

## Does Foreign Direct Investments Impact Agricultural Output in Nigeria? An Error Correction Modelling Approach

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### Abstract

This study measures the impact of foreign direct investment on agricultural output in Nigeria. It opines that foreign direct investment is one of the viable techniques of financing development in developing countries. To achieve our objective, the study used times series data spanning a period of 34 years for several variables from credible sources. The method of analysis used was Error correction model. The study found an insignificantly positive effect of foreign direct investment on agricultural output in the short-run but found a significant effect on agricultural output in the long-run. Furthermore, the study found a significant effect of employment, exchange rate, and interest rates on agricultural output in the long-run. It is recommended that deliberate policies must be quickly enacted to reduce interest rates for farm purposes, encourage labour availability in agriculture and stabilize exchange rates within the Nigerian economy. These way foreign investors will be encouraged to import their capital for agricultural production activities now which will be a guarantee for a significant impact of foreign direct investment on agricultural output in the long run.

### INTRODUCTION

Investment is simply the process of adding to capital stock available. The major sustenance of the vicious circle of poverty has been attributed to lack of capital. This is because it has a negative effect on the capacity to produce in a country. In developing countries, national income is low hence savings and investment are low. Low investment translates to low capital stock, low productivity and low output as well as low income (poverty cycle) (Ogbanje, Okwu, and Saror, 2010). According to the Keynesians, real investment refers to addition to capital (as a factor of production) which leads to increase in the levels of production and income. From this, one can note that real investment includes new plant and equipment, construction of public works like dams, roads, buildings, net foreign investment, inventories, as well as stocks and shares in new companies

In the economic world today, Foreign Direct Investment (FDI) is the largest and most stable element in capital flows which is necessary for economic growth and it has become an important alternative in the development finance process (Global Development Finance, 2005). Foreign Direct Investment (FDI) represents an important source of capital and potential lifeline for many developing countries especially Africa where there are high poverty levels, low savings culture and relatively weak or non-existing capital markets (Idrisu, Immurana, and Halidu, 2015).

Kumar (2003), described Foreign Direct Investment (FDI) in several ways. First and most likely, it may involve parent enterprise injecting equity capital by purchasing shares in foreign affiliates. Second, it may take the form of reinvesting the affiliate's earning. Third, it may entail foreign investment as a share of Gross Domestic Product (GDP) has grown rapidly, becoming the largest source of capital moving from developed nations to developing nations.

The importance of FDI to any economy cannot be overlooked such as increase in employment opportunities, technological know-how, and capital inflow etc to name a few. FDI inflows are much needed to accelerate growth rates to around eight or nine per cent to be able to move majority of a country's population out of poverty (Onyeagu and Okeiyika, 2013).

Agriculture has been an important sector in the Nigerian economy in the past decades and is still a major sector despite the oil boom. Basically, it provides employment opportunities for a large population of the economy, eradicates poverty and contributes significantly to the growth of the economy (Oji-Okoro, 2011). However, the role it plays in the regional and economic development of the country has diminished over the years due to the dominant role of the crude oil sector in the economy. In recent times the role of agriculture in rebuilding the Nigerian economy is being reiterated most especially given the global fall in the price of crude and hence the reduction of the revenue earning capacity of Nigeria. The agricultural sector has the potentials to be the industrial and economic springboard from which a country's development can take off as posited by many development economists through its spheres of activities at both the macro and at micro level, also, it is strategically positioned to have a high multiplier and linkage effects on any nation's quest for socio-economic and industrial development.

Nigeria is an economy with a large market which attracts numerous FDI's. Statistics show that Nigeria's FDI inflow reached US\$2.23 billion in 2003, it rose to US\$5.31 billion in 2004 (a 138% increase) and rose again to US\$9.92 billion (an 87% increase) in 2005. The figure however declined slightly to US\$9.44 billion in 2006 and averaged 1366.45 USD Million in 2007 reaching an all-time high of 3084.90 USD Million in the fourth quarter of 2012, and a record low of 501.83 USD Million in the fourth quarter of 2015 (CBN, 2016).

The view that foreign investment in agriculture holds the key to Nigeria's food security problem particularly when it is aimed at supporting smallholder agriculture and sustainable farming is quite comforting. However, the trends in the acquisition of huge tracts of Nigerian agricultural land by foreign governments (directly or through sovereign wealth funds), and by multinationals, investment banks, hedge funds, private equity firms and speculators creates a slightly more tortuous and disturbing picture (Ogalo, 2011).

