivity and time. A negative exponential growth rate of 0.006% connotes marginal increase in the sub sector productivity over time. The forestry sub sector also has an insignificant positive relationship with time. This means that, over time the sub sector's productivity increased marginally. A positive exponential growth rate of 0.57% was discovered in the sub sector. This implies that, and average of 0.57% of the sub sector's productivity marginally increased annually.

Table 3: Exponential growth rates in specified variables

Variable	Fishery sub sector	Agricultural sector	FDI in Agric.
Constant	0.881 (10.15)***	3.599 (52.01)***	1.9712 (6.216)***
Time	0.0057 (1.208)	-0.0133 (-3.527)***	-0.07056 (-4.079)***
GR (%)	0.57	-133	-7.056
	Diagnostic tests		
R <sup>2</sup>	0.0479	0.3000	0.3645
F-Cal	1.4586	12.43849***	16.63943***

Note: Asterisk \*\*\* represents 1% significance level and "GR" represents the growth rate. Variables are as defined in equation (1).

The result for fishery sub sector revealed insignificant positive relationship with time, while an exponential growth rate of 0.57% was discovered. For the overall agricultural sector, the trend equation shows that, time has a significant negative relationship with agricultural productivity within the time frame of this study. This implies that, the annual productivity of agricultural sector on average declines over time. An average exponential growth rate of -1.33% for the sector indicates that, its productivity deteriorated annually. Similarly, the slope coefficient of time in FDI trend equation shows negative relationship between FDI inflows in the country and time. This means that, the flows of FDI into the country declines over time in Nigeria. This is evidenced by the negative exponential growth rate of 7.056% generated for the variable. To further substantiate the result of trend equation, graphical representation of the linear trend in FDI and productivity of agricultural sector is shown in figure 1. The result showed that both variables witnessed an average downward trend, undulated fluctuations with conspicuous peaks and troughs spread across the study period.

The fluctuation in the two variables is consistent with various policies adopted by the federal government of Nigeria to boost agricultural production and encourage FDI inflow. For instance, during the period 1986 to 1993 which coincided with the peak of the structural adjustment programme (SAP) in the country; both variables trended upward. This was due to the implementation of the liberalization policies, which open the economy more to the outside world and increase foreign private investments in all sectors in the economy. The period 1991 to 2010 saw increasing volatility in crude oil prices and other essential macroeconomic variables. The country during this period depended more on imports than domestic production. The trend in agricultural productivity shrinks and exhibited high volatility. The FDI into the nation economy fluctuates deeply due to increasing corruption and unnecessary government interventions in the country's economy. The global economy witnessed negative shock due to oil price volatility and this hampered the flows of FDI into recipient nations. For the agricultural sector, several agricultural policies were implemented to revive and increase the efficacy of the

country's agricultural sector and economy. During this period agricultural intensification mounted with no reasonable results (Akpan *et al.*, 2015). Thereafter, both variables assume steady decline till 2016. It is observed that, these fluctuations were consonance with government policies and interest in agricultural activities; the nature of global economy and the economic and political environments that prevailed in the country.

