DETERMINATION OF INTERCAUSAL RELATIONSHIPS BETWEEN AGRICULTURAL GROWTH, FOREIGN DIRECT INVESTMENT (FDI) AND SOME MACROECONOMIC DETERMINANTS IN NIGERIA

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ABSTRACT

This study examined the kind of causal relationships (short or long run) agricultural growth has with foreign direct investment (FDI) in agriculture and some macroeconomic variables that determine the flow of FDI. These other macroeconomic variables include: annual variability of consumers' price index (inflation rate), exchange rate, interest rate differentials, macroeconomic instability, political instability, stock of gross external debts on the one hand and agricultural growth in Nigeria on the other hand. Annual time series data were sourced from the Central Bank of Nigeria (CBN), World Bank and the United States of America (US) Federal Reserve System ranging from 1981 to 2014. Unit roots, co-integration and Granger causality tests were used to analyze data, while Chi square (X^2) tests was used to test hypotheses, all at the 5% probability level ($p<0.05$). Results indicated the existence of long run relationship among the variables with FDI in agriculture, stock of gross external debts and variability of consumers' price index having unidirectional causality on agricultural growth, while agricultural growth was significant in granger causing macroeconomic instability. It is recommended that the Nigerian Government should seek for and make deliberate efforts to encourage more FDI in agriculture, with a view to encouraging joint venture partnerships between foreign and domestic investors/entrepreneurs, especially in agriculture. Furthermore, the interest (monetary policy) rate should be fixed such that the differentials between the domestic interest rates and the prevailing interest rates in most source of FDI is minimal and ensure that there is stability and consistency in the implementation of macroeconomic policies.

Keywords: Agricultural FDI, Agricultural Growth, Causal Relationships, Granger Causality, Macroeconomic Variables.

INTRODUCTION

There have been varying definitions to the concept of FDI, but all the various authors agreed to the fact that it has to be an investment in another country other than that of the investor(s), with the investor(s) having direct control and taking decisions concerning their investment(s) in the other country. As such, the World Bank (2007), defined foreign direct investment (FDI) as an investment made to acquire a lasting management interest (normally 10% of voting stock) in a business enterprise operating in a country other than that of the investor(s) defined according to residency. FDI data are usually measured in current United States of American Dollars (US$) (World Bank, n.d.).

Almost all foreign investments are usually attracted to the country (Nigeria) through partnerships by direct or portfolio investments. This is done by partnering with already existing domestic firms in the way of providing technology, finance, expertise, market, research and so on, or by actually buying shares and other portfolios in them. Countries all over the World (especially least-developed and developing), have seen attracting FDIs as an important part in their strategy for agricultural growth and by extension, economic growth, as the economy of most of these countries rely mainly on agriculture and exploitation of natural resources. Similarly, Kurtishi-Kastrati (2013), stated that least-developed countries (LDCs), developing countries, emerging economies and countries in transition due to advantages related

to FDI, have liberalized their FDI regime, and followed best policies to attract investment. Apart from the economic benefits that can be derived, it is believed that by providing guide to more socially and environmentally responsible corporate policies, and by relocating better and cleaner technologies, FDI, which contributes to higher economic growth and which is the main instrument for alleviating poverty in many host countries, can also help in improving social and environmental conditions in those economies. However, the economic impact of FDI is difficult to measure with accuracy as benefits of FDI do not increase automatically and equally across countries, sectors and local communities. These benefits vary from one country to another and are difficult to be separated and measured.

