Inward Foreign Direct Investment Flows, Growth, and Agriculture in Ghana: A Granger Causal Analysis

Justice G. Djokoto
Department of Agribusiness,
Central Business School, Central University College
P. O. Box DS 2310, Dansoman, Accra, Ghana
Tel: 233-28-503-7399 E-mail:dgameli2002@gmail.com

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Abstract

The paper described the movements of agricultural growth and FDI to agriculture, and determined the causality between the two variables. Agricultural growth was represented by real agricultural GDP growth rate and FDI represented by a ratio of inward FDIs to agriculture as a ratio of agriculture value added. Between 1966 and 2008, growth showed significant movements across the zero line. Over the same period, the gyrations of the FDI ratio were above the zero line. Whilst, growth showed small amplitudes above and below the zero line, FDI variable was asymptotic to the zero line, at 0.001. Applying the traditional Granger causality to the stationary variables at levels, neither FDI ratio nor agricultural growth caused each other. The results suggest that the variables in their computable form may not induce each other singularly. Other policy variables may be considered separately or in conjunction to induce increases in either of them.

Keywords: FDI, Agriculture, Granger causality test, Growth

1. Introduction

FDI refers to an investment made to acquire lasting interest in enterprise operating outside of the economy of the investor (UNTAD, 2002). This suggests that FDI, comprise international capital flows in which a firm in one country creates or expand a subsidiary in another. FDI can also be defined as an investment involving a long-term relationship and reflecting a lasting interest and control of a resident entity in one economy in an enterprise resident in another economy (Rotjanapa, 2005). Clearly, FDI implies that the investor has significant degree, partial or full control or influence on the management of the enterprise resident in the other economy. According to Krugman and Obstfeld (2009), the most distinctive feature of FDI is that it encompasses transfer of resources and acquisition of control. Consequently, UNCTAD (2008) delineates components of FDI as equity capital, reinvested earnings, and other capital.

In the face of inadequate resources to finance long-term development in Africa and with poverty reduction and other Millennium Development Goals (MDGs) looking increasingly difficult to achieve by 2015, the issue of attracting foreign direct investment (FDI) has assumed a prominent place in the strategies of economic renewal being advocated by policy makers at the national, regional and international levels (UNCTAD, 2005). de Mello Jr. (1997) in a comprehensive survey of relationship between FDI and economic growth and evidence from other studies have noted additionally, the importance of FDI to host countries. Firstly, inward FDI can stimulate local investment by increasing domestic investment through links in the production chain when foreign firms buy locally made inputs or when foreign firms supply intermediate inputs to local firms. Secondly, the foreign capital inflow augments the supply of funds for investment thus promoting capital formation in the host country. Thirdly, inward FDI can increase the host country's export capacity causing the developing country to increase its foreign exchange earnings. Fourthly, FDI is also associated with new job opportunities and enhancement of technology transfer, and boosts overall economic growth in host countries.

The empirical evidence from studies on the direction of the causal link between FDI and economic growth is not clear. Even in the specific case of Ghana, the results are conflicting. The possibility of two-way (bidirectional) causality among variables of interest may exist. Thus, not only FDI can Granger-cause GDP growth (with either positive or negative impacts), but GDP growth can also Granger-cause the inflow of FDI or there could be no causal link (de Mello Jr., 1997). Given the possible conflicting results and the particular case for Ghana, and the timing of the two aggregate data sets, what is the case for specific sectors within Ghana? More formally, what is the strength and direction of the causal relationship between inward FDI flow to Agriculture and Agricultural output growth in Ghana?

The study will describe Agricultural inward FDI flows to Ghana over 1966-2008 as well as the outturn of Agricultural GDP growth over the same period. In search of rigour, the causal links between the two variables will be examined.

Karikari (1992) studied FDI the causal relationship between FDI and output for Ghana over 1961 to 1988, whilst lately, Frimpong and Oteng-Abayie (2008) using data covering1970 to 2002 examined economic growth and output for the total economy. The relationship between Agriculture and Growth is less known. Given the importance of Agriculture to Ghana, the current study is relevant. Secondly, more current data covering a longer period than the others will be employed. The results will add to the relatively scarce literature of FDI in the Agricultural sector globally.

The rest of the paper is organised into four sections. The next section presents the review of relevant literature. Section 3 outlines the data and methods employed in the study. The results and discussions then follow in section 4. The final section contains the conclusions and recommendations.

