IMPACT OF FOREIGN DIRECT INVESTMENT(FDI) ON DOMESTIC AGRICULTURAL PRODUCTION (DAP) IN NIGERIA: EVIDENCE FROM ARDL MODEL APPLICATION (1981-2018)

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Abstract

Increase in Domestic Agricultural Productivity (DAP) is germane for food security and employment of our increasing population in Nigeria. This study determined the impact of Foreign Direct Investment (FDI) on the domestic agricultural production with evidence from Autoregressive Distributed Lag (ARDL) model using time series data that spans from 1981-2018. The findings from the growth model affirms a positive growth in FDI and domestic agricultural production as found in previous studies. The result suggests that FDI has positive impact on domestic agricultural production in the long run and short run. The result also shows that the present value of domestic agricultural production will predict future values of FDI. Therefore, policies to attract inflows of FDI to agriculture are suggested while limitations of the study as well as direction for future research are discussed.

***Keywords**: FDI, Domestic Agricultural Productivity (DAP), ARDL Model, Causal Relationship, Nigeria*

INTRODUCTION

Domestic Agriculture plays an important role in the growth of any country, and this is more so in Africa, where it directly and indirectly supports the survival and well-being of 70% of its population and contributes over 20% to the Gross Domestic Product (GDP) (Nchuchume and Adejuwon, 2012; Wiggins, Farrington, Henley, Grist, & Anne, 2013;). Agriculture accounts for 40% of the Gross Domestic Product (GDP) in Nigeria and employs about 70% of the working population. (CIA, 2020). Nigeria currently faces many challenges. The core of the challenges relates to unemployment and food insecurity. Food production in Nigeria is inadequate and needs a significant amount of agricultural spending because of the constraints of agricultural technologies and adverse weather conditions (Awunyo and Sackey, 2018).

Foreign Direct Investment (FDI) is the inflow by investment (setting aside money or resources to obtain beneficial returns, such as interest, dividends or value appreciation) of foreign income into a particular economy involving multinational corporations (Agba *et al*., 2018). Foreign direct investment, according to the Organization for Economic Cooperation and Development (OECD,2008), represents the purpose of creating a permanent interest of a resident enterprise in a single economy (direct investor) in an enterprise (direct investment enterprise) residing in an economy other than that of a direct investor. The presence of a long-term relationship between the direct investor and the direct investment enterprise and a substantial degree of control on the management of the enterprise indicates a lasting interest.

Evidence from Falki (2009) noted that Growing jobs, increasing production, improving exports and increasing the speed of technology transfer are normally believed to be the effects of FDI on

the host economy. FDI's potential benefits are that it promotes the use and utilization of local raw materials, incorporates modern management and marketing methods and facilitates access to emerging technologies. Aremu (1997) also noted that as one of the world's developing countries, Nigeria has taken a range of steps aimed at accelerating domestic economic growth and development, one of which is to attract foreign direct investment (FDI) into the country.

In the light of the significance of FDI on domestic agricultural productivity, a considerable amount of literature has grown up to investigate different factors that could be responsible for the slow performance of the domestic agricultural sector in Nigeria. Some of the factors includes micro and macro-economic factors like Labour cost, cost of inputs, exchange rate, GDP, inflation rate and agricultural policies like food importation (Adedeji and Okocha, 2011; Akpan, 2012; Akpan *et al*., 2012; Kareem *et al*., 2013; Oloyede, 2014; Oluwatoyese *et al*., 2016; Edet and Akpan, 2019). Earlier studies have not considered factors such as non-linearity and structural breaks, and it is an established fact that most time series data do not exhibit a linear trend (Meo et al. 2018; Meo et al., 2020).
The research aims to examine the influence of foreign direct investment on the domestic agricultural productivity growth in Nigeria and make judicious use of its potentials and returns to improve the standard of living in Nigeria. While it is possible for FDI to have high returns to the output of the domestic agricultural productivity, and also want to examine the counterfactual.

First, we have chosen the domestic agricultural productivity because domestic agriculture contributes a fair share of Nigeria's GDP relative to other sectors in the country, therefore agriculture remains germane to Nigeria's economic development.
Secondly, because of the volatility of oil price and the fall in revenue from the oil sector over the years, the focus of the government is now shifting to domestic agriculture as a source of revenue to fund our budget and also reduce the high rate of unemployment.

Unlike previous studies that focused on exchange rate and other macro-economic variables on the agricultural sector, the research aims to add knowledge to growing area of research by exploring the impact of foreign direct investment on domestic agricultural productivity in Nigeria using the ARDL model that is tried and tested considering fractional disintegration, small sample size as ours, non-linear relationship and endogeneity problem. The methodology employed is a reason the study was embarked on as a linear model might produce inaccurate results. We use the non-linear ARDL to solve these problems highlighted. The study also uses the most recent data available that spans from 1981 to 2019, a time period that captures the triple whammy of high inflation, recession, and the farmer-herder's conflict in the country, while also controlling for other significant variables.
This research work has been structured considering the review knowledge to literature which explains relevant empirical studies, methodology which explains the data and method employed, results and discussion displays and explains the result from the analysis while the concluding remarks, policy direction and suggestion for further studies are presented in the conclusion.