It is common knowledge that for a country to grow it must raise the level of her national savings/capital which leads to increased investments. It is believed that Nigeria as an economy has a relatively low savings rate. This is not due to the unavailability of income but rather the consumption behaviour of the citizens. The Nigerian economy spends a high portion of its income on consumption expenditure. This consumption expenditure is however not spent on locally produced goods but on imported goods. An average Nigerian would rather consume foreign goods rather than the ones made at home. This attitude leads to leakage in the economy as the money that could have been spent on local production to boost the economy is being channelled to imports in a very substantial quantity. This high rate of imports reduces the amount of savings left in the economy and hence investment thereby limiting the level of growth

Nigeria as a country is enriched with various humans and a natural resource which makes her have an edge in becoming the largest African economy and also secures a high place in the global market. This potential is however a mirage as major sectors of her economy is experiencing major drawbacks due to lack of effective linkage provided by agriculture. A nation greatly endowed with resources but yet cannot feed itself is a great paradox. In addition, these drawbacks are due to the economy's over dependence on oil leaving other sectors neglected. The agricultural sector which has always been a major source of revenue to the economy prior the oil boom has also greatly been affected. Quite a number of policies and programmes have been put in place to address these drawbacks such as Operation Feed the Nation (O.F.N), Agricultural Transformation Agenda and a number of others. This shows that the government is interested in the development of the agricultural sector if the problems of governance are fixed. Can the agricultural sector be revamped to raise agricultural output and general economic growth? This question has led to the need for an examination of FDI inflows and its impact on the Nigerian economy. Can FDI's be the channel through which the sector will bounce back to its prior position of economic prosperity?

Despite the large amount of inflows from FDI's, the level of agricultural development is not satisfactory. Other studies as may be seen in the section on empirical literature have shown that the level of FDI attracted to the Nigerian economy is small compared to what is actually needed given the current level of resources. The key questions in this study are as follows: What is the impact of FDI's on agricultural output in Nigeria? And what is the impact of other factors such as employment, exchange rate, gross capital formation on agricultural output in Nigeria?

## LITERATURE REVIEW

### Conceptual and Theoretical Literature

Investment is the act of setting aside money or capital in order to gain profitable returns, as interest, income or appreciation in value. Foreign Direct Investment (FDI) is the inflow of foreign income into a particular economy through investment which involves multinational corporations.

Nirupam and Nandita (2004) defined foreign direct investment as investments made to acquire lasting interest in enterprises operating outside of the economy of the investor. The FDI relationship consists of a parent enterprise and a foreign affiliate which together form a multinational corporation (MNC). In order to qualify as FDI the investment must afford the parent enterprise control over its foreign affiliate.

Kumar (2003) described Foreign Direct Investment (FDI) in several ways. First and most likely it may involve parent enterprise injecting equity capital by purchasing shares in foreign affiliates. Second, it may take the form of reinvesting the affiliate's earning. Third, it may entail short-or-foreign investment as a share of Gross Domestic Product has grown rapidly, becoming the largest source of capital moving from developed nations to developing nations. The need for foreign capital to supplement domestic resources is being felt by the developing economies, in view of growing mismatch between their domestic capital stock and capital requirements. This is proven in the new attention being given to the drive for foreign capital especially in developing economies such as Nigeria.

FDI may have negative effects on the growth prospect of the host economy if they give rise to a substantial reverse flows by the activities of transnational corporations (TNCs) in the form of remittances of profits, dividends and substantial concessions from the host country (Akinlo, 2004). Dauda (2007) argues that FDI is generally believed to propel economic growth in developing countries as it makes significant contributions to the host country's development process especially through easing of the constraints of low levels of domestic savings and investment as well as foreign exchange shortages. The study further argues that FDI increases the GDP and generates a stream of real incomes in the host country. The increased productivity benefits local income groups through higher wages and expanded employment, lower product prices paid by consumers, rent to local resource owners, and high tax revenue or royalties to the government.

The model of Harrod-Domar in 1930 suggests that the economy's rate of growth depends on level of saving and productivity of investment, i.e. the capital output ratio. They therefore placed considerable emphasis on investment, savings and technology as the main agents of economic growth. Increased investment would, in turn, force the production possibility curve outwards and create more wealth. The model concludes that increasing the savings ratio, or the amount of investment or the rate of technological progress is vital for the growth process. Furthermore, economic growth depends on the amount of labour and capital, as developing countries often have an abundant supply of labour. It is lack of physical capital that holds back economic growth and development, more physical capital generates economic growth, net investment leads to more capital accumulation, which generates higher output and income. Higher incomes allows higher levels of saving,

Robert Solow in 1956 developed the neo-classical theory of economic growth. The Solow Growth Model is a model of capital accumulation in a pure production economy. According to the model growth comes from adding more capital and labour inputs and also from ideas and new technology. The Solow model believes that a sustained rise in capital investment increases the growth rate but just temporarily because the capital-labour ratio goes up. The theory is built on the concept of diminishing returns. Hence, the marginal product of additional units of capital may decline (due to diminishing returns) and thus an economy will move back to a long-term growth path, with real GDP growing at the same rate as the growth of the workforce plus a factor to reflect improving productivity. The relevance of this theory in this study is that increase in agricultural investments will lead to a corresponding increase in agricultural output. Theoretical and empirical analyses have shown that a booming agricultural sector is essential for economic development. This is true both for agriculture itself and in the stimulation of other industries. Addition to capital is required to boost investment in agriculture. This is why for most developing countries foreign direct investments are highly desirable because of the strong linkage effects with other sectors of the economy e.g. manufacturing sector. Therefore, increasing agricultural investments is expected to lead to growth in output and hence economic growth.