2. Literature Review

The role of FDI in Agriculture in Ghana is crucial for Agriculture, is the key to Ghana's economy, employs more than 60% of the labour force, and is predominantly rural (ISSER 2007). It also contributes significantly to gross domestic product (GDP) and foreign exchange earnings. For example, in 2008 the sector contributed 31.6% to GDP (ADI, 2011) and 29.1% of total exports (FAO, 2010). Growth and development in developing countries is dependent on Agricultural development (World Bank, 2008). Increase in aggregate output, that is, growth, is often a key goal for managers of economies. Investments, both domestic and foreign, specifically foreign direct investment (FDI) is desirable to spur development of agriculture and realise the needed growth.

de Mello (1997) discussed a detailed survey of studies in FDI and output growth. The results suggest positive, unidirectional and bidirectional relationships between FDI and GDP growth. Nguyen (2011) found a two-way causality between FDI and economic growth for Malaysia and Korea. There were differences in policies; the Malaysian government promoted FDI as a tool of industrialisation, while the Korea government built an "integrated national economy" using "chaebol" industrial structures and minimising the role of FDI, did not change the effect of FDI on GDP growth rate in both ways. The bi-directional relationship between FDI and growth is also the case for Portugal (Andraz & Rodrigiues, 2010). However, Obwona & Muwonge (2002) established a one-way causality of FDI to GDP growth for Uganda. Zhang (2000) supports the growth-driven FDI hypothesis for China, while de Mello (1999) concludes that FDI boosts long-run growth in a sample of OECD and non-OECD countries. On the other hand, Hansen and Rand (2006) support the FDI-led growth hypothesis in a set of developing countries. Other studies present evidence on the relationship between FDI and domestic investment, which could be considered as a proxy for economic growth. For instance, Kim and Seo (2003), found positive but insignificant effects of FDI on economic growth. Choe, (2003) also using domestic investment confirmed the relationship between domestic investment and economic growth, specifically, that, domestic investment does not Granger–cause economic growth, but economic growth robustly Granger–causes domestic investment. In examining the relationships between economic growth and FDI for 80 countries over the period 1971–95, by using a panel VAR model, Choe (2003) again showed that FDI Granger–causes economic growth, and vice versa; however, the effects are rather more apparent from growth to FDI than from FDI to growth, suggesting that strong positive associations between economic growth and FDI inflows do not necessarily mean that high FDI inflows lead to rapid economic growth.

Most recently, McCloud, and Kumbhakar (2011) investigated empirically, the existence of a heterogeneous relationship between foreign direct investment (FDI) and economic growth across developing countries. They argued that, across countries, differences in institutional quality were correlated with heterogeneous absorptive capacities and hence a heterogeneous FDI–growth relationship. The analysis further showed substantial heterogeneity in the FDI–growth relationship. Controlling for certain measures of institutional quality reduced the degree of heterogeneity. The findings of the duo, questioned the orthodox assumption of a homogeneous return to FDI in the existing empirical literature and brought to the fore the importance of specific aspects of institutional quality in the FDI–growth relationship.

Evidence exist to show the extent of robustness of the above relationship between FDI and economic growth. Wang and Wong (2009) using data from 69 countries over 1970–1989, have shown that under two economic conditions: a sufficient level of human capital and well-developed financial markets, there exist a positive relationship between FDI and economic growth. However, they noted that these two conditions could be fundamentally different catalysts for FDI to promote economic growth in the perspective of growth accounting. Specifically, FDI promotes productivity growth only when the host country reaches a threshold level of human capital; and FDI promotes capital growth only when a certain level of financial development is achieved.

Turning to Ghana specific studies, Karikari (1992) concluded that, for the period, 1961 to 1988, FDI did not Granger-cause economic output. On the other hand, economic output Granger-caused FDI. The effect was a slight decrease in FDI because of increases in output. In a more recent study, Frimpong and Oteng-Abayie (2008) using data covering1970 to 2002 concluded that there was no Granger causality between economic growth and output. After decomposing the sample into 1970-1983 and 1984-2002, the former sample results concurred with the no causality conclusion of Karikari (1992). However, the latter sample showed a contrary outcome; FDI Granger caused GDP growth positively.