LITERATURE REVIEW

A plethora of studies exists with arguments from different school of thought on the magnitude

of foreign direct investment on the development of domestic agricultural sector in developing economies including Nigeria. It has been envisaged by the neoclassical and endogenous theory that both private and public capital inflows enhance economic growth and development.
According to Edewor *et al.* (2018), the existence of Foreign Direct Investment and its attendant growth can be broadly explained by the neo-classical theory of economic growth and the investment theory, also known as the 'two-gap model'. Dunning and Sarianna (2008), made a submits that Foreign Direct Investment has the capacity to bring about positive growth as a direct relationship exists between growth and increased productivity. Fisher and Gelb (1991), due to the investment of Transnational Corporations (TNCs) in developing regions serving as host affiliations related to these Transnational Corporations, there is resultant transfer of technology and fund to these affiliations thereby transforming them into global networks of research and development.

Furthermore, the growth of enterprises is enhanced as Foreign Direct Investment leads to trade openness, thereby providing access to foreign markets, which in turn creates employment opportunities, stimulating domestic demand of inputs from suppliers. The enhancement of trade openness by FDI, enables an environment where new enterprises outside the borders of the domestic economies hosting the affiliations of Transnational Corporations (Apter, 1965). A contrasting argument exists by advocates of the Dependency theory opposing the positivity of Foreign Direct Investment. Their submission sees FDI as a disguised tool used by developed economies to control the economies of the developing regions (Bailey, 1995; Ake, 1996).
Also part of their argument is that the penetration of host economies by foreign investors would bring about 'disarticulated development', which can also cause underdevelopment.

- **Foreign Direct Investment and Domestic Agricultural Productivity**

According to Msuya (2007), the adoption of new and advanced technologies cannot be overemphasized as it enhances growth in domestic agricultural productivity. But a limitation exists as local farmers find it difficult to adopt such advanced technologies due inadequate income and lack of access to credit facilities, believed to be tackled by the financial and technological support of Foreign Direct Investment.
The importance of FDI in agricultural growth is further buttressed by a study carried out by Binuyo (2014) assessed the impact of FDI on the development of the agricultural sector in the Nigerian economy, for a period of 1981 to 2012.
Also, Agba *et al*. (2018) conducted a research which was directed in answering the question whether Foreign Direct Investments impacts Agricultural output in Nigeria. The study made use of time series data which spanned a period of 34 years (1981-2014), with variables such as the Agricultural Gross Domestic Product, Foreign Direct Investment, Exchange rate, Interest rate, employment and Gross Capital Formation. From the Error Correction Model (ECM) method used to analyze the impact of the variables showed that Foreign Direct Investment positively affected Agricultural output, but this effect was only significant in the long-run, while it was positive and insignificant in the short-run. This positive long-run effect was seen in other variable like interest rate, exchange rate and employment.

Furthermore, a study which sought to determine the relationship between Foreign Direct Investment to the agricultural sector and economic growth in Ghana, was conducted by Awunyo-Victor and Sackey (2018). Error Correction Model (ECM) was also applied to analyze the effect of the selected variables (Gross Domestic Product, Foreign Direct

Investment in agriculture), with time series data collected from 1975 to 2018. The result showed a significant positive relationship exists between the Foreign Direct Investment in agriculture and economic growth in Ghana. Evidence of the effect of Foreign Direct Investment in the growth of Agricultural Sector is seen in the Study conducted by Akinwale *et al.* (2018) which employed the Error Correction Model technique to examine the effect of Foreign Direct Investment, Nigeria's government agricultural expenditure on agricultural productivity and bank credit. The data on variables used were collected from 1986 to 2015. The result revealed that FDI had significant direct relationship on Agricultural productivity, implying that a unit change in FDI will cause a significant change in Agricultural productivity in same direction. Government expenditure and Bank credit to Agricultural Sector had a direct relationship with agricultural productivity best was insignificant.

Umechukwu and Okezie, C. A. (2018) conducted a study which sought to examine the impact of Foreign Direct Investment on the agricultural sector in Nigeria, while making use of Ordinary Least Square to estimate the time series data obtained for the period of 1990 to 2014. The study made use of variable such as Agricultural Sector GDP, Foreign Direct Investment inflow to agriculture, Exchange rate, Inflation rate, Trade openness and Natural resource flow. The effect of FDI on the agricultural sector was examined over the different policy periods combined.

It further revealed that the impact of Foreign Direct Investment on the agricultural sector was more during the pre-deregulated period compared to the deregulated period.
According to a Study by Ugwuegbe *et al.* (2013), growth model through the Ordinary Least Square method was adopted to investigate the relationship between FDI and economic growth in Nigeria.
Time series data for variables like Gross Domestic Product, Gross Fixed Capital Formation, Foreign Direct Investment, Exchange rate and Interest rate, were collected over a period of 1981 to 2009. The result revealed a positive insignificant impact of both Foreign Direct Investment and Interest rate on the economics, over the period under consideration which the impact of Gross Fixed Capital Formation and Exchange rate were found to be positive and significant.

