academicJournals

Vol. 8(17), pp. 1693-1699, 9 May, 2013
DOI: 10.5897/AJAR10.853
ISSN 1991-637X ©2013 Academic Journals
http://www.academicjournals.org/AJAR

African Journal of Agricultural Research

Full Length Research Paper

Causal relations between foreign direct investment in agriculture and agricultural output in Nigeria

Akande, Olaide Rufai* and Biam, Celine K.

Department of Agricultural Economics, University of Agriculture, Makurdi, Benue State, Nigeria.

Accepted 12 August, 2011

An inflation shock based scenario analysis of causal relations between foreign direct investment (FDI) in agriculture and agricultural output in Nigeria was conducted using data that spanned between 1960 and 2008. Augmented Dickey-Fuller test, Johansen co integration procedure, error correction model, granger causality test and impulse response were employed as methods of data analyses. The results revealed that no long run equilibrium relationship exists between FDI in agriculture and agricultural output in Nigeria both in the presence of inflation shock and in its absence. However, 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 negative role on the short run influence of FDI in agriculture on agricultural output. The persistent responses of both variables in opposite direction to exogenous shocks to the system consolidate the findings that no long run relationship exists between these variables. The study recommends that policy that encourages FDI in agriculture should be stemmed up with more attention paid to inflation control.

Key words: Foreign direct investment (FDI) in agriculture, agricultural production, inflation shock, long run relationship, granger causality.

INTRODUCTION

The intense competition for foreign direct investment (FDI) inflow among developing economies in recent years is premised upon the perceived growth multiplier effects of multinational enterprises (MNEs) in their host countries. In order to provide conducive environment for FDI inflow and therefore benefit from these advantages, most developing countries have made changes to their investment regulatory framework. For instance, evidence provided by United Nations Conference on Trade and Development (UNCTAD) (2003), indicates that during the period 1991 to 2002, around 95% of the changes to worldwide laws governing FDI were made favorable to multinational firms activities. According to this report, establishment of investment promotion agencies, provision of fiscal incentives, inflation and exchange rates control have characterized these efforts. As a corollary, the share of net FDI inflow in middle income countries rose from 0.74% in the 1970s to 1.08% between 1985 and 1994, and subsequently to 2.85% between 1995 and 2005 (Sayek, 2009).

In Nigeria, the establishment of Nigerian Investment Promotion Council (NIPC) as well as the liberalization of foreign exchange market has been the major policy framework for encouraging FDI inflow. Consequently, about $1.5 billion of invested foreign capital was estimated to have flown into the Nigerian economy in 1997 alone and $1billion in both 1998 and 1999. Available statistics also show that about N63 billion was

*Corresponding author. E-mail: olaide_akande@ymail.com. Tel: +2348067473041.

invested by foreign companies in Nigeria between January and June, 2002. However, in spite of the huge foreign capital inflow into the country, the slow pace of economic growth and technological development continued, casting doubt on the growth influence of FDI on Nigerian economy. Therefore, this study conducted an inflation based scenario analysis of causal relationship between FDI in agriculture and agricultural output in Nigeria.

The rationale for offering special incentives to attract FDI inflow by developing countries is rooted on believe that FDI produces externalities in form of technological transfer and spillovers effects. Romers (1993) buttresses this view by noting that the idea gaps that exist between the rich and the poor countries can be bridged by FDI intermediation through transfer of technological and business knowhow to poorer countries. This is because, FDI not only have capacity to boost productivity of firms receiving foreign capital, but boost productivity of all firms. In other words, transfer of technology through FDI may have spillover effects on the entire economy.

Empirical works of Romer (1986) and Lucas (1988) also revealed that FDI spurs long term growth through Research and Development (R and D) and human capital development. Evidences provided by Haddad and Harrison (1993), Girma et al. (2001), Aitken and Harrison (1999), Elibariki (2007) and Borenszten et al. (1998) supports the positive impact of FDI in terms of higher productivity levels and growth in developed and developing countries. In contrast to these views, however, Jansen (1995) and UNCTAD (2002) observe that the impact of FDI could be negative when high import content and large profit outflows are associated with multinational capital inflow. Boyd and Smith (1992) shared this view by showing that where price and other distortions exist, FDI activities may hurt resource allocation and slow economic growth.