3. Methodology

3.1 Data Sources and Descriptions

Agricultural inward FDI (AGFDI) was obtained from Ghana Investment Promotion Centre (GIPC) in US dollars however; the data covered 1995 to 2010. To generate data for 1966-1994, a model with AGFDI as explained and Net FDI (obtained from UNCTADSTAT database) as explanatory variable was estimated. This model was used to estimate data for 1971-1995. An exponential growth equation was then applied to the 1971 to 2010 data to fill in the spaces for 1966-1970. Real Agricultural GDP growth rate was obtained from ADI of the World Bank. However, the data covered 1966 to 2008. Therefore, the analysis will cover 1966 to 2008. The GDP growth figures contained negative numbers. Frankel (1976) proposed that, in order to make a series with negative numbers amenable to conversion to logarithms, a figure *k* might be added such that all the values become positive. This procedure was followed with an addition of 20 to the real GDP growth rate series.

3.2 Model

Studies in the relationship between Growth and FDI have been examined from diverse perspectives. For example Wang and Wong (2009) used growth accounting perspective. In the current study, Granger (1969) test in the VAR environment was employed. Starting with the assumptions by Granger; If A_t is a stationary stochastic process, let $\overline{A}_t$ represent the set of *past* values $\{A_{t-j}, j=1,2,\ldots,\infty\}$ and $\overline{\overline{A_t}}$ represent the past and present values $\{A_{t-j}, j=0,1,\ldots,\infty\}$. Additionally, let $\overline{A}(k)$ represent the set $\{A_{t-j}, j=k, k+1,\ldots,\infty\}$. Then, the optimum, unbiased, least-squares predictor A_t using the set of values of B_t is shown as $P_t(A|B)$.Furthermore, the associated predictive error process would be denoted as $\varepsilon_t(A \mid B) = A_t - P_t(A \mid B)$. Thus, the variance of this error process is represented as $\sigma^2(A \mid B)$.

Based on the preceding assumptions in set notation, Granger (1969) provided four dimensions of causality, namely; causality (unidirectional), feedback (bidirectional), instantaneous and causality lag. The study employed the first two dimensions. However, the second, feedback or bidirectional is presented as it encompasses the unidirectional as well.

If $\sigma^2(X \mid U) < \sigma^2(X \mid \overline{U - Y})$, then *Y* causes *X*, denoted by $Y_t \Rightarrow X_t$. So Y_t is causing X_t if it is better to predict X_t using all available information than if the information apart from Y_t had been used. Assuming a stationary time series with zero means of X_t and Y_t so that:

$$X_t = \sum_{j=1}^{m} a_j X_{t-j} + \sum_{j=1}^{m} b_j Y_{t-j} + \varepsilon_t \tag{1}$$

$$Y_t = \sum_{j=1}^{m} c_j X_{t-j} + \sum_{j=1}^{m} d_j Y_{t-j} + \eta_t \tag{2}$$

where ε_t, η_t are taken to be two uncorrelated white-noise series, so that $E[\varepsilon_t \varepsilon_s] = 0 = E[\eta_t \eta_s], s \neq t$, and $E[\varepsilon_t \varepsilon_s] = 0$ for all *t,s*. From 1 and 2, *m* is less than the time series for the estimation. From 1, Y_t causes X_t if more than one b_j is not statistically different from zero. On the other hand, X_t causes Y_t if any of the c_j is not statistically equal to zero in equation 2. Granger (1969) described either of the above cases as causality, more appropriately as unidirectional or one-way causality. Both cases he christened 'feedback' stated differently, as bidirectional causality.

Following Granger (1969), many studies (e.g. Thiam, 2007; Herzer, 2010; Gaiha & Annim, 2010) investigating causality have relied on the non-spurious test. Karikari (1992) used Granger (1969) test to study causality between GDP and FDI. Assuming stationarity of the time series of the variables under investigation, Asteriou and Hall (2007;

282-283) outlined a five-step procedure for determining the causal relations (modified for the variables under investigation in the study);

Step 1**.** Regress AGFDIR on lagged values of AGFDIR such as:

$$LnAGFDIR_t = \lambda_0 + \sum_{j=1}^{m} \phi_{1i} LnAGFDIR_{t-1} \quad (3)$$

and obtain restricted residual sum of squares (RSS_R)

Step 2**.**

$$LnAGFDIR_t = \lambda_0 + \sum_{j=1}^{m} \phi_{1i} LnAGFDIR_{t-1} + \sum_{i=1}^{n} \varphi_{1i} LnAGGDPGR_{t-1} + \varepsilon_{1t} \quad (4)$$

and obtain of the unrestricted residual sum of squares RSS_U.