The accelerator theory of investment is an economic postulation that investments made by companies increase when either demand or income increases. The theory also suggests that when demand produces an excess of demand, companies can meet the need in two ways: decrease demand by raising prices or increase investment to the level of demand. The accelerator theory posits that companies typically choose to increase production, thereby increasing profits; this growth, in turn, attracts further investors that work to accelerate growth.

The profits theory of investments regards profits, in particular undistributed profits, as a source of internal funds for financing investment. Investment depends on profits and profits, in turn, depend on income. In this theory, profits relate to the level of current profits and of the recent past. If total income and total profits are high, the retained earnings of firms are also high, and vice versa, Retained earnings are of great importance for small and large firms when the capital market is imperfect because it is cheaper to use them. Thus if profits are high, the retained earnings are also high. The cost of capital is low and the optimal capital stock is large. That is why firms prefer to reinvest their extra profit for making investments instead of keeping them in banks in order to buy securities or to give dividends to shareholders. Contrariwise, when their profits fall, they cut their investment projects. This is the liquidity version of the profits theory. Foreign direct investment is important as it a tool for further provision of capital for the economic activities of nations especially in circumstances where undistributed profit within the economy is unable to provide adequate impetus for economic growth.

## Empirical Literature

Sunde, T. (2017) empirically investigated economic growth as a function of foreign direct investment and exports in South Africa. The study applied the autoregressive distributed lag model, known as the ARDL bounds testing approach to cointegration for the long run relationship between economic growth, foreign direct investment and exports. The error correction model was used to examine the short run dynamics; and the VECM Granger causality approach was used to investigate the direction of causality. The article confirmed cointegration between economic growth, foreign direct investment and exports. The article indicates that both foreign direct investment and exports spur economic growth. The VECM Granger causality analysis found unidirectional causality between economic growth and foreign direct investment running from foreign direct investment to economic growth, unidirectional causality between foreign direct investment and exports running from foreign direct investment to exports and bidirectional causality between economic growth and exports. The study confirms the FDI-led growth hypothesis for South Africa. The study recommends that government could stimulate foreign direct investment through incentives to investors, creation of a good macroeconomic environment and a careful utilisation of loose monetary policy to grow the economy.

Adams, S., Evans, E. and Opoku, O. (2015). study examines the effect of foreign direct investment (FDI) on economic growth and determines how the regulatory regime of the countries affects the FDI-growth relationship for 22 sub-Saharan African countries for the period 1980–2011. Using General Methods of Moments (GMM) estimation technique, the findings of the study were that both FDI and regulations (total regulations, credit market regulations, business regulations and labor market regulations) do not have an independent significant effect, however, their interaction has a significant positive effect on economic growth. This implies that the growth effect of FDI is stimulated in the presence of effective and quality regulations. Therefore the study recommends measures to be put in place to strengthen regulations in sub-Saharan Africa in order to realize the benefits of FDI.

Alvarado, R., María I., and Ponce, P. (2017) looks at the effect of foreign direct investment (FDI) on economic growth in 19 Latin American countries. They used panel data econometrics, the study found a robust empirical evidence which suggests that the effect of FDI on economic growth is not statistically significant in aggregated form. This result varies when we incorporate the levels of development reached by the countries in the region. FDI has a positive and significant effect on product in high-income countries, while in upper-middle-income countries the effect is uneven and non-significant. Finally, the effect in lower-middle-income countries is negative and statistically significant. their results show that FDI is not an adequate mechanism to accelerate economic growth in Latin America, with the exception of high-income countries.

Ould (2015) did a study titled An Investigation of the Impact of Foreign Direct Investment on Economic Growth: A Case Study of Mauritania. The study employed variables like Gross Domestic Product (GDP) and Foreign Direct Investment (FDI) and Gross Fix Capital Formation (GFCF) using Granger-Causality Test, Error correction model ECM etc as his analytical technique. The study found that increasing trend of FDI also increases the GDP of the country. The Granger Causality test indicates no causality between GDP and FDI in the period under investigation. The significance of FDI in generating the target growth rate in Mauritania may be restricted by the level of infrastructure, business environmental, Economic reforms, and political instability. The study suggests that Mauritanian government should give full consideration to improve and develop infrastructure across the country as a cursor to growth

Effiong and Eke (2016) investigated the effect of foreign capital inflows (foreign private investment, foreign aids and grants and net export earnings) on index of crops output in Nigeria using time series data from 1980-2013. The result revealed that foreign capital inflows (Foreign private investment (FPI), Foreign aids and grant to agriculture (FAG), Net export earnings (NEE), and Exchange rate (EXR) has a positive impact but does not significantly affect crop output in Nigeria. The method of analysis used is error correction model (ECM), On the basis of its findings the study recommends that government should put in place a strategy for attracting more foreign investors as well as pursue an aggressive export promotion drive with a view to increasing the volume of value- added agricultural exports.