A study by Iddrisu, *et al.* (2015) which looked at the impact of Foreign Direct Investment on the Ghanaian agricultural sector, using the Vector Error Correction Model (VECM) analytical technique, found that FDI positively impact the productivity of the agricultural sector in the short run, but has a negative impact on the agricultural sector productivity in the long run, during the considered period of 1980 to 2013. Variables included in the model include FDI, Trade openness, Value Addition Constant in Agriculture, Inflation rate, Exchange rate, and Gross Fixed Capital Formation. The study also observed a deformation in the country's currency (Cedi) which negatively impacted the long run growth at the agricultural sector because of high cost associated with imported inputs and machinery necessary to enhance agricultural productivity in the country.

Amongst these previous studies by researchers, one common observation remains how foreign direct investment has influenced the growth of the Agricultural sector, especially in developing economies. Also, most of the research in this line made use of the Vector Error Correction Model (VECM) as the technique to determine the impact of FDI on growth of either the agricultural subsector or the economy as a whole. The relevance of this Study is seen as it employs the Autoregressive Distributed Lagged Model with the Bounds testing

approach to examine the influence of foreign direct investment on Nigeria's domestic production in the agricultural sector while covering a more period of 1981 to 2018.

METHEDOLOGY

1. Variables

To examine the economic impact on how foreign direct investment relates with domestic agricultural productivity in Nigeria, the study uses time series data. Table 1 shows all the variables used in this research and their sources. In order to obtain more meaningful insight, logarithmic transformation of these variables was adopted to remove large and extreme bias that might be associated with the variables.

Table 1: Definition of variables

Variables	Measurement	Source	Symbol
Domestic agricultural productivity	Naira equivalent	CBN annual report	DProd
FDI to agriculture	Naira to USD equivalent	CBN annual report	FDI
Exchange rate	Naira to USD equivalent	CBN annual report	Exch Rate
Labour	Number of persons involved in agric.	CBN annual report	AGRL
Inflation rate	In % equivalent	CBN annual report	INFL
Interest rate	In % equivalent	CBN annual report	INTR

Source: Author's Compilation (2020)

2. Data Analysis Techniques

The unit root test was carried out on all variables. In addition to the Dickey and Fuller (1981) process, the Phillip and Perron (1989) test was used to check for the unit root presence in each variable (an indication for non-stationarity). This is because the use of unit roots identified in data can lead to significant statistical inference errors, the lag length structure was used to select the model lag length. The Zivot and Andrews (1992) test, a third test, was used to check for bias when a structural break is present, a weakness not addressed in the previous two tests. To test for structural break in the sequence, the Chow test was used. The growth model was used to determine the domestic productivity growth path, ARDL was used to figure out long-term and short-term effect of FDI on domestic agricultural productivity, and granger causality indicating how to figure out the existence of causal relationship between domestic agricultural productivity in Nigeria and FDI. The Growth Model was used to evaluate the pattern and growth rates of Foreign Direct Investment and Domestic Agricultural Productivity. The Granger Causality Test was used to analyze the causal relationship between Foreign Direct Investment and Domestic Agricultural Productivity, while the Bounds Testing technique was used to figure out the influence of FDI on Domestic Agricultural Productivity. From the Granger Causality test results and the Autoregressive Distributed Lag model, the hypotheses were checked. The logarithmic transformation of these variables was introduced in order to gain more meaningful insight. Using the Augmented Dickey Fuller (ADF) method, the unit root tests of all variables were carried out. The Jarque-Bera test was also used to check the correctness of the fit of the data to see whether a normal distribution was followed. The Growth model for the variables of interest is specified below:

$\ln Y_t = \alpha + \beta_{AGDP} t + \mu_t$ . . . . . (i)

$\ln Y_t = \alpha + \beta_{FDI} t + \mu_t$ . . . . . (ii)

Where,

α = intercept.

β = vector of the trend variable and μ is the econometric error term.

β_{AGDP}, β_{FDI} = coefficients of the trend variables for Agricultural Gross Domestic Product (AGDP) and Foreign Direct Investment (FDI).

Following Oyinbo and Rekwot (2014), the constant term and trend Augmented Dickey Fuller (ADF) model is defined as follows:

$$\Delta Y_t = \alpha_0 + \alpha_1 t + \beta Y_{t-1} + \sum_{i=1}^{p} \delta_i \Delta Y_{t-i} + \varepsilon_t \quad . \quad . \quad . \quad . \quad \text{(iii)}$$

Where,

Y = variables of interest (domestic agricultural productivity, foreign direct investment, exchange rate, inflation rate and interest rate,).

α_0 = constant.

α_1 = coefficient of the trend series.

p = lag order of the autoregressive process.

Y_{t-1} = is lagged value of order one of Y_{t-1}

ε_t = error term.