Chakraborty and Nunnenkamp (2006), reported that traditionally, FDI was a phenomenon that primarily concerned with the highly developed economies, and that these developed countries still attract a higher share of worldwide FDI than developing countries (to which Nigeria belongs). However, Fingar (2015), showed that Africa witnessed the largest increase in inward investment, with US$87 billion of FDI announced in 2014. In the former (developed economies), for instance, agricultural FDI inflows in 2008-2010 represented an average increased share of 1.0% of gross fixed capital formation, compared to 0.1% in developed countries. Inward FDI stocks of developing countries in 1998 amounted to 20% of their GDP, compared to 12% in developed countries. In relative terms, it is believed that agricultural FDI plays a more important role in developing countries than in developed countries. Hence, the need to carry out a study that would empirically fill the knowledge gap that exists by determining the direction of causality between FDI and agricultural growth, in recognition of its role in economic transformation in developing countries generally and Nigeria in particular. UNCTAD (2012a) while noting that FDI in agriculture (including forestry and fishery, and food and beverages) world over, is still small, but rising in recent years, stated that the increase in FDI inflows to agriculture in developing countries (such as Nigeria) turned out to be higher than the increase in FDI in agriculture inflows to developed countries. More so that there is an increasing resistance to further liberalization within the economy, thus limiting options available to governments in sourcing funds for agricultural development purposes. This makes seeking FDI for the sector a much more critical option. Despite numerous studies that have examined the influence of FDI on Nigeria's economic growth with varying outcomes (Osuji, 2015), the empirical linkage between FDI and agricultural growth in Nigeria is yet unclear in addressing the country's specific dimensions to the FDI-growth debate. Furthermore, in an attempt to provide empirical evidences on economic drivers in trying to revamp the Nigerian economy, which is already in recession, as at the time of carrying out this research, it has become even more expeditiously imperative to determine the contributions of FDI to agricultural growth and by extension, economic growth in order to return the economy back to growth path.

Using empirical analysis and citing other countries of the world that actively engage in FDI, Okoro and Atan (2013), stated that authors who find positive linkages between FDI and economic development in Nigeria, disagree with others that believe FDI retard economic growth in Nigeria, thus, prompting this work, which would enrich the existing literature by providing additional knowledge that will empirically contribute in reducing the knowledge gap that exists by establishing the direction of causality between FDI and other macroeconomic parameters and agricultural growth. By so doing, it lends a voice to the FDI-growth debate and as such, enables policy makers to formulate policies that will enable the government have direct and accelerated impact in attracting or discouraging FDI into Nigeria, based on the direction the policies would want to tilt. While serving as reference material to other researchers, scholars showed interest in the FDI-growth debate with particular reference to agriculture. This study is also different from previous studies in scope, as it covers a 34-year period, from 1981 to 2014.

The broad objective of this study is to determine the inter-causal relationships between agricultural growth, foreign direct investment (FDI) and some macroeconomic determinants in Nigeria, while the specific objectives are to determine the (i) existence of a short or long run relationship between FDI and agricultural growth; (ii) causal relationships between FDI and agricultural growth in Nigeria; and (iii) direction of causality between agricultural growth and other macroeconomic variables, like exchange rates, interest rate differentials, stock of gross external debts, macroeconomic instability, political instability and

annual variability of consumers' price index (inflation) in Nigeria.

The null hypothesis tested is:

H_0: There is no significant causality between FDI and agricultural growth in Nigeria.

LITERATURE REVIEW

Conceptual Framework

There is the need to properly define what constitutes FDI, as sometimes it may be misconstrued with other forms of investment, especially foreign portfolio investment. Generally, academics and policy makers have never been in complete agreement on what constitutes FDI (Ibrahim & Onokosi-Alliyu, 2008). However, FDI is broadly believed to include mergers and acquisitions, building new facilities, reinvesting profits earned from overseas operations and intra-company loans (Adeleke, Olowe & Fasesin, 2014). Krugman and Obstfeld (2009), surmised the most distinctive feature of FDI to be that, it encompasses transfer of resources and acquisition of control. FDI, according to Ayanwale (2007), comprises of not only mergers and acquisitions and new investments, but also reinvested earnings and loans and similar capital transfer between parent companies and their affiliaties in foreign lands. Ebekozien, Ugochukwu and Okoye (2015), however, submitted that FDI is not simply (or even primarily) constituted by an international transfer of capital but rather, the extension of an enterprise from its home country into a foreign host country in the form of managerial skills, marketing connections, technical knowledge and training of local workforce. On the other hand, Chenery and Stout, as cited in Macaulay (2012), noted that this extension of enterprise involves flows of capital, technology and entrepreneurial skills and, in most recent cases, management practices to the host economy, where they are combined with the local factors in the production of goods and services. UNCTAD (2012b), listed equity, reinvested earnings and intracompany loans as all components of FDI. Alfaro, Chanda, Sebnam & Sayek (2009), are of the belief that FDI is made up of direct capital financing creating positive externalities via the adoption of foreign technology and expertise. Saibu and Keke (2014) in their submission, wrote that unlike capital inflows, FDI always brings additional resources, technology, management and access to export markets that are desperately needed in developing countries.