Adigun (2015) investigated the impact of the sectorial inflow of FDI on economic growth and also the impact of FDI on poverty reduction in Nigeria using secondary data. The method of analysis used is Vector autoregressive method (VAR). His findings show a positive relationship exists between GDP and FDI and that in the long run, investment in the business and agricultural sectors can only make meaningful impact on the economy because it takes time to get back investment in these sectors. He concluded that the major reason for the low impact of FDI on Economic Growth in the country is that FDI inflow has been towards certain sectors (oil and gas, communication, construction, etc.) at the expense of those sectors (agriculture, tourism, manufacturing, etc.) that has the greatest potential for poverty reduction and economic growth.

Gubak and Samuel (2015) in their work analysed the nature and volume of Chinese trade and investment in Nigeria's Agricultural sector and its impact on the Nigerian economy using qualitative and descriptive method of analysis. The paper revealed that Chinese trade and investment in Nigeria's agriculture is very low compared to

other sectors and has not focused much in the development of the agricultural sector in Nigeria. The paper identifies the need for more engagement with Chinese in trade and investment in the agricultural sector in Nigeria to enhance growth and development of the economy among others.

Lawrence and Mohammed (2014) worked on the nature of foreign direct investment and its impact on sustainable economic growth in Nigeria using qualitative research method. The study found that continuous inflow of foreign direct investment in mining and quarrying, telecommunication, building and construction, trading and business and agricultural sectors have a robust impact on Nigeria's economic growth. The study recommended among others that there is need for government to consciously improve the business environment by conscious provision of necessary infrastructure, which will lower the cost of doing business in Nigeria and adequate macroeconomic policies that will open up the economy should be put in place to encourage foreign direct investment inflow and make Nigeria an export platform, where export commodities could be manufactured for established international market, this will help to Strengthen Nigeria's Balance of Payment position (BOP).

Akande and Biam (2013) examined causal relations between foreign direct investment in agriculture and agricultural output in Nigeria employing error correction model (ECM). The results revealed that there is no long run equilibrium relationship existing between FDI in agriculture and agricultural output in Nigeria both in the presence of inflationary shock and in its absence. However, while 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 a negative role on the short run influence of FDI in agriculture on agricultural output. Their recommendation is that policies that encourage FDI in agriculture should be improved with more attention paid to inflation control.

Obansa and Maduekwe (2013) investigated the impact of agriculture financing on economic growth for Nigeria. The study employed secondary data and used Ordinary Least Square (OLS). The result suggest a bi-directional causality between economic growth and agriculture financing; furthermore, it showed a bi-directional causality between economic growth and agricultural growth. The recommendation follows that the maintenance of credible macroeconomic policies that are pro-investment; and debt-equity swap option are necessary for a agricultural-led economic growth.

Onyeagu and Okeiyika (2013) empirically examined the relationship between FDI, human capital development (HCD) and economic growth in Nigeria. Their results show that FDI in Nigeria has a negatively significant relationship with growth in the long run. The negative significant effects of human capital in Nigeria with the overall growth in the long run, suggest that there is shortage of skilled labour in the country. The ECM is method of analysis used. Recommendations were made to improve on the development of human capital with use of appropriate policy in other to benefit more from the presence of foreign investors in Nigeria.

Yusuff, Afolayan and Adamu (2015) in a study titled Analysis of Foreign Direct Investment on Agricultural Sector and Its Contribution to GDP in Nigeria using vector autoregressive model. The study used variables like foreign direct investment (FDI) and gross domestic product (GDP). The result shows fluctuations in the flow of FDI to agriculture, and it further indicates that the sector is heavily marginalized when compared with the flow received by other sectors of the economy. The result also shows that there is a significant longrun relationship between agricultural FDI and the sector contribution to GDP. This study therefore recommends FDI that focuses on the improvement of existing technology and/or introduction of new technology that would enhance domestic production should be sought for agricultural sector.

Another study on the impact of foreign direct investments on the Nigerian economy by Shirro (2009) showed a positive relationship between foreign direct investment and the following variables (gross domestic product, gross fixed capital formation and index of industrial production), using ordinary least square as a technique of analysis. The study also indicates that foreign direct investment has not contributed significantly to the growth and development of Nigerian economy. The suggestion of the study is that in order to further improve the economic climate for foreign direct investments in Nigeria; the government must appreciate the fact that the basic element in any successful development strategy should be the encouragement of domestic investors before considering going international.