The system for the Autoregressive Distributed Lag (ARDL) model is specified as follows:

$$lnDProd_{t-i} = a_0 + a_1 lnFDI_{t-i} + a_2 lnEXGR_{t-i} + a_3 lnINFR_{t-i} + a_4 lnINTR_{t-i} + a_5 lnAGRL_{t-i} + a_6 lnGFCF_{t-i} + a_7 lnAP_{t-i} + \partial ECM_{1t} + u_{1t} \dots\dots\dots (iv)$$

$$lnFDI_{t-i} = a_0 + a_1 lnDProd_{t-i} + a_2 lnEXGR_{t-i} + a_3 lnINFR_{t-i} + a_4 lnINTR_{t-i} + a_5 lnAGRL_{t-i} + a_6 lnGFCF_{t-i} + a_7 lnFDI_{t-i} + \partial ECM_{2t} + u_{2t} \dots\dots\dots (v)$$

$$lnEXGR_{t-i} = a_0 + a_1 lnDProd_{t-i} + a_2 lnFDI_{t-i} + a_3 lnINFR_{t-i} + a_4 lnINTR_{t-i} + a_5 lnAGRL_{t-i} + a_6 lnGFCF_{t-i} + a_7 lnEXGR_{t-i} + \partial ECM_{3t} + u_{3t} \dots\dots\dots (vi)$$

$$lnINFR_{t-i} = a_0 + a_1 lnDProd_{t-i} + a_2 lnFDI_{t-i} + a_3 lnEXGR_{t-i} + a_4 lnINTR_{t-i} + a_5 lnAGRL_{t-i} + a_6 lnGFCF_{t-i} + a_7 lnINFR_{t-i} + \partial ECM_{4t} + u_{4t} \dots\dots\dots (vii)$$

$$lnINTR_{t-i} = a_0 + a_1 lnDProd_{t-i} + a_2 lnFDI_{t-i} + a_3 lnEXGR_{t-i} + a_4 lnINFR_{t-i} + a_5 lnAGRL_{t-i} + a_6 lnGFCF_{t-i} + a_7 lnINTR_{t-i} + \partial ECM_{5t} + u_{5t} \dots\dots (viii)$$

$$lnAGRL_{t-i} = a_0 + a_1 lnDProd_{t-i} + a_2 lnFDI_{t-i} + a_3 lnEXGR_{t-i} + a_4 lnINFR_{t-i} + a_5 lnINTR_{t-i} + a_6 lnGFCF_{t-i} + a_7 lnAGRL_{t-i} + \partial ECM_{7t} + u_{7t} \dots\dots\dots (ix)$$

Where,

$DProd_{t-i} = Domestic\ Agricultural\ Productivity\ (naira)$

$FDI_{t-i} = Foreign\ Direct\ Investment\ (US\ dollars)$

$EXGR_{t-i} = Exchange\ Rate\ (dollar/naira)$

$INFR_{t-i} = Inflation\ Rate$

$INTR_{t-i} = Interest\ Rate$

$AGRL_{t-i} = Agricultural\ Labour\ in\ number\ of\ persons\ involved\ in\ agriculture$

$ECM = error\ correction\ term$

u_t = error term

RESULTS AND DISCUSSION

- **Descriptive Statistics**

Table below 2 present results of the descriptive statistics of the variables used in analyzing the data. The result showed that domestic production, FDI, exchange rate and labour showed positive skewness to the right tail which is the measure of degree of symmetry.

The kurtosis having peak value above 3 and are all said to be leptokurtic. Also, the Jarque-Bera probability test of normality indicates all variables were normally distributed except interest rate.

Table 2: Descriptive Statistics

	DPROD	EX_RATE	FDI	INFL_RATE	INT_RATE	LABOUR
Mean	9.21E+12	90.20154	6.81E+09	19.23769	17.89094	1.11E+10
Median	5.04E+12	92.34000	1.21E+09	13.00000	17.94836	38329000
Maximum	3.06E+13	360.0000	8.24E+10	72.80000	31.65000	3.62E+11
Minimum	2.30E+12	0.550000	1.17E+08	5.400000	8.431600	23366000
Std. Dev.	7.46E+12	96.91211	1.83E+10	17.02660	5.293505	5.82E+10
Skewness	1.363432	1.178482	3.399143	1.779824	0.004425	5.848698
Kurtosis	4.364387	4.018575	13.64001	4.994656	3.896192	35.76370
Jarque-Bera	15.10817	10.71325	259.0680	27.05583	0.017638	1966.720
Probability	0.000524	0.004717	0.000000	0.000001	0.991220	0.000000
Sum	3.59E+14	3517.860	2.66E+11	750.2700	697.7467	4.32E+11
Sum Sq. Dev.	2.11E+27	356894.4	1.28E+22	11016.40	1064.805	1.29E+23
Observations	39	39	39	39	39	39

Source: Author's Compilation (2020)

- **Growth Rate and Direction of Growth**

The result of the growth rate and direction of growth are presented in Tables 3 and 4. The exponential parametric growth model was chosen as the best fitted model for both domestic production growth model & foreign direct investment growth model because of their high values of R square and low value of Akaike Information criterion (AIC). The result showed that the adjusted R of domestic production model is 0.943, this means that 94.3% variation in domestic production was explained over period under study. The result of domestic production showed that the coefficient of domestic production is

positive (0.066) and significant at 1% probability level. This means that there is acceleration in the growth of domestic production and the instantaneous and compound growth rates for domestic production were found to be 6.6% and 6.82% respectively. Also, the acceleration in domestic production could be due to flexible macroeconomic policies that attracts domestic private investors to invest in local production to increase domestic production. These policies could be in form of tax reduction, tax holiday, stable exchange rate and interest rate and adequate security that will guarantee the safety of life and properties which would in turn accelerate domestic production in Nigeria.