Step 3**.**Set the null and alternative hypothesis as below:

$$H_0 : \phi_i = 0, i = 1,2....n \text{ or } AGGDPGR \text{ does not cause } AGFDIR \quad (5)$$

$$H_1 : \phi_i \neq 0, i = 1, 2,....n, \text{ or } AGGDPGR \text{ does cause } AGFDIR \quad (6)$$

Step 4**.** Calculate the *F* statistics for the normal Wald test on coefficient restrictions given by

$$F = \frac{(RSS_R - RSS_U)/m}{RSS_U/(n-k)} \quad (7)$$

and follows the $F_{m,n-k}$ distribution. Here $k=m+n+1$ where *m* is the number of lagged explanatory terms different from the explained term, *k* is the number of parameters estimated in the unrestricted model and *n* is the sample size adjusted for the lags.

Step 5**.**If the computed *F* value exceeds the *F*-critical value, reject the null hypothesis and conclude that *AGGDPGR causes AGFDIR*

However, Gujarati (1995) have noted that the conventional *F*-test for determining joint significance of regression-derived parameters, used as a test of causality, is not valid if the variables are non-stationary (as noted by Granger, 1969 himself) and the test statistic does not have a standard distribution. Furthermore, the test is based on asymptotic theory and therefore critical values are only valid for stationary variables that are not bound together in the long run by a co-integrating relationship (Granger, 1988). Also, in the view of Frimpong and Oteng-Abayie (2008), although the traditional pair-wise Granger causality tests is more revealing than simple correlation coefficients, the Granger test abstracts from philosophical issues of causality by merely insisting on temporal precedence and predictive content as the necessary criteria for one variable to Granger-cause another. Additionally, Toda and Phillips (1993), Toda and Yamamoto (1995), and Dufour and Renault (1998) provided reasons for an alternative from the traditional Granger (1969) test. Subsequently, Frimpong and Oteng-Abayie (2008) adopted Toda-Yamamoto (1995) test.

The Toda-Yamamoto (1995) (T-Y test) requires the estimation of an augmented VAR (k+d_{max}) model (equation 8 and 9), where *k* is the optimal lag length in the original VAR system, and d_{max} is the maximal order of integration of the variables in the VAR system. An alternative Wald test, a modified Wald (*MWald*) test for zero restrictions on the parameters of the original VAR (*k*) model is employed. The remaining d_{max} autoregressive parameters are regarded as zeros and ignored in the VAR (*k*) model. This test has an asymptotic chi-square distribution when the augmented VAR ($k + d_{max}$) is estimated. Using Seemingly Unrelated Regression (SUR) model estimation results in efficiency improvements (Rambaldi and Doran, 1996).Furthermore, in the SUR environment, the *MWald* test statistic is easily computable.

Srivastava (1967) described SUR procedure developed by Zellner (1962)as multiple-design multivariate (MDM) models. The regression equations are “seemingly unrelated” because taken separately; the error terms would follow standard linear OLS linear model form. However, the standard OLS solutions ignore any correlation among the errors across equations; yet, because the dependent variables are correlated and the design matrices may contain some of the same variables there may be “contemporaneous” correlation among the errors across the equations. In spite of the name ‘unrelated’, SURs are however, ‘related’ for three reasons; (1) some coefficients are the same or assumed to be zero; (2) the disturbances are correlated across equations; and/or (3) a subset of right hand side variables of the formulated equation are the same. This third condition is of particular interest because it allows each of the two dependent variables in equation 8 and 9 to have a different design matrix with some of the predictor variables being the same.

In an environment of non-stationary of the each series and cointegration of the variables, equation 8 and 9 would be appropriate.

$$LnAGFDIR_t = \lambda_0 + \sum_{j=1}^{k+d_{\max}} \phi_{1t} LnAGFDIR_{t-1} + \sum_{l=1}^{k+d_{\max}} \varphi_{1t} LnAGGDPGR_{t-1} + \varepsilon_{1t} \quad (8)$$

$$LnAGGDPGR_t = \lambda_0 + \sum_{j=1}^{k+d_{\max}} \phi_{2t} LnAGGDPGR_{t-1} + \sum_{l=1}^{k+d_{\max}} \varphi_{2t} LnAGFDIR_{t-1} + \varepsilon_{2t} \quad (9)$$

where $AGFDIR$ and $AGGDPGR$ are FDI to Agriculture and Agricultural GDP growth rate (proxy for growth) respectively, k is the optimal lag order and d is the maximal order of integration of the variables in the system ε_1 and ε_2 are error terms (assumed to be white noise). The natural log form was avoided as some data points turned out to be negative.