Theoretical Framework

FDI, is, most times, the distinctive feature of multinational enterprise; hence, a theory of FDI is also a theory of the multinational enterprise as an actor in the world economy (Ekpo, 2010). Helpman and Krugman as cited in Oloyede (2014), argued that the impact of trade performance adopted by multinational enterprise in the case of vertical investment, in theoretically imperfect competition models predict complementary relationship between FDI and trade. Offiong and Atsu (2014), listed some theories that explain the existence and growth of FDI globally to include:

i. The neo-classical theory of economic growth
ii. The investment theory (the two gap model)
iii. The product life cycle theory
iv. The location (eclectic) theory
v. The integrative theory

EMPIRICAL FRAMEWORK

The agricultural sector has long been neglected as a motor of development and poverty reduction, and a lack of private and public investment has led to lower productivity growth rates and stagnated production in many developing countries (Oloyede, 2014). But, Smaller (2014), reported that the global community was taken by surprise at the sharp rise of investor interest in agricultural land and water after the 2008 food crisis; a phenomenon that is now commonly referred to as "land grabs". Nigeria as a country, given her natural resource base and large market size (a population of over 160 million), qualifies to be a major recipient of FDI in Africa and indeed, is one of the top three leading African countries that received FDI in 2014, (Loewendahl, 2015). However, Ajuwon and Ogwumike (2013), reported that the level of FDI attracted, especially to agriculture, is small compared to the resource base and potential needs, and that Nigeria's share of FDI inflow to Africa, averaged around 20.68% between 1976 and 2007. They further posited that the

percentage of FDI inflow to the agricultural sector in Nigeria during the same period, is less than 1% and that between 1980 and 1984, it was 2.46%, which was the highest and currently stood at 0.37%.

MATERIALS AND METHODS

Data Collection

To achieve the stated objectives, this research work covering a 34-year period, spanning from 1981 to 2014, made use of secondary data in the form of annual time series data of agricultural output, measured by the share of agriculture to GDP, FDI inflows into agriculture and other macroeconomic variables such as exchange rates, stock of gross external debts, macroeconomic instability, political instability and annual variability of consumer price index in Nigeria, interest rates in Nigeria and the United States of America (USA). The dataset for share of agriculture to GDP, FDI, exchange rate, domestic interest rate, stock of gross external debts and consumers' price index were sourced from the statistics database of the Central Bank of Nigeria (CBN), while, dataset for political instability was sourced from the World Bank World Development Indicators, and that for the interest rate of the USA, known as the US Federal Funds Rate was sourced from the Federal Reserve System of the USA.

DATA ANALYSES

The Augmented Dickey Fuller (ADF) test carried out to test for unit roots (stationarity) of the data. Objective (i) was achieved using Johansen co-integration test. While objectives (ii) and (iii) were achieved using pairwise Granger causality tests which was applied as the estimation technique in determining the causal relationships among the variables (that is, agricultural growth, FDI inflows into the agricultural sector, exchange rate, interest rate differential, stock of gross external debts, macroeconomic instability, political instability and annual variability of consumer price index) with the aid of STATA 10.1 software.