The result showed the adjusted R square for FDI model is 0.566. This implies that 56.6% variation in foreign direct investment was explained over trend. The result of FDI showed the coefficient of FDI is positive (0.12) and significant at 1% probability level.

This implies that there is acceleration in the growth of FDI and the instantaneous and compound growth rates were found to be 12.0% and 12.72% respectively. The government should continue with policies that can attract and sustain FDI to country. The result is also is in line with the findings of CBN (2004) which found that the stock of FDI rose to 25.8% in 2001.

Table 3: Instantaneous and Compound Growth Rate

Variable	Instantaneous growth rate	Compound growth rate
Domestic production	6.6%	6.82
FDI	12.0%	12.74

Source: Author's Compilation (2020)

Table 4: Trend Regression of Domestic Agricultural Production and FDI

Variable	Model	Determinant	Coefficient	T-value	Prob	AdjR^2	AIC	Fstat	DW
Dprod	Linear	@Trend	5.84E+11	4.83E+10	0.000	0.792	60.59	164.4(0.000)	0.2222
		Constant	-1.90E+12	1.07E+12	0.000				
	Quadratic	@Trend	-3.42E+11	-3.239	0.000	0.935	59.45	275.6(0.000)	0.6104
		@TREND^2	2.44E+10	9.081	0.000				
		Constant	3.81E+12	4.403	0.000				
	Exponential	@Trend	0.066	31.711	0.000	0.964	-0.94	100.5(0.000)	0.472
		Constant	28.29	612.92	0.000				
FDI	Linear	@trend	6.82E+08	2.85	0.007	0.157	49.97	8.12(0.000)	0.720
		Constant	-6.14E+09	-1.116	0.252				
	Quadratic	@trend	-3.38E+08	-0.413	0.954	0.210	49.99	4.80(0.000)	0.750
		@Trend^2	2.80	1.180	0.167				
		Constant	4.36E+08	0.057	0.954				
	Exponential	@Trend	0.120	7.107	0.000	0.566	3.232	50.53(0.000)	0.66
		Constant	**18.418**	**49.33**	**0.000**				

Source: Author's Compilation (2020)

Unit Root Test

Table 5 presents preliminary investigation of the stationary properties of the variables using Phillip-Perron (PP) and Augmented Dickey–Fuller test (ADF). The result is presented for Agricultural domestic production, exchange rate, FDI, inflation rate, interest rate and labor. The PP and ADF test results indicate that only inflation was stationary at levels and all other series

were not integrated at I(0) level but integrated of order I(1) or at first difference.
The result implies that level form of these series exhibited random walk or have multiple means of covariance or both. However, the first difference of those variables is integrated or stationary. The existence of difference in stationarity level form of the series necessitated bounds test after the initial ARDL to examine long run causation or relationship in the variables. According to Enger and Granger (1987), the linear combination of non-stationary variables is often co-integrated.

In other to correct for the biasness in Philip-Perron and ADF statistics which could not account for structural break in the model, Zivot and Andrew test that gives the potential break points of each variable with their respective break point year was applied and it is presented in table 6.

Table 5: Unit Root Test for all Variables (PP and ADF)

Variables	Phillip-Perron (PP)		Augmented-Dickey Fuller (ADF)			
	At level	Difference	At level		Difference	
	T-statistic	T-statistic	T-statistic	Prob	T-statistic	Prob.
LnDPROD	0.9116	0.9946	0.9118	0.9946	-5.66400	0.000
LnEX_RATE	-1.7161	0.4156	-1.7161	0.4153	-5.26858	0.000
LnFDI	-1.8260	0.3627	-1.8260	0.3627	-5.03818	0.000
LnINF_RATE	-3.9288	0.000	-3.9284	0.0045		
LnINT_RATE	-2.2795	0.1835	-2.2795	0.1835	-6.57544	0.0000
LnLABOUR	-2.333	.09988	-2.3321	0.9999	-6.4093	0.000

***** denotes rejection of the null hypothesis at 1 percent level of significance**
NOTE: EX_RATE= exchange rate, INF_RATE= inflation rate DPROD = domestic production
Source: Author's Compilation (2020)

Table 6: Unit Root Test for all Variables using Zivot and Andrew Test

	Level		**First Difference**	
Variables	**t-statistic**	**Break Year**	**t-statistic**	**Break Year**
LnDPROD	-3.4349	2001	-5.236	2005
LnEX_RATE	-2.5881	1989	4.9921	2002
LnFDI	2.8788	2001	3.9961	2005
LnINF_RATE	-3.1156	1999	-4.1231	1990
LnINT_RATE	-2.5872	1999	-3.6112	1990
LnLABOUR	-5.2314	2002	-6.0142	2005

Source: Author's Compilation (2020)

Lag Length Selection Criteria
Table 7 presents the result of lag length from six different selection criteria to ascertain the optimum lag for the ARDL model. The model showed that the optimum lag is 1; Akaike Information Criterion was chosen because of its lowest value 3.951 at lag 1. Lag 1 is the appropriate lag to be in used for the model.