4. Analyses, Results and Discussions

4.1 Chart and Descriptive Statistics

Real Agricultural GDP growth Rate (AGGDPGR) showed significant activity over the period. Between 1966 and 1986, there were movements across the zero growth line (Figure 1). Between 1992 and 2008, growth was mostly positive except for 2003. In all, there were ten negative growth rates, nine out of the ten occurred between 1966 and 1992. Significantly, that period coincided, with short periods of civilian governments and long periods of military governments. Indeed, about five years out of the 26 years period was civilian government rulership. The 16 years from 1993 to 2008 was positive except for 2004. Turning to the specifics, the lowest growth of -19.933 was reordered in 1975 and the highest of 19.05 was reordered in 1978 (Table 1). The resulting mean was 2.30 with a standard deviation of 5.928. The FDI to Agriculture Value Added ratio also showed active movements. However, this was only between 1966 and 1980. Subsequently, the ratio remained stable. Though the value of FDI rose consistently over the whole period, that for Agricultural Value Added grew faster, hence the plateauing of the ratio at less than 0.1.As a result, the minimum ratio was 0.001 (2005) and a maximum of 70.539 (1971) and a mean of 6.710.The level of the ratios suggest outcomes to efforts at attracting FDI into Agriculture yielded minimal results compared to growing Agricultural output. The ratios also point to the relatively small contribution of FDI to Agricultural output in Ghana. The T-Y test will examine the relationship between the ratio and real GDP growth rate.

4.2 Correlation Analyses

To get a glimpse of the relationship between the AGGDPGR and AGFDIR, a correlation matrix was generated (Table 2) in spite of the less revealing character of correlation in studying causality (Frimpong and Oteng-Abayie, 2008). The Pearson correlation coefficient was small 0.010 with probability of 94.7%. Despite a positive movement between both variables, the low coefficient coupled with the high probability shows that the positive correlation observed is by chance. It is unknown, whether; there will be any causality between the two variables.

4.3 Granger Causal Analyses

4.3.1 Unit Root Tests

A test for unit roots is shown in Table 3 and 4. The null hypothesis that there is unit root for the variables is rejected. Hence, the variables are both stationary at levels and integrated of order zero. Following from the above result, the limitations associated with the use of the traditional Granger causality test become ineffective, specifically, that the Granger (1969) test is appropriate. Thus, the VAR estimation system is necessary but the SUR system was not necessary. In order to use the VAR, appropriate lag length should be established. Table 5 presents the summary of the choice with various models and information choice criteria. Irrespective of the model type, all information choice criteria; Log likelihood (LL), Akaike Information criteria (AIC) and Schwarz Criteria (SC) chose up to two lags. In both restricted models, SC specifically rejects the zero lag. In the case of the linear model, AIC rejects the 1 lag. The maximum lag employed was 2.

4.3.2 Empirical Results and Discussion

Using two as the lag length, $k + d_{max}$ is commuted to two. The empirical outcomes according to Asteriou and Hall (2007) procedure follows:

Step1.

$$LnAGFDIR_t = 1.46 + 0.632\text{LnAGFDIR}_{t-1} + 0.070\ \text{LnAGFDIR}_{t-2} \quad (10)$$

Step 2;

$$LnAGFDIR_t = 0.276 + 0.605\text{LnAGFDIR}_{t-1} + 0.089\text{LnAGFDIR}_{t-2} + 0.216\text{LnAGGDPGR}_{t-1}$$

$$(0.138616) \quad (3.741048)^{***} \quad (0.557334) \quad (0.814902)$$

$$0.326\text{LnAGGDPGR}_{t-2} \quad (11)$$

$$(1.224543)$$

where figures in brackets are student *t* values, *** significance at 1%, ** significance at 5%, * significance at 10%.