Pre-estimation Tests

Test for stationarity (unit root test)

Time series data often exhibit stochastic trend that can be removed through differencing. The ADF test to detect the stationarity of the variables at the 5% level of significance was done to eliminate autocorrelation. The ADF test was based on the following regression.

$$\Delta Y_t = \alpha + \beta Y_{t-1} + \delta t + \sum_{k=1}^{P} \varsigma_k \Delta Y_{t-k} + \varepsilon_t \quad (1)$$

H_0: $\delta = 0$ (Y has no unit root);

H_1: $\delta \neq 0$ (Y has unit root)

Where:

Variable tested (lnGDP$_{AGR}$, lnFDI$_{AGR}$, lnEXR, and so on)

α = Intercept (constant term)

δt = Coefficient on a time trend

Parameter of the variable in regression

P = Lag order

Δ = Difference operator

ε_t = Error term

Determination of lag order

To ensure that the error term, ε_t in the test model is empirically white noise, the optimum lag order, P was chosen where the Akaike information criteria (AIC) is minimum within the lag range as directed by the Schwert (1989) I_{12} rule, which is given as:

$$P_{Max} = \left[\left(12\frac{T}{100}\right)^{0.25}\right] \quad (2)$$

Where: T = Sample Size

Furthermore, the significance of the coefficient, β was tested against the null hypothesis of the unit root based on the computed ADF and the tabulated Mackinnon critical values. The null hypothesis of the unit root was accepted if the computed ADF statistic is greater than the critical value at the 5% level of significance; where otherwise, it was rejected. The objective of applying the ADF unit root test for individual series included in the model is to provide evidence as to whether or not the variables used in the regression are stationary and to indicate the order of integration.

Co-integration Test

In this study, the Johansen (1991) co-integration method was used to find out whether there is long-term relationship between the variables. This involves looking for linear combinations of I in equation (3) time series that are stationary or more generally, linear combinations of I(d) time series that are integrated of an order lower than d. This procedure focuses on the rank of the Π-matrix as shown in equation (3).

$$\Delta Z_t = \varphi + \Pi Z_{t-1} + \sum_{i=1}^{P-1} \Gamma_1 \Delta Z_{t-i} + \varepsilon_t \quad (3)$$

Where:

Z = n x 1 vector of variables that are integrated of order one, often denoted as I (1)

Π = coefficient matrix

Γ = number of co-integrating relationships

Such that if the Π-matrix has reduced rank, implying that αβ = Π, the endogenous variables depicted by Z are co-integrated, with α as the co-integrating vector. However, if the variables are stationary in levels, Π would have full rank. Johansen proposed a different likelihood ratio test of the significance of the canonical correlations; hence, the reduced rank of the Π matrix is depicted by the trace test as shown in equation (4).

$$J_{trace} = -T \sum_{i=r+1}^{n} \ln(1 - \lambda_i) \quad (4)$$

Where:

T = sample size

λ_i = ith largest canonical correlation

The trace test was applied to test the null hypothesis of Γ co-integrating vectors against the alternative hypothesis of n co-integrating vectors.

Test for Causality

The causal relationship between agricultural output and FDI in agriculture and the other variables were tested using the pairwise Granger Causality model for the standard growth accounting model. This is given in the empirical bivariate regressions as:

$$Y_t = \alpha_0 + \sum_{i=1}^{p} \alpha_i X_t + \sum_{i=1}^{p} \beta_i Y_t + \varepsilon_{1t} \quad (5)$$

$$X_t = \lambda_0 + \sum_{i=1}^{p} \lambda_i Y_t + \sum_{i=1}^{p} \delta_i X_t + \varepsilon_{2t} \quad (6)$$

Where:

Y_t = dependent variable in equation (5), independent variable in equation (6)

X_t = independent variable in equation (5), dependent variable in equation (6)

ε_{1t} and ε_{2t} = error terms, assumed to be uncorrelated α, β, λ and δ = coefficients to be estimated.

The above equation (5) postulates that current values of variable Y is related to past values of itself as well as those of variable X and the next equation (6) presents a similar behavior to X. It should be noted that the two variables to be used in each set of pairwise standard Granger causality test need to be stationary.

We have basically four cases of causality, which are:

1. Unidirectional causality from X to Y is indicated if the estimated coefficient on the lagged 2X in equation (5) is statistically different from zero as a group ($\sum\alpha_i \neq 0$) and the set of estimated coefficients on the lagged Y in equation (6) is not statistically different from zero ($\sum\delta_i = 0$);
2. Unidirectional causality from Y to X exists if the set of lagged X coefficients is not statistically different from zero ($\sum\alpha_i = 0$) and the set of lagged Y coefficients is statistically different from zero ($\sum\delta \neq 0$);
3. Feedback or bidirectional causality, which is suggested when the sets of X and Y coefficients are statistically significantly different from zero in both regressions, i. e. ($\sum\alpha_i \neq 0$) and ($\sum\delta_i \neq 0$);
4. Independent, if the set of X and Y coefficients are not statistically significant in both regressions, i. e. ($\sum\alpha_i = 0$) and ($\sum\delta_i = 0$).