Table 7: Lag length of the Model

Lag	LogL	LR	FPE	AIC	SC	HQ

0	-226.2973	NA	0.008221	12.22618	12.48474	12.31817
1	-33.07713	315.2540*	4.15e-06*	3.951428*	5.761392*	4.595399*

* 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

Source: Author's Compilation (2020)

- **Bounds Test**

  Table 8 present the result of bounds co-integration test that shows how long its relations exist among log of variables used in the model from initial ARDL, the F statistics value of 5.33(0.000) greater than the critical value of the I1 bound value of 4.68 at 1% probability levels, showing it's long run relations that exist among variables and this necessitated the long form of ARDL for co-integration.

Table 8: Bounds Test for co-integration

Null Hypothesis: No long-run relationships exist

Test Statistic	Value	K
F-statistic	5.390513136553523	5
Critical Value Bounds		
Significance	I0 Bound	I1 Bound
10%	2.26	3.35
5%	2.62	3.79
2.5%	2.96	4.18
1%	3.41	4.68

- **Short and Long Run Impact of FDI on Domestic Agricultural Production Using ARDL Model Based on AIC**

Table 9 shows the result of estimated ARDL. Indicating adjusted R-square of 0.994, this means that 99.4% variation in the log of domestic production is explained by the explanatory variables used in the model. The short run model is known as the cointegrating form of ARDL model. The cointegration equation shows negative (-0.303) with 1% significant level of probability.

This means that the system has a self-adjustment mechanism with a speed of adjustment of 30.03% which implies that previous year's error is corrected in current year or any disequilibrium in the short run will be corrected at the highest speed of 30.03% in the long run annually which allows the model to return to equilibrium. In the short run, log of FDI was positive and significant at 5% significant levels. Meaning an increase in log of FDI will increase log of domestic production by the value of its coefficient. The log of labor is positive (0.03) and it is significant at 1% probability level, implying that an increase in the log of labour increase log of domestic production in

Nigeria by the value of its coefficient. All other variables used in the model are positive and not significant.

In the long run, the coefficient of log of exchange rate, interest rate and labor are positive and significant at 1% probability level. This means acceleration in the log of these variables will lead to acceleration in the log of domestic production with the value of their coefficients. The coefficient of FDI is positive and significant at 5% significant level, this also implies that acceleration in the log of FDI will lead to acceleration in the log of domestic production in Nigeria. The coefficient of inflation rate is positive and not significant.

Increase in domestic production per unit increase in FDI could be due to attractive macroeconomic fiscal and monetary policies such as tax reduction, stabilization of exchange and interest rate and increase in government spending on basic social amenities including electricity, roads, health center, pipe borne water etc. Increase in FDI means increase in the nation's gross capital formation, increase in economic activities as well as increase in labour involve in agricultural production. Similarly, to the outcome of Adeleke et al. (2014) observed an increase in FDI increases GDP in Nigeria. The finding is also in consonant with Otepola (2002) who found that FDI contributes significantly to growth especially through exports.

Table 9: Cointegration and Long Run Form

ARDL Cointegrating And Long Run Form
Dependent Variable: SER01

Cointegrating Form (Short Run)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(Ex_rate)	-0.000757	0.043919	-0.017237	0.9864
D(FDI)	0.042239	0.016088	2.625385	0.0244
D(INFL)	0.013535	0.018574	0.728706	0.4722
D(INT)	-0.050935	0.094209	-0.540656	0.5930
D(LAB)	0.030563	0.010589	2.886162	0.0074
CointEq(-1)	-0.303824	0.082003	-3.705022	0.0009

Long Run Coefficients

Variable	Coefficient	Std. Error	t-Statistic	Prob.
EX_rate	0.443016	0.054011	8.202328	0.0000
FDI	0.023263	0.041445	-0.561301	0.0271
Infl_rate	0.044550	0.062274	0.715377	0.4803
Intr_rate	-1.024496	0.208599	-4.911314	0.0000
Labour	0.100594	0.022444	4.481939	0.0001
C	29.751826	1.256119	23.685507	0.0000

R-squared	0.994124	Mean dependent var	29.58557
Adjusted R-squared	0.992235	S.D. dependent var	0.760835
S.E. of regression	0.067045	Akaike info criterion	-2.345956
Sum squared resid	0.125863	Schwarz criterion	-1.915013
Log likelihood	54.57317	Hannan-Quinn criter.	-2.192630
F-statistic	526.3096	Durbin-Watson stat	2.018124
Prob(F-statistic)	0.000000		

*Note: p-values and any subsequent tests do not account for model selection.

Source: Author's Compilation (2020)

- **Causal relationship between Domestic Agricultural Production and FDI**

The result of the causal relationship between domestic production and FDI is presented in table 10 below. This indicates unidirectional causal relationship between domestic production and FDI. But FDI does not Granger cause domestic production. This implies that the past value of domestic production may have influence on future value of FDI. This is in line with Udousoro *et. al*. (2013) who found a unidirectional causality between and foreign capital investment and exchange rate but foreign capital does not Granger cause exchange rate.