How could price distortion affect FDI inflow? Price instability could undermine FDI growth through the negative effects of inflation on savings. This is because money is worth more presently than in future in an inflationary condition. Low savings in turn retards the growth of FDI with local financial component. Also, because inflation has negative effect on future prices, interest and exchange rates, a condition of inflation discourages FDI growth by limiting confidence of investors on investment that take long period to mature (Hellerstein, 1997; Gerolamo http://econc10.bu.edu/Ec341_money/Papers/Gerolamo_paper.htm).

MATERIALS AND METHODS

The data

Secondary time series data that spanned between 1960 and 2008 were used. These were collected from Statistical Bulletin of the Central Bank of Nigeria. The data on agricultural output (AGGDP) were in real terms and derived as the agricultural share of Nigeria's real gross domestic product. Data on FDI in agriculture (AGFDI) were in their nominal values in million Naira while inflation was headline inflation measured as dummy variable with value of 1 (when inflation is double digit) rather than 0 (when single digit). Furthermore, the logarithm transform of these variables were used in the analysis.

Analytical methods

The study employed a combination of augmented Dickey-Fuller test, cointegration test, error correction model (ECM), Granger causality test and impulse response function analysis.

Unit root test

The Augumented Dickey Fuller test for the presence of unit root (evidence of non stationarity) was employed. The advantage of the method lies on its robustness to handle both first order and higher order auto regressive processes (Nkang et al., 2007). The ADF test is based on the following regression:

$$Y_t = \alpha + \sigma Y_{t-1} + \psi T + \sum_{k=0}^{N} \beta_k \Delta Y_{t-k} + u_t \quad (1)$$

Ho: $\sigma = 0$ (Y has unit root); H_1: $\sigma \neq 0$ (unit does not exist in Y)

In other to ensure that the error term (ut) in the test model is empirically white noise, the optimum lag order N was chosen where Akaike information criteria (AIC) is minimum within the lag range dictated by Schwert (1989); l_{12} rule ($K_{max} = \left(12\frac{T}{100}\right)^{0.25}$; where T = sample size). Furthermore, the significance of coefficient σ is tested against the null hypothesis of unit root based on the computed ADF and the tabulated Mackinnon critical values. The decision rule is that, if the computed ADF statistic is greater than the critical value at the specified level of significance, then the null hypothesis of unit root is accepted; otherwise, it is rejected.

Co integration test

Co integration test look for linear combinations of I in Equation (1) time series that are stationary (or, more generally, linear combinations of I (d) time series that are integrated of an order lower than d. Johansen (1991) co integration method was employed in this study. This procedure focuses on the rank of the Π-matrix as shown in Equation (1).

$$Z_t = \varphi + \sum_i^p \Gamma_i \Delta Z_{t-i} + \Pi Z_{t-p} + \ldots\ldots + \xi_t \quad (2)$$

Such that if the Π-matrix has reduced rank, implying that $\alpha\beta = \Pi$, 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.

Error correction model (ECM) and Granger causality test

ECM is used to model causal influence between non stationary I (1) variables with evidence of long run relationship. The advantage of this procedure lies in the fact that both long run and short run influences of the endogenous variables in model can be determined

Table 1. List of acronyms in the error correction model (ECM) and their description.

Acronyms	Description
ECT:	Error correction term or adjustment parameter
$\Delta AGGDP_t$:	Change in agricultural output in period t
$\Delta AGGDP_{t-i}$:	Change in lagged value of agricultural output in period t-i
$\Delta AGFDI_t$:	Change in FDI in agriculture in period t
$\Delta AGFDI_{t-i}$:	Change in lagged value of FDI in agriculture in period t-i
INF_t:	Inflation shock in period t