TEST OF HYPOTHESIS

The null hypothesis, H_0 was tested using Chi square (X^2), with significance taken at the five

percent (5%) probability level. If the computed value of X^2 given in equation (7) is greater than the critical value of X^2 at the 0.05 significant level (i.e. $X^2_{.95}$), it is concluded that the observed frequencies are significantly different from the expected frequencies and the null hypothesis is rejected, if otherwise, then the null hypothesis is accepted. The formula is given as:

$$X^2 = \sum \frac{(O_i - E_i)^2}{E_i} \qquad (7)$$

Where:

O_i = Observed frequency in the i^{th} cell

E_i = Expected frequency in the i^{th} cell

RESULTS PRESENTATION

The results from data analyzed are presented here in tables.

Pre-estimation Tests

In order to determine the existence of short-run or long-run relationship between the dependent and independent variables, we carried out certain pre-estimation tests and procedures, such as the Augmented Dickey Fuller test and lag length selection criteria before carrying out the Johansen co-integration and the pairwise Granger causality (Wald) tests.

i. Test for Stationarity (unit roots test)

The results of the unit root test carried out on the variables by using the Augmented Dickey Fuller (ADF) test to determine their stationarity with constant and time trend, as stated in equation (1) above are presented in table 1 below.

Table 1 Results of the unit roots test for stationarity based on the ADF test

Variables	At the levels		After first difference		Decision
	Test Statistic	Stationarity position	Test Statistic	Stationarity Position	
*ln*GDP$_{AGR}$	-0.322	Not Stationary	-15.299*	Stationary	I (1)
*ln*FDI$_{AGR}$	-4.688*	Stationary	-10.436*	Stationary	I (1)
*ln*EXR	-0.868	Not Stationary	-5.401*	Stationary	I (1)
*ln*INT$_D$	-2.730	Not Stationary	-7.107*	Stationary	I (1)
*ln*EXD	-2.185	Not Stationary	-3.594*	Stationary	I (1)
*ln*MECS	-2.148	Not Stationary	-6.366*	Stationary	I (1)
*ln*POL	-2.734	Not Stationary	-8.174*	Stationary	I (1)
*ln*INF	-3.561	Not Stationary	-5.748*	Stationary	I (1)

Source: Author's computation using STATA 10.1

Note: * denotes significance at 5% critical level

ii. Lag order (length) Selection

The lag length selection criteria show the Final prediction error (FPE), Likelihood ratio (LR) and Akaike information criterion (AIC) in table 2 below.

Table 2 Lag length selection criteria

Lag	LR	FPE	AIC
0		6.8e-06	10.8002
1	401.30	1.5e-09*	2.2596
2	152.29*	1.6e-09	1.5007*

Source: Author's computation using STATA 10.1

Note: * indicates lag length selected by the criterion.

Results of the Johansen Co-integration Test

The result from the Johansen co-integration test in table 3 below shows that the values of both the trace and maximum statistics at No Co-integration (None) is greater than the critical value at 5%, indicating that we reject the null hypothesis, which states that there is no co-integration at the 5% critical level. Thus, accepting the alternative hypothesis that says there is co-integration among

the variables. As can be seen from the table, there is at most 1 co-integrating equation at the 5% critical level ($p > 0.05$) in the trace test, while the maximum Eigenvalue test shows at most 2 co-integrating equations at the same 5% critical level.