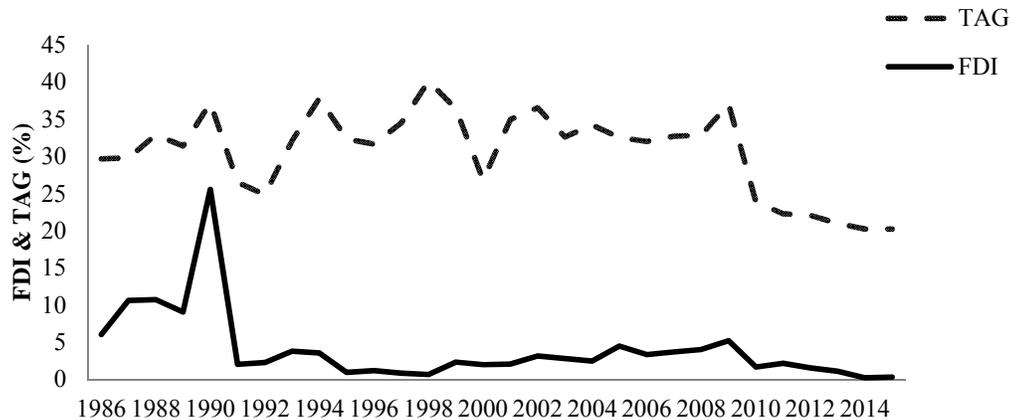


Fig 1: Trend in FDI and Agricultural Productivity in Nigeria (1986- 2015)

#### Pairwise granger causality test

The estimated result obtained from Granger Causality test is presented in Table 4. From the result, FDI is not statistically significant in explaining variations in productivity of crop, livestock, fishery and forestry sub sectors as well as the agricultural sector in Nigeria. This result corroborates the findings of Izuchukwu *et al* (2014) in Nigeria.

Table 4: Pairwise Granger Causality test for sub Sectoral Productivities, Agricultural Productivity and FDI in Nigeria

Null Hypothesis	Observation	F-Statistic	Probability
CRG does not Granger Cause FDI	27	1.70945	0.2041
FDI does not Granger Cause CRG		0.81538	0.4554
LSG does not Granger Cause FDI	27	4.03252	0.0322**
FDI does not Granger Cause LSG		0.27008	0.7658
FSG does not Granger Cause FDI	27	0.41533	0.6652
FDI does not Granger Cause FSG		1.46643	0.2524
TAG does not Granger Cause FDI	27	0.04721	0.9540
FDI does not Granger Cause TAG		0.41632	0.6646

Note: Asterisks \*\* represents 5% significance level. Variables are as defined in equation (1) and are expressed in log difference; while lag length is determined by information criterion.

This result implies that, FDI is not a strong exogenous variable (compared to other variables) explaining changes in the sub sectoral productivity of agricultural sector in Nigeria. Perhaps the volume of FDI that entered agricultural sector was small compared to other sectors in the economy. The underdeveloped nature of the Nigeria's agricultural sub-sectors could partly be responsible for this trend. For instance, the practice of land fragmentation could hinder foreign investment in the sub sector. Poor species of animals and low yield variety of crops could also hinder inflow of FDI to agricultural sector. Other issues explaining this result are; inconsistency in agricultural policies, poor economic policies, insecurity and high volatility of key macroeconomic indicators during the period considered in this study.

#### The long and short run impact of foreign direct investment on sub-sectoral productivity

The long run relationship among agricultural sub sectoral productivities and FDI as well as macroeconomic variables in Nigeria was investigated using multiple regressions based on Ordinary Least Squares estimation method and the result is presented in Table 5. The Engle Granger two- step method was used to test for Cointegration among specified variables. The result showed that, evidence of cointegration existed for crop sub sector; livestock sub sector and forestry sub sector as well as the agricultural sector model. The presence of co-

integration warrants the specification of the short run model for these sub- sectors and agricultural sector in particular.

Table 5: Long run relationship between FDI and Agricultural Sub sector's Productivity in Nigeria