Step 3;

$$H_0 : \varphi_{11}, \varphi_{12} = 0.216313, 0.326647 = 0, \textit{AGGDPGR does not cause AGFDIR} \quad (12)$$

$$H_1 : \varphi_{11}, \varphi_{12} = 0.216313, 0.326647 \neq 0 \textit{ or AGGDPGR does cause AGFDIR} \quad (13)$$

Step 4;

The calculated F statistic = 1.181141733.

Step 5:

Level of significance 10% 5% 1%

Critical F values 2.44037 3.2317 5.179

First, the null hypothesis (12) could not be rejected since both φ_{11} and φ_{12} are statistically the same as zero. Thus, by implication, the alternative hypothesis was rejected. Secondly, the computed *F* statistic of 1.181141733 was less than 2.44037 (the critical *F* value) from *F* table at 10%. Therefore, AGGDPGR does not cause AGFDIR. This finding confirms that of Frimpong & Oteng-Abayie (2008) for FDI and economic growth for total economy of Ghana. However, the findings are at variance with that of de Mello (1999), Zhang (2000), and Hansen & Rand (2006).

Skipping step 1 for AGGFDI causing AGGDPGR, the following were noted:

Step 2;

$$LnAGGDPGR_t = 2.21 - 0.053\text{LnAGFDIR}_{t-1} + 0.046\text{LnAGFDIR}_{t-2} + -0.095\text{LnAGGDPGR}_{t-1}$$

$$(1.780300)^{*} \quad (-0.531109) \quad (0.467455) \quad (-0.576620)$$

$$0.121\text{LnAGGDPGR}_{t-2} \quad (14)$$

$$(0.730598)$$

Step 3;

$$H_0 : \phi_{21}, \phi_{22} = -0.053561, 0.046895 = 0, \textit{AGFDIR does not cause AGGDPGR} \quad (15)$$

$$H_1 : \phi_{21}, \phi_{22} = -0.053561, 0.046895 \neq 0, \textit{AGFDIR does not cause AGGDPGR} \quad (16)$$

Step 4;

The computed *F* statistics = 0.200462167

Step 5:

Level of significance 10% 5% 1%

Critical *F* values 2.44037 3.2317 5.179

It was observed that the constant term in 14 is significant but irrelevant. In addition, the coefficient of the first lag of FDI ratio was negative and the second lag positive. It is possible, that, the desirable effects of any year's FDIs on growth would not be realised until in the second year of entry of the resource. Akin to this relationship is the finding of Karikari (1992) of a negative relation between economic output and FDI for Ghana for the period 1961 to 1988. The computed *F* statistic is less than the weakest probability level (10%) of 2.44037. Thus, there is no causation from AGFDIR to AGGDPGR. This outcome falls in line with the conclusions of Frimpong & Oteng-Abayie (2008) but different from those of Obwona & Muwonge (2002) for Uganda, Hansen & Rand (2006) for developing countries and Nguyen (2011) for Malaysia and Korea. It is worthy of note that, the AGFDIR is a ratio, thus, the effect of FDI alone may be masked by the agricultural value added. The results should therefore be interpreted with caution. Specifically, it is not FDI that does not cause Agricultural output growth in this study, but that the ratio of FDI to agricultural value added does not cause agricultural output growth.

The results mean that FDI-led strategy for growth of the agricultural sector may not be feasible. On the other hand, using growth of the agricultural sector to induce FDI into agriculture in Ghana may not be a suitable idea. It is important to note, that, the agricultural output variable is 'growth', that is, increase of GDP due to agriculture. Thus, it is not impossible for FDI into agriculture to contribute to agricultural output.

5. Conclusions and Recommendations

The ratio of FDI to GDP for agriculture showed significant movements between 1966 and 1979. However, beyond that, the ratio remained essentially stable around zero subsequently. Though, the value of FDI increased, that for agricultural GDP grew faster hence the decline.

Agricultural output growth, measured as real GDP growth, similarly showed gyrated movements between 1966 and 1979. However, subsequent periods showed wider movements than FDI GDP ratio though not many gyrations.

Pearson correlation coefficients generated as prelude to the causal analysis, showed positive but terribly insignificant (probability 94.7%) relationship.

For the agricultural sector in Ghana, FDI does not Granger cause agricultural output growth, conversely, agricultural output growth does not Granger cause FDI into the sector.

Following from the above, government requires stimuli other than FDI to induce growth in the agricultural sector. Additionally, achieving growth of the agricultural sector is not a precondition to attract FDI into the sector. Thus, growing the agricultural sector may be pursued for reasons other than attracting FDI.