Table 3: Results of the Johansen Co-integration Test

Hypothesized No. of Co-integration	Trace Eigenvalue Test		Maximum Eigenvalue Test	
	Trace Statistic	Critical value at 5%	Max Statistic	Critical value at 5%
None	234.5616*	156.00	75.1845*	51.42
At most 1	159.3770*	124.24	67.8658*	45.28
At most 2	91.5113	94.15	38.0217	39.37
At most 3	53.4895	68.52	18.8445	33.46
At most 4	34.6450	47.21	14.1265	27.07
At most 5	20.5185	29.68	11.5515	20.97
At most 6	8.9670	15.41	5.3873	14.07
At most 7	3.5797	3.76	3.5797	3.76

Source: Author's computation using STATA 10.1
Note: * indicates rejection of the null hypothesis.

Determination of Causality

Having ascertained that there is co-integration relationship among the variables (lnGDP$_{AGR}$, lnFDI$_{AGR}$, lnEXR, lnINT$_D$, lnEXD, lnMIN, lnPOL and lnINF), then there must be causality between them, either in one-way or in both directions. The causality being tested for is sometimes called "short-run Granger causality". The final step is to verify if agricultural growth Granger causes the other variables (lnFDI$_{AGR}$, lnEXR, lnINT$_D$, lnEXD, lnMIN, lnPOL and lnINF) individually or if these variables individually Granger causes lnGDP$_{AGR}$. Since some of the variables are non-stationary (whether or not they are co-integrated) at levels, the usual Wald statistic test was used following the Toda-Yamamoto procedure proposed by Toda and Yamamoto (1995) as applied by Oladipo (2010) and Alimi and Ofonyelu (2013). Statistical significance was taken at the five percent (5%) probability level. The results of the Wald tests Granger causality as presented in table 4 below shows that all of the other variables put together, jointly causes changes in agricultural growth.

Table 4: Short run Granger Causality (Results of the Wald Tests)

Regression type	Chi^2
lnFDI$_{AGR}$ → lnGDP$_{AGR}$	8.639*
lnGDP$_{AGR}$ → lnFDI$_{AGR}$	1.750
lnEXR → lnGDP$_{AGR}$	1.097
lnGDP$_{AGR}$ → lnEXR	16.999*
lnINT$_D$ → lnGDP$_{AGR}$	14.434*
lnGDP$_{AGR}$ → lnINT$_D$	1.173
lnEXD → lnGDP$_{AGR}$	3.565
lnGDP$_{AGR}$ → lnEXD	5.541
lnMIN → lnGDP$_{AGR}$	1.385
lnGDP$_{AGR}$ → lnMIN	56.195*
lnPOL → lnGDP$_{AGR}$	4.679
lnGDP$_{AGR}$ → lnPOL	1.187
lnINF → lnGDP$_{AGR}$	15.532*
lnGDP$_{AGR}$ → lnINF	5.018
ALL → lnGDP$_{AGR}$	57.891*

Source: Author's computation using STATA 10.1

Note: * indicates significance at the 5% probability level.

DISCUSSIONS

Pre-estimation Tests

Test for stationarity (Unit roots test)

As seen in table 1 above, only lnFDI$_{AGR}$ have a test statistic that is higher than the 5% critical value of -3.568, and as such we accept the null hypothesis of no unit root, meaning that it has no unit roots and as such, lnFDI$_{AGR}$ is stationary at levels. The test statistics for all other variables were lower than the 5% critical value of -3.568, so we reject their null hypotheses and accept the alternate hypotheses indicating that they have unit roots, and as such were not stationary at levels. After applying the ADF test to the first differences, all the variables (lnGDP$_{AGR}$, lnFDI$_{AGR}$, lnEXR, lnINT$_D$, lnEXD, lnMIN, lnPOL and lnINF) became significant at the 5% critical level (with a value of -3.568), thus, becoming stationary. We therefore

accept the null hypothesis that there is no unit root in the series, hence it is stationary. Thus, implying that all the variables are integrated of order one, I(1).

Determination of the Long or short run relationship (Johansen co-integration test)

In order to properly determine whether there is co-integration among the variables and its ranks, the lag length was determined first.

Lag length Selection

Although, the FPE lag order selection criterion suggests a lag order of 1 (one), the test statistics in this study are based on a constant trend and a lag interval of 2 (two), which was chosen based on the output of the AIC and reinforced by the LR as shown in table 2 above.