(Table 1). For instance, if we hypothesized that variable Y and X are jointly determined (that is, endogenous to a system) and influenced by an exogenous shock (W_t). Given these conditions and following Sims (1980), the relationship between these variables can be described by VAR such that,

$$Y_t = \varphi_1 + \sum_{i=1}^{p} \alpha_{1i} Y_{t-i} + \sum_{i=1}^{p} \beta_{1i} X_{t-i} + \sigma_1 W_t + \xi_{1t} \quad (3)$$

$$X_t = \varphi_2 + \sum_{i=1}^{p} \alpha_{2i} Y_{t-i} + \sum_{i=1}^{p} \beta_{2i} X_{t-i} + \sigma_2 W_t + \xi_{2t} \quad (4)$$

Where, φ_{ji} and σ_j are m x 1 vector of parameters, α_{ji}, β_{ji} are m x p vectors of parameters, p is the optimal lag order that minimizes information criteria, m is the number of endogenous variables; W_t is an exogenous shock and ξ_{jt} is an m x 1 vector of random variables assumed to be normally distributed white noise process. Suppose we hypothesized further that the series have unit roots and possibly co integrated, the Granger representation theorem asserts that error correction model (ECM) or restricted VAR of the form produce consistent estimates of the system parameters.

$$Y_t - \gamma_1 + \lambda_j(Y_{t-1} - X_{t-1}) + \sum_{i=1}^{p-1} A_{1i} \Delta Y_{t-i+1} + \sum_{i=1}^{p-1} \Phi_{1i} \Delta X_{t-i+1} + \mu_1 W_t + \varepsilon_{1t} \quad (5)$$

$$X_t - \gamma_2 + \lambda_j(Y_{t-1} - X_{t-1}) + \sum_{i=1}^{p-1} A_{2i} \Delta Y_{t-i+1} + \sum_{i=1}^{p-1} \Phi_{2i} \Delta X_{t-i+1} + \mu_2 W_t + \varepsilon_{2t} \quad (6)$$

The parameter λ_j in Equations (5) and (6) measures the speed of adjustment of short run disequilibrium to long run equilibrium position, μ measures the contemporaneous influence of exogenous shock (W_t) on the corresponding endogenous dependent variable while the parameter Φ_{1i} and A_{2i} measure the short run influence of X on Y, and Y on X, respectively such that if in Equation (5), $\Phi_{11} = \Phi_{12} = \ldots\ldots\ldots\Phi_{1p-1} = 0$, the variable depicted by X is said not to be Granger cause that is depicted by Y.

Impulse response function

The impulse response function examines dynamic response of a model to a shock. It traces the effect of a one-time shock to one of the innovations on current and future values of the endogenous variables. Pasarin and Shin (1998) proposed that an unrestricted VAR of the form:

$$Z_t = \sum_{i=1}^{p} A_i Z_{t-i} + U_t \quad (7)$$

Where, Z_t is a vector of the endogenous variables, Z_{t-i} is a vector of lagged values of the series, U_t is a vector of innovations, A_i is a vector of parameters considered stable. As a moving average (MA) representation given by:

$$Z_t = \sum_{i=1}^{\infty} \Phi_i U_{t-i} \quad (8)$$

Where, $\Phi_i = A_1\Phi_{i-1} + A_2\Phi_{i-2} + \ldots\ldots\ldots\ldots A_p\Phi_{i-p}$.

The parameter Φ_i is the MA coefficient measuring the impulse response of 7 to a unit exogenous innovation. More specifically, Φ_i represents the response of Z_t to a unit impulse from one of the variables in the system occurring i-th period ago. However, in order to avoid problem associated with correlated innovations, transformation procedures such as Choleski factoring are usually applied to achieve orthogonalized responses.

RESULTS AND DISCUSSION

The result of augmented Dickey Fuller unit root test (Table 2) indicates that both agricultural production and FDI in agriculture series are not stationary at their levels but stationary on first differencing. Thus, the two series have unit roots. The result of co integration test (Table 3) to investigate whether long run equilibrium relationship exists between these variables in the absence and presence of exogenous inflation shocks revealed that no long run equilibrium relationship exists between the variables under the two scenarios. The result of error correction model (Tables 4 and 5) revealed that the maximum lag length that minimizes Akaike information criterion and whose prediction errors were free of autocorrelation problem (Tables 6 and 7) was four.