Variables	Crop sub-sector	Livestock sub sector	Forestry sub sector	Fishery sub sector	Agricultural Sector
Constant	4.28 (93.43)*	3.54(7.69)*	3.34 (7.45)*	1.11(1.36)	2.89(5.13)*
FDI	0.01 (2.58)**	-0.12(-3.83)*	0.002(0.08)	0.01(0.25)	0.14(3.77)*
Credit to Agric.	0.02 (2.88)*	-0.11(-1.63)	-0.29 (-4.48 )*	-0.11(-0.92)	0.02(0.21)
UEM	-0.01 (-2.61)**	0.14 (2.57)**	0.257 (5.03)*	-0.08(-0.87)	-0.18(-2.86)*
Per capita income	0.02 (5.77)*	-0.15(-4.48)*	-0.30 (-9.40)*	0.02(0.38)	0.07(1.76)***
Diagnostic Tests					
R-squared	0.5870	0.4909	0.8574	0.1128	0.5309
F-cal.	9.2401*	6.2682*	39.0677*	0.8268	7.3579
Auto correl. (1)	0.1041	3.9194*	0.4462	14.6345*	12.1257*
Normality test	12.392*	3.6394	1.1846	2.1839	1.8364
RESET test	20.1082*	6.7533*	4.0542**	1.5403	0.8250
ADF of error term					
With constant	-6.4816*	3.4508**	-4.8693*	-2.3611	-2.5873***
Constant & trend	-5.0562*	3.4819***	-4.8502*	-2.2460	-2.5618

Note: Asterisks \*, \*\* and \*\*\* represent 1%, 5% and 10% significance levels respectively. Variables are as defined in equation (1) and are expressed in log for crop, livestock and forestry sub sectors but in log difference for fishery sub sector.

Following the result of the unit root and co-integration tests, the error correction model was estimated for crop, livestock and forestry sub sectors as well as the agricultural sector. Information criteria were used to select appropriate lag length, while Hendry's (1995) approach was adopted to generate the short run model presented in table 6. The diagnostic tests for the short run models in all sub-sectors and agricultural sector showed significant F-test statistic which justified the significant contribution of explanatory variables to sub sectoral productivities and agricultural productivity.

Table 6: Short run relationship between FDI and agricultural sub sector's productivity in Nigeria

Variables	Crop sub-sector	Livestock sub sector	Forestry sub sector	Agricultural Sector
Constant	-0.001(-0.54)	0.008(0.33)	0.030(1.31)	0.042(1.14)
$\Delta$ Self-Lag	0.51(5.8)*	0.398(1.93)***	0.297(2.12)**	0.164(1.19)
$\Delta$ FDI	0.001 (0.27)	-0.034(-1.19)	0.033(1.44)	0.161(6.12)*
$\Delta$ CRD	0.01 (1.34)	-0.001(-0.01)	-0.077(-1.34)	-0.033(-0.76)
$\Delta$ UEM	-0.001 (-0.16)	0.008(0.15)	0.031(0.62)	-0.104(-2.60)**
$\Delta$ PPI	0.01 (1.24)	-0.054(-0.54)	-0.276(-3.23)*	-0.187(-1.51)
$ECM_{t-1}$	-0.59(-3.45)*	-0.372(1.93)***	-0.439(-2.56)**	-0.467(-3.46)*
Diagnostic Tests				
R-squared	0.6302	0.2351	0.6101	0.5547
F- cal.	6.2498*	1.1270	5.7371*	8.1394*
Auto correl. (1)	1.4579	2.2087	1.0199	0.3308
Normality test	1.6383	11.7035*	2.3832	0.7992
RESET test	5.2439**	8.4346*	0.6294	1.7788

Note: Asterisks \*, \*\* and \*\*\* represent 1%, 5% and 10% significance levels respectively. Variables are expressed in log difference.

The slope coefficient of the error correction term is negative and statistically significant at conventional probability levels for the preferred sub-sectors. The result validates the existence of a stable long-run equilibrium relationship among time series used in the study, and also indicates that, the sub sectoral and agricultural sector productivities are sensitive to the departure from their stable or equilibrium values in the previous period. The slope coefficient of the error correction term represents the speed of adjustment and also is consistent with the hypothesis of convergence towards the long-run equilibrium once the sub sectoral and agricultural productivity equations are shocked. The coefficient of  $ECM_t$  expressed in percentage, suggests the degree of variation in independent variable in the short run that is corrected in the long run. For instance, about 59% and 47% variations in crop sub sector's productivity and agricultural productivity in the short run are corrected in the long run.