Table 10: Granger Causality Tests

Null Hypothesis	F-Statistics	Prob.
Ln Ex_rate does not Granger Cause LnDProd	2.03804	0.1623
LnDProd does not Granger Cause LnEx_rate	0.01527	0.9024
LnFDI does not Granger Cause LnDProd	0.46090	0.5017
LnDProd does not Granger Cause LnFDI	3.18901	0.0328
LNInfl_rate does not Granger Cause LnDProd	0.05333	0.8187
LnDProd does not Granger Cause LnInfl_rate	0.71134	0.4047
LnInt_rate does not Granger Cause LnDProd	0.07107	0.7914
LnDProd does not Granger Cause LnInt_rate	0.05575	0.8147
LnLab does not Granger Cause LnDprod	0.00393	0.9504
LnDprod does not Granger Cause LnLab	1.75119	0.1943
LnFDI does not Granger Cause LnEx_rate	0.01900	0.8912
LnEx_rate does not Granger Cause LnFDI	3.80950	0.0590
LnInfl_rate does not Granger Cause LnEx_rate	0.57803	0.4522
LnEx_rate does not Granger Cause LnInfl_rate	0.18889	0.6665
LnInt_rate does not Granger Cause LnEx_rate	0.03947	0.8437
LnEx_rate does not Granger Cause LnInt_rate	0.41672	0.5228
LnLab does not Granger Cause LnEx_rate	0.00689	0.9343
LnEx_rate does not Granger Cause LnLab	0.63299	0.4316
LnInfl_rate does not Granger Cause LnFDI	0.09088	0.7649
LnFDI does not Granger Cause LnInfl_rate	0.64475	0.4274
LnInt_rate does not Granger Cause LnFDI	3.91009	0.0559
LnFDI does not Granger Cause LnInt_rate	0.01468	0.9042
LnLab does not Granger Cause LnFDI	2.19155	0.1477
LnFDI does not Granger Cause LnLab	2.64894	0.1126
LnInt_rate does not Granger Cause LnInfl_rate	0.74943	0.3926
LnInfl_rate does not Granger Cause LnInt_rate	1.33209	0.2563
LnLab does not Granger Cause LnInfl_rate	0.00518	0.9430

LnInfl_rate does not Granger Cause LnLab	0.02763	0.8689
LnLab does not Granger Cause LnInt_rate	0.11154	0.7404
LnInt_rate does not Granger Cause LnLab	0.65564	0.4236

Source: Author's Compilation (2020)

CONCLUSION

The research determined how foreign direct investment has influence domestic agricultural production in Nigeria. With different order of stationarity, a bounds test approach embedded in the ARDL was carried out confirming a long run relationship among all the variables. The study revealed acceleration in growth of domestic production and FDI. Only FDI and labor had significant effect on domestic production in short run and all variables in the model except inflation rate had impact on domestic production in the long run.The results revealed past values of domestic agricultural production can predict the future value of FDI. The positive impact of FDI on domestic agricultural production both in the short and long run suggests that Nigeria government should make policies that can lead to increased inflows of FDI to domestic production so that domestic production can meet its capacity demand. Macroeconomic policies that will strengthen the naira value and reduce interest rate for farm purposes which suggests labour availability and stability of exchange rate as it tend to affect domestic agricultural production.

The study is limited to 38 years because of availability of data. Future studies should be on individual domestic agricultural production subsector like crop, fishery, livestock and forestry to know the impact of FDI on these subsectors. Also, future studies should give apriority to influence of private investment on domestic production.

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APPENDIX

DIGNOSTIC CHECKING

Stability Test

Figure 1 presents the result for structural break of the model using the CUSUM test. The CUSUM test line is situated between the gridlines, this implies that it lies between two standard deviation or 95% confident interval level. From the graphs it showed that there is no break, all residuals are stable since it is maintained within the 5% significant level during the period of observation and the model is said to be a fitted model.

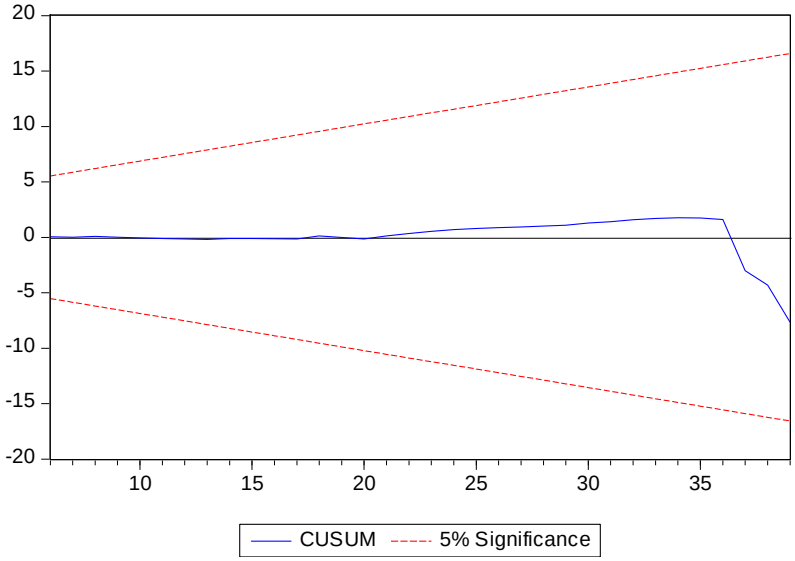

Figure1: Stability Test

LM TEST FOR SERIAL CORRELATION

The LM for serial correlation is presented in the table below. The result of LM test confirm the

Durbin Watson statistics value of 2.018 which means variable are free autocorrelation. The Breuch-Godfrey LM test for serial for correlation shows the probability value of 0.5885, this is insignificant at 5% significant level. This implies model is free from autocorrelation.