Adegbemi (2012) in his paper titled 'Foreign Direct Investments and Economic Growth in Nigeria: A Disaggregated Sector Analysis' investigated the impact of Foreign Direct Investment (FDI) on economic growth in Nigeria using a three-stage least squares (3SLS) technique and macro econometric model of simultaneous equations to capture the disaggregated impact of FDI on the different sectors of the economy and the inter-linkages amongst the sectors in order to give better insight into the variations inherent therein. The result shows that FDI has a significant impact on output of the economy, but that the growth effects of FDI differ across various sectors. The recommendation is that sector- specific policies, enhanced trade openness, import substitution development strategy incentives to existing investors, and potential overseas investors so as to enhance the development of the country.

## MEHODOLOGY

### Sources and Types of Data

The type of data employed for this study is secondary data collected from published Central Bank of Nigeria Statistical Bulletins for various years and World Bank statistics. There are six variables for which data was collected. The dependent variable designated as Y, which is the Agricultural Gross Domestic Product (AGDP), and the Independent variable X, which includes the Foreign Direct Investment (FDI), Exchange rate (EXR). The version of EXR used is its nominal value because the study considers the direct exchange rate of the Naira compared to the foreign currencies of the countries traded with. Interest Rate (INT), Employment (EMP) and Gross Capital Formation (GCF). The time series data covers the period of 1981-2014.

### Theoretical Framework

The Harrod-Domar growth model gives some insights into the dynamics of growth. The main idea behind this model is that an increase in savings will lead to an increase in growth rate due through investments and therefore greater capital formation. To determine an equilibrium growth rate  $g$  for the economy, let Y be GDP and S be savings. The level of savings is a function of the level of GDP:

$$S = sY \dots\dots\dots 1$$

The level of capital K needed to produce an output Y is given by the equation:

$$K = \sigma Y \dots\dots\dots 2$$

where  $\sigma$  is called the capital-output ratio.

Investment is a very important variable for the economy because it has a dual role. It represents an important component of the demand for the output of an economy as well as the increase in capital stock. Thus

$$\Delta K = \sigma \Delta Y \dots\dots\dots 3$$

To attain equilibrium, there must be a balance between supply and demand for a nation's output. In simple case this equilibrium condition reduces to  $I = S$ . S represents investment Thus,

$$I = \Delta K = \sigma \Delta Y \dots\dots\dots 4$$

$$I = S \dots\dots\dots 5$$

Therefore,

$$S = sY = I = \Delta K = \sigma \Delta Y \dots\dots\dots 6$$

However, there is a limitation here. In the case of an economy's inability to generate adequate savings, such an economy will be limited in growth. The economy then has an option of sourcing for foreign aids or investments to fill the gap in the economy.

Adapting Harrod-Domar:  $I = \Delta K = \sigma \Delta Y$

$$I = \Delta K + FDI = \sigma \Delta Y \dots\dots\dots 7$$

Where FDI is Foreign Direct Investment

### Model Specification

The variables used in this study had been used by previous scholars. Binuyo (2014) found a positive relationship between FDI and agriculture not only in the short run but also in the long run. Based on these, the variables for the study are Foreign Direct Investment (FDI); Agricultural Gross Domestic Product (AGDP) used here is the implicit price deflator because it take care of the inflationary effect on the series. Exchange rate (EXR); Interest rate (INT); Gross capital formation (GCF); Employment (EMP), Cultivable land area (CLA), Fertilizer (FERT), Rainfall (RAIN). It is important to note that INT, GCF, and EMP are not sector specific to agriculture but are general aggregates within the Nigerian economy. They are however used because sector specific data are not available in the statistical books.

The functional form,

$$AGDP = f(FDI, EXR, GCF, INT, EMP, CLA, FERT, RAIN) \dots\dots\dots 8$$

Cultivable land area (CLA) was eliminated from model 9 because of unavailability of complete data for all the years studied. In specifics, missing data for cultivable land area was almost half of the total number of years covered so the series is excluded from model 9. Data on fertilizer (FERT) use is unavailable, so the series was also eliminated in model 9. Rainfall (RAIN) was completely obtained by computation from data available in Central Bank Statistical book but did not perform well in the model so the series was eliminated.

$$AGDP = f(FDI, EXR, GCF, INT, EMP) \dots\dots\dots 9$$

The econometric form of equation 8 is as follows:

$$AGDP = \alpha_0 + \alpha_1 FDI + \alpha_2 EXR + \alpha_3 GCF + \alpha_4 INT + \alpha_5 EMP + \mu_t \dots\dots\dots 10$$

Where;

$\alpha_0$  = Intercept

$\alpha_1 - \alpha_4$  = coefficients of the independent variables

$\mu_t$  = Stochastic Error Term

The log form is specified as follows:

$LAGDP = \alpha_0 + \alpha_1 LFDI + \alpha_2 LEXR + \alpha_3 LGCF + \alpha_4 LINT + \alpha_5 LEMP + \mu_t \dots 11$  Variables are estimated in their log forms so as to ensure that we get the best possible sets of estimates from the analysis.