**FDI, macroeconomic variables and crop sub-sectoral productivity**

The long run estimates showed that, FDI has a positive significant relationship with the crop sub sector's productivity in Nigeria. This result implies that, continuous inflow of FDI into the country increases the productivity of the crop sub sector in Nigeria. However, changes in the crop sub sector's productivity were greater than corresponding changes in inflow of FDI in the country. The result suggests that, significant proportion of FDI inflow to agricultural sector settled in the crop sub sector compared to other sub-sectors. Another reason for this result could be attributed to the fact that, many agricultural policies in Nigeria were focused on arable and tree crop production. Since this represents the priority and preferred area for policy intervention and majority of rural farmers, FDI was easily attracted to this sub sector as a booster and or interventionist as well as to tap enormous potential available in the sub sector. For instance, rubber, cocoa and oil palm production have tremendous FDI inflow in Nigeria. Hence, as FDI inflow increases, the crop sector contribution to GDP or productivity increases too. The result also revealed that, volume of credit to the agricultural sector and the country's per capita income (which proxy demand capacity) affected crop sub sector's productivity positively in the long run. Hence, increasing these variables increases the percentage of crop productivity in Nigeria. This result therefore suggests that, good proportion of credit disbursed to the agricultural sector over the years went to the crop sub sector. Also, the result for per capita income implies that the demand for crop sub sector products is high in the country. However, unemployment rate impacted negatively on the sub sector's productivity within the study period. The findings suggest that, the menace of rural –urban migration among active youths in most farming communities is biting hard on crop sub sector's productivity in the country. Increase outward migration among active labour in the rural areas has resulted in high wage rate, hence lower quantity of outputs. However, in the short run, FDI and other macroeconomic variables specified did not exhibited significant relationship with the crop sub sector's productivity in the country.

**FDI, macroeconomic variables and Livestock Sub-Sectoral Productivity**

The livestock sub sector's productivity in the long run is negatively linked with the FDI inflow in Nigeria. This means that FDI inflow in the country reduces the productivity of livestock sub sector in Nigeria. This result implies that, the FDI inflow was not targeted on the sub sector or it was wrongfully utilized. Another reason could be that, the FDI was not sufficiently channeled into the sub sector or it was not the preferred area. Similar relation was also obtained for the per capita income. The result shows that, increase per capita income reduces the sub sector's productivity. This could be attributed to high import demand for foreign poultry product in the country and the porosity of our borders. Before the recent banned on imported frozen chicken, the sub sector was suffering due to dumping. Perhaps, this could explain this result at this point in time, however, it is hoped that this result will change due to the current trade policy on livestock in the country. The relationship between livestock productivity and unemployment rate revealed positive significant correlation. This implies that, the livestock sub sector was one of the preferred destinations for most unemployed youths in the country. This means that, as unemployment rate increases, more youths relocated to the livestock sub sector thereby contributing to increase in turn over in the sub sector. Similarly in the short run period, the impact of FDI and other macroeconomic variables were not significant in the livestock sub sector.

**FDI, macroeconomic variables and Forestry Sub-Sectoral Productivity**

In the forestry sub sector, the FDI inflow in both short and long run periods has no significant relationship with the sub sector's productivity in Nigeria. This means that, the flow of FDI into the country did not significantly influence the productivity of the sub sector. This could mean that, the sub sector is not a preferred area of investment by foreigners or is restricted to domestic investment alone. It could also be that, the sub sector is restricted from foreign investment as in the case of natural reserves abound in the country. However, credit and per capita income exhibited negative impact on the sub sector's productivity, while increase in unemployment rate shows positive relationship.