Breusch-Godfrey Serial Correlation LM Test:

F-statistic	0.541194	Prob. F(2,26)	0.5885
Obs*R-squared	1.518726	Prob. Chi-Square(2)	0.4680

Source: Author's Compilation (2020)

HETEROSKEDASTICITY TEST

Table present the result of heteroskedasticity below. The test suggest variable are free from the problem of heteroskedasticity since probability value and Obs*R-square of 0.0635 and 0.0598 are greater than 5%.

Heteroskedasticity Test: Breusch-Pagan-Godfrey

F-statistic	2.950340	Prob. F(9,28)	0.0635
Obs*R-squared	18.49605	Prob. Chi-Square(9)	0.0598
Scaled explained SS	17.48249	Prob. Chi-Square(9)	0.0417

Source: Author's Compilation (2020)

NORMALITY TEST

The figure 2 below presented the graph of normality test. The result showed it is positively skewed to right tail and kurtosis greater than 3 meaning it is leptokurtic under the null hypothesis of that residual are normally distributed. The Jarque-Berra test probability value 0.0011 showed the null hypothesis can be accepted that the residual are normally distributed.

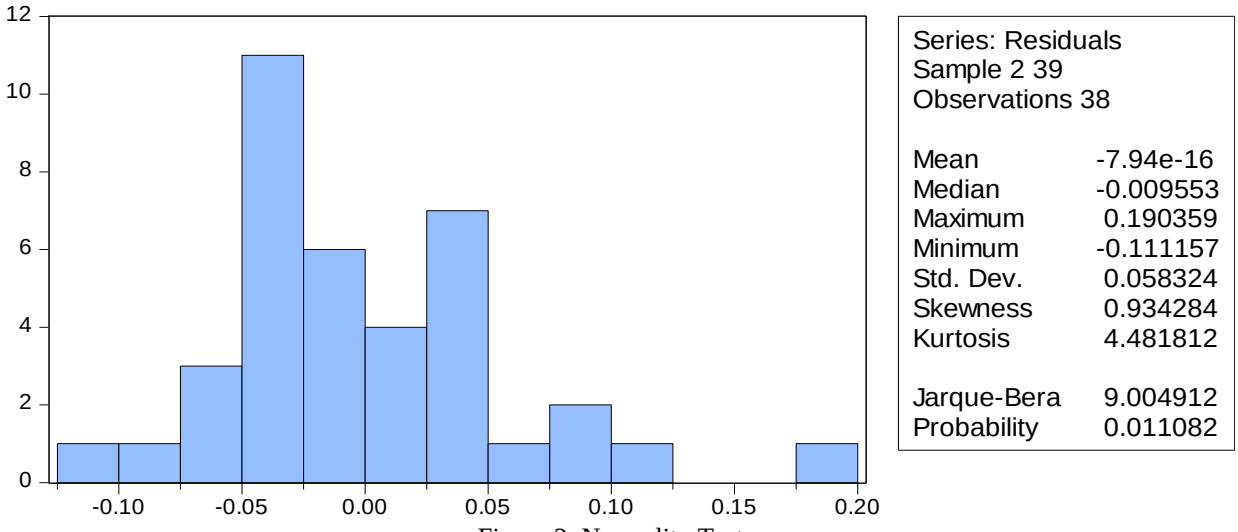

Figure 2: Normality Test

COLLELOGRAM TEST FOR AUTO CORRELATION

The table below presents the collelogram test for autocorrelation. The Q statistics suggests variable are free from autocorrelation with probality value greater than 5%.

Autocorrelation	Partial Correlation		AC	PAC	Q-Stat	Prob*
. |. |	. |. |	1	-0.039	-0.039	0.0633	0.801
.*|. |	.*|. |	2	-0.162	-0.164	1.1774	0.555
. |. |	. |. |	3	0.071	0.058	1.3937	0.707
.*|. |	.*|. |	4	-0.176	-0.204	2.7824	0.595
.*|. |	.*|. |	5	-0.174	-0.177	4.1706	0.525
. |. |	. |. |	6	0.065	-0.022	4.3711	0.627
. |. |	. |. |	7	0.000	-0.045	4.3711	0.736
. |. |	.*|. |	8	-0.051	-0.074	4.5014	0.809
. |. |	. |. |	9	0.049	-0.038	4.6276	0.865
. |. |	. |. |	10	0.066	0.027	4.8667	0.900
. |. |	. |. |	11	0.052	0.071	5.0195	0.930
.*|. |	.*|. |	12	-0.163	-0.188	6.5790	0.884
.*|. |	.*|. |	13	-0.080	-0.110	6.9715	0.904
. |. |	. |. |	14	0.056	0.006	7.1672	0.928
.*|. |	.*|. |	15	-0.136	-0.141	8.3973	0.907
. |*. |	. |. |	16	0.100	0.049	9.0856	0.910
*Probabilities may not be valid for this equation specification.						