The short run equation for the ECM is written as:

$$\Delta LAGDP_t = \alpha_0 + \alpha_1 \Delta LFDI_t + \alpha_2 \Delta LEXR_t + \alpha_3 \Delta LGCF_t + \alpha_4 \Delta LINT_t + \alpha_5 \Delta LEMP_t + \alpha_6 ECT_{t-1} + e_t \dots 12$$

The long run equation for the error correction can be written as:

$$AGDP_t = \alpha_0 + \alpha_1 FDI_t + \alpha_2 EXR_t + \alpha_3 GCF_t + \alpha_4 INT_t + \alpha_5 EMP_t + e_t \dots 13$$

### Preliminary Tests

A test of stationarity aimed at determining whether the variables in their time series form have dependable means and variances was done using Augmented Dickey-Fuller to test for order of stationarity of the series. Also, the presence of long run relationship among the variables was tested using Engle-granger cointegration method. The method specifies that though all the series may not be stationary at first difference, if their residual is stationary at levels I(0), there can still be a long run relationship among the series, The test of long run relationship among the series is called cointegration.

### Technique of Data Analysis

Error Correction Model (ECM) was used to analyse the short-run and long-run behaviour of the model. The Error Correction Model (ECM) was used to correct the inherent behaviour of the times series used and the speed of adjustment from the short-run equilibrium to the long-run equilibrium state. The greater the coefficient of the parameter the higher the speed of adjustment of the model from the short-run to the long-run equilibrium, the parameter of the speed of adjustment is expected to be negative meaning that the system is converging towards long run equilibrium

### Definition of Variables and Theoretical Expectations

Theoretical expectations simply refer to the signs which follow the parameters based on economic relationships which are determined by laid down economic theories. In this study:

Agricultural Gross Domestic Product (AGDP) is simply the share of agricultural output in the total GDP of the total economy.

Foreign Direct Investment (FDI) refers to inflows from a foreign country to a host economy. This affects the growth rate and output in the host economy. Both on theoretical and empirical grounds it has been shown that there is a positive relationship existing between FDI and agricultural output except in the case of the 'crowding-out effect'. Therefore, the theoretical expectation between FDI and AGDP is positive. Exchange rate (EXR) is simply the rate at which one currency exchanges for another. It is the value of a country's currency in terms of another currency. The theoretical expectation between EXR and AGDP is negative because it believed that if EXR increases, the cost of imports of agricultural inputs will also increase, thereby causing a decrease in the performance of agriculture since many farmers may not be able to afford the cost of inputs.

Real interest rate is the lending interest rate adjusted for inflation as measured by the GDP deflator. It has a negative theoretical expectation with AGDP. Gross Capital Formation (GCF) refers to the outlays on additions to the fixed assets of the economy plus net changes in the level of inventories. The theoretical expectation between GCF and AGDP is positive. Employment (EMP) is simply the total share of the workforce available in the economy. The theoretical expectation between EMP and AGDP is positive. The above theoretical expectations can be summarized as follows:

**Table 1 Theoretical Expectations**

Variable/ Co-efficient	FDI ( $\alpha_1$ )	EXR( $\alpha_2$ )	GCF ( $\alpha_3$ )	INT ( $\alpha_4$ )	EMP ( $\alpha_5$ )
Expected sign	>0	<0	>0	<0	>0

Source: Authors Computation (2017)

### PRESENTATION AND DISCUSSION OF RESULTS

This section involves presentation and discussion of results. The variables were first examined for their levels of stationarity using the Augmented Dickey- Fuller test which enabled us to check for the existence or not of unit root in the time series data. The basis of this test is that the assumption of non-autocorrelation of the disturbance term may be violated. Next, the OLS method was used to test for long run relationship, after which the error correction model was conducted which involves using the lagged residual to correct short run deviations from equilibrium.

**Table 2 Results of Unit Root Tests**

Series	ADF at levels	Critical Values at 5%	ADF at First Difference	Critical Values at 5%	Order of Integration
LAGDP	0.378586	-2.954021	-5.560291	-2.957110	I(1)
LEMP	0.026993	-2.954021	-6.611401	-2.957110	I(1)
LEXR	-2.038754	-2.954021	-4.841075	-2.957110	I(1)
LFDI	-2.637827	-2.954021	-7.052743	-2.957110	I(1)
LGCF	-0.958410	-2.954021	-3.702226	-2.963972	I(1)
LINT	-2.780772	-2.954021	-7.347917	-2.957110	I(1)

Source: Computed from E-views 9.0 (2017)

The unit root results as seen in table 2 above shows that all variables are integrated at order one i.e. I(1) at 5 percent level of significance in their respective log forms. Thus the null hypothesis that the series has unit root which means the series is not stationary is accepted.