**FDI, macroeconomic variables and Fishery Sub-Sectoral Productivity**

The result for the fishery sub sector revealed that, FDI inflow and economic policies in the long run period does not have significant relationship with the sub sector's productivity in Nigeria. This means that, the sector's productivity depended mostly on artisans; and government policies do not influence their activities significantly. The result also suggests that, the fishery sub sector is highly underdeveloped and lack sufficient economic incentives and thus do not attract external investments. It is also important to note: for the past years the country depended heavily on imported frozen fishes; this stiffens the domestic production and exposed the country to dumping.

**FDI, macroeconomic variables and Agricultural Sector Productivity**

For the entire agricultural sector, the empirical result revealed that, the productivity of the agricultural sector has a positive relationship with the foreign direct investment inflow in the long and short run periods. This means that, continuous inflow of FDI in the country will increase the sector's productivity both in the short and long run

periods. Also, in the short and long run periods, the unemployment rate has negative relationship with agricultural sector's productivity in the country. This connotes that, the country is witnessing increasing rural – urban migration as well as agricultural diversification among active youths or farming labour force in the rural areas. As aggregate unemployment increases, farm labour becomes increasingly unavailable and this constrained total factor productivity of mostly resource poor farmers.

## CONCLUSION AND RECOMMENDATIONS

The study established the short and long runs empirical relationships between sub sectoral productivity in agricultural sector and foreign direct investment inflow in Nigeria. In addition, the empirical link between the agricultural sector productivity and the FDI inflow was determined. The exponential growth rates in sub sectoral productivity revealed marginal positive growth within the period considered; while the entire agricultural sector and FDI had negative growth rate respectively in the same period. Meanwhile, both FDI and agricultural sector productivity exhibited undulated trend with distinct peaks and troughs which are consistent with government policies on agricultural development and stability of domestic economy. The Granger causality test revealed that, FDI is not a strong exogenous variable to sub sectoral productivity and agricultural sector productivity. The empirical evidence has revealed mixed results; for crop sub sector, the relationship is positive in the long run and neutral in the short run period. It is negative in the long run and neutral in the short run for livestock sub sector; while forestry and fishery sub sector's productivity in short and long run regimes showed no significant correlation with the FDI inflow in Nigeria. The overall agricultural sector analysis confirmed positive significant relationship between agricultural sector's productivity and FDI inflow in Nigeria both in the long and short run periods. However, other specified macroeconomic variables exhibited various degrees of impact on sub sectoral productivities in both periods and the overall sector productivity. For instance, unemployment rate impacted negatively on the sector's productivity in both short and long run periods.

Based on the current need of the federal government to diversify the source of the country's revenue, it is needful to intensify agricultural production in order to sustain the country's economy. Hence, sufficient inflow of FDI to agricultural sector is one sure way to achieve increase revenue in non-oil sector in Nigeria. Therefore, it is the duty of the federal government to generate workable policies to encourage inflow of FDI into the economy and agricultural sector in particular. The domestic policies on agriculture and economic environment should be strengthened and environmentally conducive for FDI to flourish in Nigeria.