Furthermore, the result of Granger causality test using Wald's procedure (Table 8) revealed that the FDI in agriculture influence agricultural output with one of its short run coefficients being positively significant. In contrast, agricultural output was found not to have significant causal influence on FDI in agriculture in the short run.

Table 2. Augmented Dickey-Fuller (ADF) Test of stationarity of agricultural output (AGGDP) and FDI in agriculture (AGFDI) series.

Variable	Level		First difference	
	ADF	DW	ADF	DW
AGGDP	-2.10	1.98	-5.27	2.05*
AGFDI	-1.99	1.98	-5.23	1.87*

*Denote rejection of hypothesis of a unit root at 5% level of significance based on Mackinnon critical value of 3.51. Source: Data analysis, 2010.

Table 3. Johansen maximum likelihood co integration test of agricultural output (AGGDP) and FDI in agriculture (AGFDI) in Nigeria.

Eigen value	Likelihood ratio	Critical value		Hypothesized number of CE(s)
		5%	1%	
Model without exogenous inflation shock (INF_t)				
0.15	8.49	15.41	20.04	None
0.04	1.58	3.76	6.65	Atmost 1
Model with exogenous inflation shock				
0.17	12.80	15.41	20.04	None
0.11	4.75	3.76	6.65	Atmost 1*

*Denotes the rejection of the hypothesis at 5% (1%) significance level; L.R. test rejects cointegration at 5% significance level in both models. Source: Data analysis, 2010.

Table 4. Error correction model (ECM) of agricultural output (AGGDP) and foreign direct investments in agriculture in Nigeria (1960 - 2008).

Variable	Parameter	
	Agricultural output model	FDI in agriculture model
ECT	None	None
$\Delta AGGDP_{t-1}$	-0.02(-0.12)	0.01(0.06)
$\Delta AGGDP_{t-2}$	-0.06(-0.37)	0.0.09(0.64)
$\Delta AGGDP_{t-3}$	-0.15(-1.02)	0.06(0.45)
$\Delta AGGDP_{t-4}$	0.02(0.13)	0.06(0.39)
$\Delta AGFDI_{t-1}$	-0.21(-1.18)	0.11(0.66)
$\Delta AGFDI_{t-2}$	-0.17(-1.07)	-0.18(-1.14)
$\Delta AGFDI_{t-3}$	0.08(0.45)	0.43(2.73)**
$\Delta AGFDI_{t-4}$	0.54(2.96)**	-0.13(-0.73)
Constant	0.11(1.56)	0.07(0.89)

Determinant residual covariance = 0.01; log likelihood = -17.63; akaike information criterion: 1.70; schwarz criterion = 2.44. **Significant at 5%. Source: data analysis, 2010.

The stability test of ECM short run parameters under exogenous inflation shock revealed that the influence of FDI in agriculture on agricultural output is less stable under the shock compared to its status in the absence of the shock based on the decrease in the level of joint significance of these parameters upon the shock. Furthermore, the result of generalized impulse response analysis (Figure 1) revealed that agriculture output and FDI in agriculture respond to exogenous shocks is in opposite direction. The effect of the shocks persists into the distant future for both variables. These responses remain irremovable after ten years with the gap between

Table 5. Error correction model (ECM) of agricultural output (AGGDP) and foreign direct investments in agriculture (AGFDI) under inflation shocks in Nigeria (1960 - 2008).

Variable	Dependent variable parameter	
	Agricultural output ($AGGDP_t$)	FDI in agriculture ($AGFDI_t$)
ECT	None	None
$\Delta AGGDP_{t-1}$	0.01(0.06)	0.00(0.00)
$\Delta AGGDP_{t-2}$	-0.09(-0.60)	0.10(0.70)
$\Delta AGGDP_{t-3}$	-0.19(-1.26)	0.07(0.51)
$\Delta AGGDP_{t-4}$	0.10(0.61)	0.03(0.22)
$\Delta AGFDI_{t-1}$	-0.20(-1.17)	0.11(0.64)
$\Delta AGFDI_{t-2}$	-0.19(-1.18)	-0.17(-1.10)
$\Delta AGFDI_{t-3}$	0.03(0.20)	0.45(2.74)**
$\Delta AGFDI_{t-4}$	0.52(2.90)**	-0.12(-0.69)
Constant	-0.00(-0.03)	0.10(0.94)
INF_t	0.19(1.53)	-0.06(-0.47)

Determinant residual covariance = 0.01; log likelihood = -15.94; akaike information criterion = 1.71; schwarz criterion = 2.54; **Significant at 5%.Source: data analysis, 2010.