### Engle Granger Test of Cointegration

**Table 3 Unit Root Test of Residual 'μ' at Levels**

Variable	ADF Statistics	Test Critical Values at 5%	Prob.
U(-1)	-3.619417	-2.954021	0.0107

Source: Computed from E-views 9.0 (2017)

Hypothesis: Null Hypothesis ( $H_0$ ): The residual 'μ' has a unit root.

Alternative Hypothesis ( $H_1$ ): The residual 'μ' does not have unit root.

Decision rule: Reject  $H_0$  if test statistic is less than critical values, if not accept the alternative hypothesis. The error term here is stationary. This means that even though the variables used are not stationary at levels, the model is not spurious since their error term is stationary at levels. This implies that there exists a long run relationship among the variables. The Error Correction Model is then used to test for short run and long run relationships.

**Table 4 Results of Short Run Error Correction Model**

Variable	Coefficient	Std. Error	t-Statistics	Prob.
D(LEMP)	0.012518	0.244690	0.051159	0.9596
D(LEXR)	-0.026451	0.047640	-0.555224	0.5835
D(LFDI)	0.007906	0.012405	0.637334	0.5295
D(LGCF)	0.127316	0.052872	2.407977	0.0234**
D(LINT)	0.016065	0.093199	0.172375	0.8645
U(-1)	-0.311688	0.140724	-2.214888	0.0357**
C	0.025180	0.007882	3.194773	0.0036**

Source: Computed from E-views 9.0 (2017) \*\*\*, \*\* indicates significant at  $p < 0.01$ ,  $p < 0.05$ , respectively.

The coefficient of the error term is referred to as the speed of adjustment which shows how quickly disequilibrium in the short run is restored in the long run. The lagged residual in the error correction model plays the role of error correction in the model. Its coefficient is expected to be negatively signed while also being statistically different from zero (i.e. statistically significant). The error correction term is significant and negatively signed. Its coefficient (-0.311688) shows that about 31 % of disequilibrium in the short run is corrected towards long run equilibrium per annum.

The results of table 4 above shows that in the short-run, GCF have a positive and significant effect on agricultural output AGDP while EXR has a negative but an insignificant effect on AGDP. Furthermore EMP, FDI, and INT presented an insignificant effect on AGDP in Nigeria. The study is optimistic that exchange (EXR) presented a negative effect on agricultural output because of its rate of fluctuation over time, this is why there is need for the central bank of Nigeria to adopt realistic means of stabilizing the exchange rate otherwise its clear negative effects have the tendency of causing great harm on the development efforts of the Nigerian economy.

**Table 5 Results of Long run Error Correction Model**

Variable	Coefficient	Std. Error	t-Statistics	Prob.
LEMP	0.911038	0.183760	4.957760	0.0000***
LEXR	0.124968	0.043546	2.869790	0.0077**
LFDI	0.052165	0.014877	3.506406	0.0016**
LGCF	0.101092	0.062546	1.616292	0.1172
LINT	-0.322564	0.127420	-2.531505	0.0173**
C	2.203584	0.236788	14.46920	0.0000
R-squared = 0.972085	Prob (F-statistic) = 0.000000			

\*\*\*, \*\* indicates significant at  $p < 0.01$ ,  $p < 0.05$ , respectively.

Source: Computed from E-views 9.0 (2017)

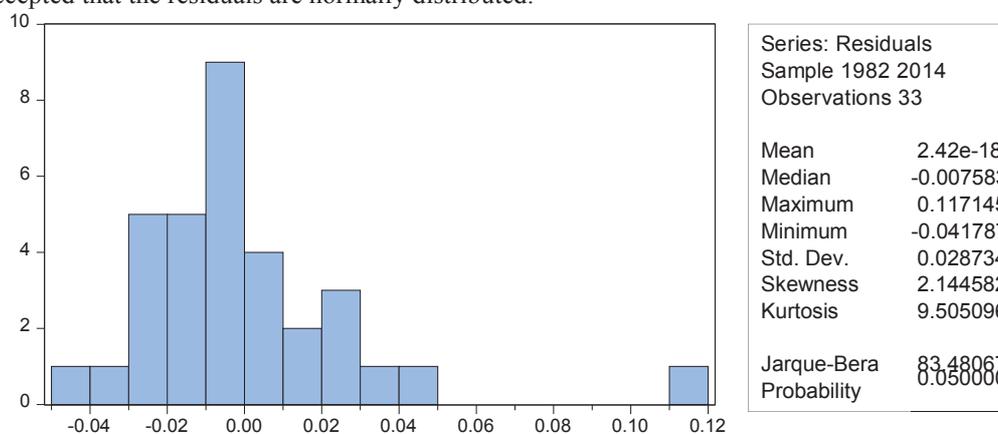
Results in table 3 above are the long run version of our model presented in table 2 above. It shows that all variables except GCF have significant impact on AGDP at 5 % level of significance with  $R^2 = 0.972085$  indicating that 97 % of the dependent variable is explained by the independent variable. The results however indicates that INT which is interest rates have presented a negative value meaning that interest rates have a generally negative effect on agricultural output indicating that the higher the interest rate the lower the agricultural output given that farmers would generally access less credit when the cost of credit is higher. This result is in line with theoretical expectations.