Determination of Co-integration

The result in table 3 above indicates that the variables are co-integrated and therefore have long run causal relationship among them, meaning they are moving together over time. This study used the test statistic from the trace test which shows that there is at most 1 co-integrating rank (Π) between the dependent variable (lnGDP$_{AGR}$) and the independent variables (lnFDI$_{AGR}$, lnEXR, lnINT$_D$, lnEXD, lnMIN, lnPOL and lnINF), hence, indicating the existence of long run relationship between them. The maximum Eigenvalue test which also gave one (1) co-integration equation was however not considered because it usually bring about multiple-testing problems, to which there are no solutions yet (StataCorp, 2013). Since some of the variables are not stationary at levels, but became stationary after first difference, the co-integrating equation does not have full ranks.

Causal Relationships

From table 4 above, the following causal relationships were empirically established.

Agricultural Growth (lnGDP$_{AGR}$) and FDI in Agriculture (lnFDI$_{AGR}$)

As seen in the results in table 4 above, the small probability value of 0.013 is evidence that the coefficients on the lags of lnFDI$_{AGR}$ are not jointly zero in the equation for lnGDP$_{AGR}$, indicating that the evidence favours the alternative hypothesis that lnFDI$_{AGR}$ Granger causes lnGDP$_{AGR}$. The Wald test also shows that the coefficients on the lags of lnGDP$_{AGR}$ in the equation for lnFDI$_{AGR}$ are jointly zero. In this case we cannot reject the null hypothesis that lnGDP$_{AGR}$ does not Granger cause lnFDI$_{AGR}$. This means that there is a statistically significant unidirectional causal relationship running from FDI in agriculture to agricultural growth, thus, indicating that FDI in agriculture has effect in causing changes in agricultural growth. This is in consonance with earlier studies by Obansa and Maduekwe (2013) and Oloyede (2014), that agricultural growth can be induced by FDI.

Agricultural Growth (lnGDP$_{AGR}$) and Exchange Rate (lnEXR)

The Wald's test results presented in table 4 above indicates that the coefficients on the lags of lnEXR in the equation for lnGDP$_{AGR}$ are jointly zero. We therefore accept the null hypothesis that lnEXR does not granger cause lnGDP$_{AGR}$. The statistically significant probability value of 0.000 is indicative that the coefficients on the lags of lnEXR are jointly not equal to zero in the equation for lnGDP$_{AGR}$, thus, favouring the alternative hypothesis that lnGDP$_{AGR}$ can granger cause lnEXR. This implies that changes in exchange rate (lnEXR) does not cause changes in agricultural growth, while changes in agricultural growth is significant in causing changes in exchange rate in Nigeria, thus, indicating a unilateral causality running from agricultural growth to exchange rate.

Agricultural Growth (lnGDP$_{AGR}$) and Interest Rate Differential (lnINT$_D$)

The Wald tests result in table 4 above, indicates that interest rate differentials is significant in Granger causing changes in agricultural growth, while agricultural growth is not significant in causing changes in interest rate differentials. However, if there are changes in interest rate differentials in the model, agricultural growth is not statistically significant in causing these changes. That is to say there is a one-way causality running from interest rate differentials to agricultural growth.

Agricultural Growth (lnGDP$_{AGR}$) and Macroeconomic Instability (lnMIN)

Agricultural growth and macroeconomic instability have a unilateral significant causal relationship running from agricultural growth to macroeconomic instability. This means that changes in macroeconomic stability has no significant impact in causing changes in agricultural growth, while agricultural growth has significant effect in effecting changes in macroeconomic instability. This can be interpreted to mean that there is a unidirectional causality running from agricultural growth to macroeconomic instability in Nigeria, as specified by the result of the Wald's test in table 4 above.

Agricultural growth (lnGDP$_{AGR}$) and annual variability of consumer price index (lnINF)

As seen in table 4 above, annual variability of consumers' price index is statistically significant in granger causing agricultural growth, while agricultural growth is not indicated in granger causing annual variability of consumers' price index. This simply means that there is a unidirectional granger causal relationship running from annual variability of consumers' price index to agricultural growth in Nigeria.