Table 6. Auto correlation test of residual from ECM of agricultural output and FDI in agriculture in Nigeria.

Lag	Agricultural output ($AGGDP_t$) equation residual			FDI in agriculture ($AGFDI_t$) equation residual		
	Autocorrelation coefficient	Q Stat.	Prob.	Autocorrelation coefficient	Q Stat.	Prob.
1	0.04	0.01	0.987	0.10	0.00	0.95
2	0.02	0.02	0.99	0.03	0.05	0.98
3	-0.10	0.54	0.91	0.15	1.06	0.79
4	0.09	0.93	0.92	0.04	1.13	0.89
5	0.05	1.04	0.96	-0.08	1.46	0.92
6	0.10	1.54	0.96	-0.41	9.90	0.13
7	0.11	2.13	0.95	-0.04	9.99	0.19
8	-0.19	4.15	0.84	-0.06	10.17	0.23
9	-0.04	4.25	0.90	-0.14	11.28	0.26
10	0.07	4.49	0.92	-0.21	13.75	0.25
11	0.13	5.53	0.90	0.00	13.75	0.25
12	0.09	6.01	0.92	0.08	14.15	0.29
13	-0.25	9.93	0.70	0.02	14.18	0.36
14	-0.07	10.24	0.74	0.07	14.32	0.41
15	0.02	10.27	0.80	0.07	14.81	0.47
16	-0.18	12.64	0.70	0.33	22.76	0.13
17	-0.02	12.68	0.76	0.00	22.76	0.16
18	-0.04	18.82	0.80	-0.16	24.74	0.13
19	-0.03	12.97	0.34	0.17	26.95	0.11
20	-0.09	13.64	0.85	-0.10	27.86	0.11

the two profiles widening unabated, indicating further a non co integrating type of relationship between the variables.

CONCLUSION AND RECOMMENDATIONS

The study found that FDI in agriculture has no long run equilibrium influence on agricultural output in the case of Nigeria. However, a positive short run causal effect runs from FDI in agriculture to agricultural production only, with two digit inflation shocks having a negative effect on the parameters of this influence. The study also concludes that responses of both FDI in agriculture and agricultural output to exogenous shocks are likely to be volatile and persistent. The study recommends that policy that encourages FDI in agriculture should be stemmed up with more attention paid to inflation control.

Table 7. Auto correlation test of residual from ECM of agricultural output and FDI in agriculture under inflation shock in Nigeria.

Lag	Agricultural production equation residual			FDI in agriculture equation residual		
	Autocorrelation coefficient	Q Stat.	Prob.	Autocorrelation coefficient	Q Stat.	Prob.
1	0.01	0.01	0.94	0.01	0.01	0.93
2	0.07	0.24	0.89	0.04	0.09	0.96
3	0.00	0.24	0.97	0.15	1.15	0.77
4	0.15	1.31	0.86	-0.04	1.23	0.87
5	0.08	1.66	0.89	-0.09	1.68	0.89
6	0.11	2.32	0.89	-0.43	11.17	0.08
7	0.16	3.64	0.82	-0.06	11.36	0.12
8	-0.16	4.98	0.76	-0.07	11.63	0.17
9	0.07	5.26	0.81	-0.16	13.05	0.16
10	0.05	5.40	0.86	-0.20	15.27	0.12
11	0.15	6.73	0.82	0.00	15.27	0.17
12	-0.08	7.12	0.85	0.09	15.77	0.20
13	-0.25	11.14	0.60	0.03	15.81	0.26
14	-0.05	11.34	0.66	0.07	16.18	0.30
15	-0.00	11.34	0.73	0.08	16.66	0.34
16	-0.22	14.63	0.55	0.33	24.56	0.08
17	-0.10	15.34	0.57	0.01	24.56	0.11
18	-0.04	15.44	0.63	-0.15	26.22	0.10
19	-0.09	16.10	0.65	0.16	28.35	0.08
20	-0.11	17.13	0.64	-0.11	29.34	0.08

Table 8. Wald test of short-run parameters in ECM of agricultural output and FDI in agriculture in Nigeria.