### Post Analysis Tests

The post analysis test further confirms the authenticity of our results above and asserts that the results are reliable.

### Normality Test

Figure 1 below presents graph of normality test. The null hypothesis is that, (residuals are normally distributed) from the above results, the probability value of Jarque-Berra test is 0.050. This shows that the null hypothesis can be accepted that the residuals are normally distributed.



**Figure 1 Normality Test**  
 Computed from E-views 9.0 (2017)

### Heteroskedasticity Test

The null hypothesis states that there is heteroskedasticity, The P value is 8.7 percent meaning that the null hypothesis can be rejected and that the residual is not heteroskedastic but homoscedastic.

**Table 6. Heteroskedasticity Test**

F-statistic	0.126177	Prob.F(2,28)	0.8820
Obs* R-Squared	0.276897	Prob. Chi-Square (2)	0.8707

Source: Author's computation (2017)

### Serial Correlation Test

Null hypothesis: 'Residuals are not serially correlated'.

The P value is greater than 5 percent, therefore we accept the null hypothesis that there is no serial correlation. The residual is not serially correlated and this is a desirable result.

**Table 6. Serial Correlation LM Test**

F-statistic	0.049159	Prob.F(2,24)	0.9521
Obs* R-Squared	0.134636	Prob. Chi-Square (2)	0.9349

Source: Author's computation (2017)

#### Stability Test

Figure 2 below represents stability test of the model. All residuals are stable if the cumulative sums are located between the two standard deviations. For this model, the cumulative sums are plotted against the time. From the graph above, it is clear that the model is stable, as it is maintained within the 5 percent significance level under the observation period.

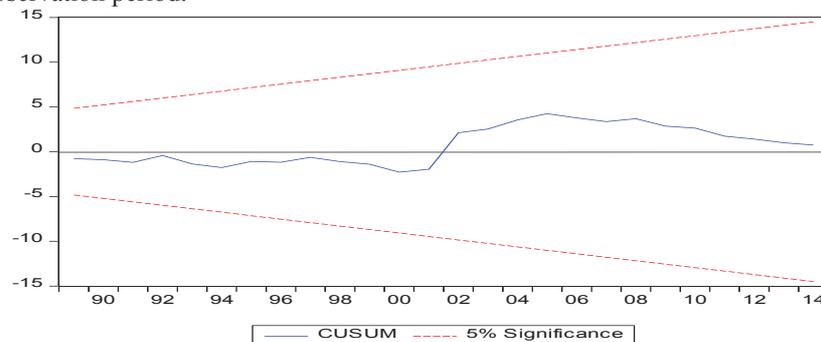


Figure 2. Stability Test

Source: Computed from E-views 9.0 (2017)

#### Conclusion and Recommendations

In the short run foreign direct investment (FDI), employment (EMP), interest rates (INT), exchange rate (EXR) have insignificantly impacted on agricultural output (AGDP) while only gross capital formation (GCF) has significantly impacted on agricultural output (AGDP) in Nigeria. Our results of error correction model shows that equilibrium can be restored in the long run at the rate 31% per annum. In the long run there is evidence of significant impact of foreign direct investment (FDI), interest rates (INT), exchange rate (EXR) and employment (EMP) on agricultural output (AGDP). Only gross capital formation (GCF) has shown evidence of an insignificant impact on our dependent variable AGDP.

Our study therefore recommends that government should enact policies that will create an enabling environment especially in the agricultural sector with a view to attracting foreign direct investments and encouraging increased employment generation in the agricultural sector. For example, all efforts should be geared towards encouraging able bodied people to contribute their labour in the agricultural sector. In addition, deliberate policies must be adopted to reduce the rate of interest charged especially on agricultural loans. This way the demand for credit will increase thereby increasing farm capital which will boost agricultural output. Furthermore, Policies must be sought to stabilize and reduce the exchange rate regime so as to encourage and create certainty in the minds of potential investors in the sector. If this recommendations are implemented it is hoped that Foreign direct investment in the long run will present a positive impact as evidenced in the study which will lead to a boost in the output of the agricultural sector.

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