Test of Hypotheses

The hypotheses were tested individually using the Chi square (X^2) test in each of the pairwise granger causality regressions. From the results as shown in table 4, we therefore reject the null hypothesis (H_0), which states that there is no statistically significant causality between FDI and agricultural growth in Nigeria and thus accept the alternative hypothesis (H_1), which states that there is statistically significant causality between FDI and agricultural growth in Nigeria. This means that FDI in agriculture and other macroeconomic variables are statistically significant in Granger causing agricultural growth in Nigeria.

SUMMARY

This study was carried out to determine inter-causal relationships between agricultural growth, FDI and macroeconomic determinants, such as exchange rate, interest rate differential, stock of gross external debts, macroeconomic instability, political instability and annual variability of consumer price index in Nigeria, within the years from 1981 to 2014. Secondary data in the form of annual time series on GDP, FDI, exchange rate, domestic interest rate, gross external debts and consumers' price index were obtained from the Central Bank of Nigeria Statistics Database, while data on political instability was gotten from the World Bank World Governance Indicators, whereas data for the US interest rate was sourced from the US Federal Reserve System. The Augmented Dickey Fuller (ADF) test applied to the data indicated that agricultural FDI is stationary at levels, while all other variables were not, but all became stationary after first difference, thus, implying that all the variables are integrated of order one, I (1). Based on a constant trend, a lag interval of 2 was selected as suggested by the AIC criterion to run the Johansen Co-integration test, in which the trace test statistic determined that there are at most 2 co-integrating ranks (Π) between the dependent and independent variables, thus, signifying that the variables have intercausal relationships amongst themselves. The Granger causality test carried out at lag 2, in levels indicated that all the variables were jointly significant in granger causing agricultural growth and there is unidirectional causality running from FDI in agriculture, stock of gross external debts, and variability of consumers' price index to agricultural growth, while agricultural growth was significant in granger causing macroeconomic instability.

CONCLUSION

The Augmented Dickey Fuller (ADF) test indicated that lnFDI$_{AGR}$ is stationary at levels while all other variables were not, but all became stationary after first difference, thus, implying that all the variables are integrated of order one, I(1). Based on a constant trend, a lag interval of 2 was selected as suggested by the Akaike Information Criterion (AIC) and reinforced by the Likelihood Ratio (LR). The trace test statistic from the Johansen Co-integration test was used to determine that there is at most 1 co-integrating ranks (Π) between the agricultural growth and FDI and the other macroeconomic variables, thus, signifying that the variables have long run relationships among themselves. The Granger causality test carried out

at lag 2, in levels indicated that all the variables were jointly significant in granger causing agricultural growth and there is unidirectional causality running from FDI in agriculture, stock of gross external debts, and variability of consumers' price index to agricultural growth, while agricultural growth was significant in granger causing macroeconomic instability. Understanding the direction of causality between agricultural growth and FDI in agriculture and other macroeconomic variables is very important for formulating policies to encourage private investments in Nigeria, especially during the period of economic recession.

RECOMMENDATIONS

The findings in this study have important policy implications which are recommended as follows:

i. The government should seek for and encourage more FDI for the agricultural sector in Nigeria, with a view to enhancing domestic investment and capacity in agriculture.

ii. There should also be deliberate efforts in encouraging joint venture partnerships between foreign and domestic investors /entrepreneurs/ agripreneurs that would be beneficial to the agricultural sector, which would act as the required stimulus in attracting the right type and volume of FDI inflows to agriculture to combine with the required volume of domestic investments that are necessary in significantly increasing the output of the agricultural sector in Nigeria.

iii. For Nigeria to attract more FDIs that would make any impact in agriculture, it is necessary for the interest (monetary policy) rate to be fixed in such a way that the differentials between the domestic interest rates and the prevailing interest rates in most source of its FDI in agriculture, is reduced to the barest minimum that is possible, so as to make investing in Nigeria attractive.

iv. The government should try as much as possible to ensure that there is stability and consistency in the implementation of its macroeconomic policy objectives and should allow these policies to be well implemented and run their full course before effecting a change in policies.

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