Hypotheses	Chi statistics	Significant level
Model without exogenous inflation shock		
Agricultural output Granger cause agricultural output	1.21	0.75
FDI in agriculture granger cause agricultural output	11.49	0.01***
Agricultural output Granger cause FDI in agriculture	0.76	0.90
FDI in agriculture Granger cause FDI in agriculture	9.72	0.03**
Model with exogenous inflation shock		
Agricultural output Granger cause agricultural output	2.32	0.75
FDI in agriculture Granger cause agricultural output	11.21	0.03**
Agricultural output Granger cause FDI in agriculture	0.80	0.90
FDI in agriculture Granger cause FDI in agriculture	9.61	0.03**

** (***) -significant at 5% (1%). Source: Data analysis, 2010.

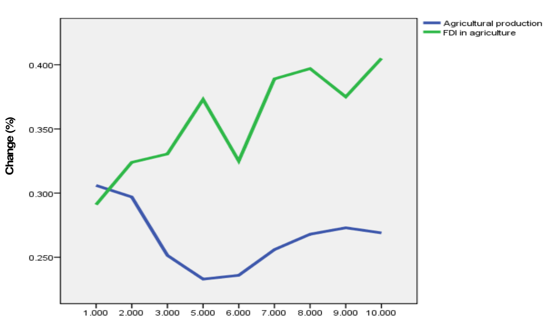

Figure 1. Generalized impulse response of agricultural output and FDI in agriculture to one standard deviation innovation.

REFERENCES

Aitken BJ, Harrison AE (1999). Do Domestic Firms Benefit from Direct Foreign Investment? Evidence from Venezuela. Am. Econ. Rev. 89(3):605-618.

Boyd JH, Smith BD (1992). Intermediation and Equilibrum Allocation of Investments Capital: Implications for Economic Development. J. Monet. Econ. 30:409-432.

Elibariki M (2007). The Impact of FDI on Agricultural Productivity and Poverty Reduction in Tanzania. MPRA Http//mpraub.unb-muenchen.de/ pp. 3681-3671.

Girma S, Greenaway D, Wakelin K (2001). Who Benefits from Foreign Direct Investment in the UK. Scottish J. Polit. Econ. 48:119-133.

Gerolamo D. Inflation and its Effects on Investments" Money and Banking Papers, http://econc10.bu.edu/Ec341_money/Papers/Gerolamo_paper.htm.

Haddad M, Harrison A (1993). Are there positive spillovers from direct

foreign investments? Evidence from Panel Data for Morocco. J. Dev. Econ. 42:51-74.
Hellerstein R (1997). The Impact of Inflation" Regional Review", Winter P. 1.
Jansen K (1995). The macroeconomic effects of direct foreign investment: The case of Thailand"World Development. 23:193-210.
Johansen S (1991). Estimation and Hypothesis Testing of Co-integration Vectors in Gaussian Vector Autoregressive Models. Econometrica 59:1551-1580.
Lucas RJ (1988). On the mechanics of economic development". J. Monet. Econ. 22(3):3-42.
Nkang MN, Henry MN, Gabriel NO (2007). Price transmission and integration of cocoa and palm oil markets in Cross River State, Nigeria: implication for rural development. Medwell. Agric. J. 2(4):457-463.
Romer PM (1986). Increasing Returns and Long Run Growth. J. Polit. Econ. 4:1002-103.
Romer PM (1993). Idea Gaps and Object Gaps in Economic Development. J. Monet. Econ. 32(3).
Sayek S (2009). Foreign direct investment and inflation. Southern Econ. J. October, 2009.
UNCTAD (2002). Trade and Development Report 2002, Geneva, United Nations.
UNCTAD (2003). Handbook of Statistics on line 2003, http://stats.unctad.org/restricted/eng/ReportFolders/Rfview/Explorerp.asp.