## REFERENCES

- Akande, O. R., Biam, C. K. 2013. Causal relations between foreign direct investment in agriculture and agricultural output in Nigeria. *African Journal of Agricultural Research*, 8(17): 1693-1699.
- Akpan, S. B., Patrick, I. V. and Amina, A. 2016. Level of Income Inequality and Determinants of Poverty Incidence among Youth Farmers in Akwa Ibom State, Nigeria. *Journal of Sustainable Development*; 9(5):162 – 174.
- Akpan, S. B., Patrick, I. V., Samuel J. U., Edem A. O., and Uwemedimo E. O. 2013. Determinants of Credit Access and Demand among Poultry Farmers in Akwa Ibom State, Nigeria. *American Journal of Experimental Agriculture*, 3(2): 293-307.
- Akpan, S. B., Ini-mfon, V., Glory, E. and Daniel, E. 2012. Agricultural Productivity and Macro- Economic Variable Fluctuation in Nigeria. *International Journal of Economics and Finance*; 4(8):114 –125.
- Aniefiok A. U., Nwosu, A., C., Udoh, E. J. and Akpan, S. B. 2016. Non-Performing Loans in the Nigerian Banking System and Manufacturing Sub-sector Productivity. *International Journal of Social Science and Economic Research* 1(7): 825 – 840.
- Aya, E. A. and Akpan, S. B. 2009. Gross Margin Analysis of Rice, Beans and Garri sellers in Southern zone of Cross River State. *Global Journal of Agricultural Sciences*, 8(2):169-171.
- Bennett, R. 2005. Theory and Evidence: The Determinants of FDI in Sub-Saharan Africa. Bachelor's Thesis, Leonard N. Stern School of Business, New York University, New York, NY, USA, 2005.
- Dabour, N. M. 2000. The role of FDI in Development and Growth in OIC members Countries. *Journal of Economic Cooperation*, 21(3): 27-55.
- De Mello Jr., L. R. 1997. "Foreign direct investment in developing countries and growth: A selective survey". *Journal of Development Studies*, 34 (1), 1-34.
- Djokoto, J. G. 2011. Inward Foreign Direct Investment Flows, Growth, and Agriculture in Ghana: A Granger Causal Analysis. *International Journal of Economics and Finance*, (3) 6:188-197.
- Eze, C. C., Lemchi J. I., Ugochukwu, A. I., Eze V. C., Awulonu, C. A. O. and Okon A. X. 2010. "Agricultural Financing Policies and Rural Development in Nigeria" the 84th annual conference of the agricultural economics society, 29th to 31st march, 2010.

- Hallam, D. 2009. Foreign investment in developing country agriculture – Issues, policy implications and international response. Conference documentation of VIII Global Forum on International Investment, OECD.
- Heumesser, C. and Erwin, S. 2012. Trends in Foreign Direct Investment in the Agricultural Sector of Developing and Transition Countries: a Review. Series of paper from University of Natural Resources and Applied Life Sciences, Vienna.
- Iddrisu, A., Mustapha, I. and Babamu, O. 2015. The Impact of Foreign Direct Investment (FDI) on the performance of the Agricultural Sector in Ghana. *International Journal of Academic Research in Business and Social Sciences* 5(7): 240 -259.
- Izuchukwu, O., Huiping, H., Abubakar, A., and Olufemi, E. A. 2014. FDI Trade and Its Effects on Agricultural Development in Nigeria: Evidence from Time Series Analysis. *International Journal of Management Science and Business Administration*; 1(1):28-40.
- Keho, Y. 2015. Foreign Direct Investment and Exports Nexus: Cointegration and Causality Evidence from Cote d'Ivoire. *Journal of Economics and Sustainable Development*, 6(9):2222-1700.
- Kurtishi-Kastrat, S. 2013. The Effects of Foreign Direct Investments for Host Country's Economy. *European Journal of Interdisciplinary Studies*, 5(1): 26-38.
- Liu, X., Wang, C. and Wei, Y. 2001, "Causal links between FDI and Trade in China", *China Economic Review*, 12(2/3): 190-202.
- Msuya, E. 2007. The Impact of Foreign Direct Investment on Agricultural Productivity and Poverty Reduction in Tanzania. MPRA Paper No. 3671
- Oloyede, B. B. 2014. Impact of Foreign Direct Investment on Agricultural Sector Development in Nigeria, (1981-2012). Kuwait Chapter of Arabian Journal of Business and Management Review, 3(12): 14 -24.
- Oyatoye, E. O., Arogundade, K. K. Adebisi, S. O. and Oluwakayode, E. E. 2011. Niger. *J. Econ. Soc. Stud.*, 2(1):205-222.
- Udoh, E. J. and Akpan, S. B. 2007. Measuring Technical Efficiency of Waterleaf (*Talinum triangulae*) production in Akwa Ibom State, Nigeria. *American Eurasian Journal of Agriculture and Environment Science*; 2 (5): 518 – 522.