For further research, the instantaneous causality between FDI and output growth for agriculture, as well as causality between FDI and output (not 'output growth') is worth investigating.

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Appendices

Table 1.Summary Statistics of Data

	Real GDP Growth	Plus 20	FDI to Agric. Value Added
Mean	2.30	22.3009	6.710375871
Min	(19.93)	0.06741	0.000626704
Max	9.05	39.0515	70.53878502
Std. Dev.	5.86	5.8587	13.31519256

Table 2. Correlations Matrix

		Real GDP Growth Rate	Agric. FDI per Agric. Value Added
Real GDP Growth Rate	Pearson Correlation	1	.010
	Sig. (2-tailed)		.947
	N	43	43
Agric. FDI per Agric. Value Added	Pearson Correlation	.010	1
	Sig. (2-tailed)	.947	
	N	43	43

Table 3.Truncated Results of Stationary Test for AGGDPGR

Null Hypothesis: AGGDPGR has a unit root			
Exogenous: Constant			
Lag Length: 2 (Automatic - based on SIC, maxlag=9)			
		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-4.898209	0.0003
Test critical values:	1% level	-3.605593	
	5% level	-2.936942	
	10% level	-2.606857	
*MacKinnon (1996) one-sided p-values.			

Table 4.TruncatedResults of Stationary Test for AGFDIR

Null Hypothesis: AGFDIR has a unit root
Exogenous: Constant
Lag Length: 9 (Automatic - based on SIC, maxlag=9)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-5.832474	0.0000
Test critical values:	1% level	-3.646342	
	5% level	-2.954021	
	10% level	-2.615817	

*MacKinnon (1996) one-sided p-values.

Table 5. Lag length Choice Results

Date: 06/11/11 Time: 20:05
Sample: 1966 2008
Included observations: 41
Series: AGGDPGRAGFDIR
Lags interval: 1 to 1

Selected (0.05 level*) Number of Cointegrating Relations by Model

Data Trend:	None	None	Linear	Linear	Quadratic
Test Type	No Intercept No Trend	Intercept No Trend	Intercept No Trend	Intercept Trend	Intercept Trend
Trace	0	1	2	1	2
Max-Eig	0	1	2	1	2

*Critical values based on MacKinnon-Haug-Michelis (1999)

Information Criteria by Rank and Model

Data Trend:	None	None	Linear	Linear	Quadratic
Rank or No. of CEs	No Intercept No Trend	Intercept No Trend	Intercept No Trend	Intercept Trend	Intercept Trend
	Log Likelihood				
0	-292.1745	-292.1745	-292.1093	-292.1093	-292.0722
1	-285.0107	-283.8208	-283.7613	-281.8110	-281.7739
2	-282.7912	-281.0565	-281.0565	-277.8143	-277.8143
	Akaike Information Criteria				
0	14.44754	14.44754	14.54192	14.54192	14.63767
1	14.29321	14.28394	14.32982	14.28346*	14.33043
2	14.38006	14.39300	14.39300	14.33241	14.33241
	Schwarz Criteria				
0	14.61471*	14.61471*	14.79268	14.79268	14.97202
1	14.62756	14.66009	14.74776	14.74320	14.83197
2	14.88159	14.97812	14.97812	15.00112	15.00112

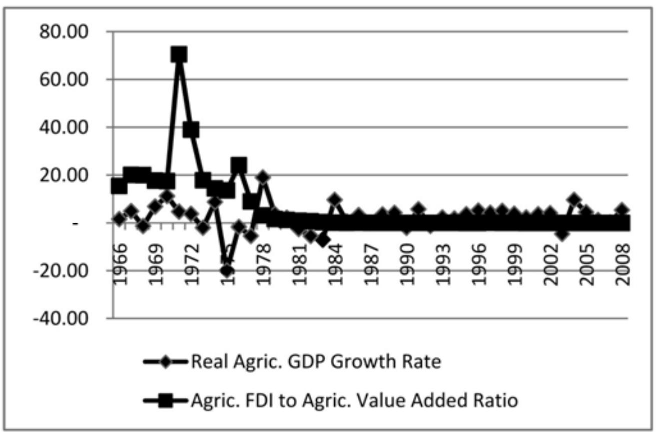

Figure 1. Real Agric. GDP Growth Rate and FDI per Agric. Value Added