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Abstract

The main objective for this paper is to study the causal link between FDI and GDP growth for Ghana for the pre- and post-SAP periods. We also study the direction of causality between the two variables, based on the more robust Toda-Yamamoto (1995) Granger no-causality test which allows the Granger test in an integrated system. Annual time-series data covering the period 1970-2002 was used. The study finds no causality between FDI and growth for the total sample period and the pre-SAP period. FDI however caused GDP growth during the post-SAP period.

INTRODUCTION

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). Even though the average annual FDI flows to Africa has increased nine-fold from $2 million in 1980s to about $18 million in 2003 and 2004, the current findings by UNCTAD have shown a positive but weak and unstable association between FDI and economic growth in Africa.

Foreign direct investment (FDI) and economic growth nexus has spurred volumes of empirical studies on both developed and developing countries[1]. This nexus has been studied by explaining the determinants of both growth and FDI, the role of transnational companies (TNCs) in host countries, and the direction of causality between the two variables.

Despite the plethora of studies on the direction of the causal link between FDI and economic growth, the empirical evidence is not clear for country groups. Following the criticisms in recent studies (Kholdy, 1995) of the traditional assumption of a one-way causal link from FDI to growth, new studies have also considered the possibility of a two-way (bidirectional) or non-existent causality among variables of interest. In other words, not only FDI can

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[1] Refer to de Mello (1997, 1999) for a comprehensive survey of the nexus between FDI and growth as well as for further evidence on the FDI-growth relationship, Asiedu (2002) on the determinants of FDI and Asiedu (2003) for discussions of the relationship between policy reforms and FDI in the case of Africa.

'Granger cause' GDP growth (with either positive or negative impacts), but GDP growth can also affect the inflow of FDI or there could be no causal link. From the numerous existing studies, the causal link between FDI and economic growth as an empirical question seems to be dependent upon the set of conditions in the specific host country economy. Chowdhury and Mavrotas (2005) have suggested that individual country studies be done to examine the causal links between FDI and economic growth since it is country specific.

Empirical studies on the importance of inward FDI in host countries suggest that the foreign capital inflow augment the supply of funds for investment thus promoting capital formation in the host country. 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 source intermediate inputs to local firms. Furthermore, inward FDI can increase the host country's export capacity causing the developing country to increase its foreign exchange earning. FDI is also associated with new job opportunities and enhancement of technology transfer, and boosts overall economic growth in host countries. A number of firm-level studies, on the other hand, however, do not lend support for the view that FDI necessarily promotes economic growth.

The main objective of this paper is, therefore, to test for the direction of causality between foreign direct investment inflows (FDI) and economic growth (GDP) in the case of Ghana. Here we look for one of the three possible types of causal relationship: 1) Growth-driven FDI, i.e. the case when the growth of the host country attracts FDI 2) FDI-led growth, i.e. the

case when the FDI improves the rate of growth of the host country and 3) the two way causal link between them (or possibly no causality at all).

The paper will contribute significantly to the literature by providing new and sturdy evidence on FDI-Growth relationship in Ghana. We used an innovative and more robust 'Granger no causality test' method developed by Toda and Yamamoto (1995), (hereafter called T-Y) to test the direction of causality between the two variables. This methodology to the best of our knowledge goes clearly beyond the existing literature on the subject in Ghana. More precisely, existing empirical work by Karikari (1992) on the causality between FDI and economic growth used the traditional Granger-type causality (Granger, 1969 and 1988) tests to identify the direction of causality in the above important relationship.

The rest of this paper is organized as follows. Section 1 presents a brief overview of FDI inflows in Ghana. Section 2 provides a description of the data, models and estimation procedures used. Section 3 presents the estimation results and discussions. Session 4 concludes the paper.

1. FOREIGN DIRECT INVESTMENT AND ECONOMIC GROWTH IN GHANA

Foreign direct investment (FDI) inflows to low-income countries has not only received much publicity in the past two decades due to its economic importance, but its overall flow to these countries has also significantly increased in both relative and absolute terms. However, only a few sub-Saharan African countries have been successful in attracting significant FDI inflows. Globally Africa's share of FDI to world FDI inflows rose from 1 percent in 2000 to

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2 percent in 2001(UNCTAD, 2002), a greater share going to resource rich countries such as Algeria, Angola, Egypt, South Africa, and Nigeria (Kandiero and Chitiga, 2003).

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Ghana has a checked history of economic and political development which reflects in the erratic inflows of FDI, changes in political and policy regime and uneven growth patterns. Since the early 1980s, Ghana has had to implement several economic reform policies such as the Structural Adjustment Programme (SAP) in 1983 and recently the Enhanced HIPC Initiatives HIPC (Ibrahim, 2005). These policies were adopted primarily to reverse the post-independence economic decline, reduce the impact of the 1980 debt crisis and, facilitate the attraction of value-added FDI inflows to Ghana. Several qualitative analyses of available evidence reveal that the adoption of the SAP, the main economic reform programme, has led to an increase in the number of multinationals investing in Ghana. Other studies have also concluded that Ghana's SAP has had some degree of success in many areas, including the lowering of inflation; promotion of an environment of financial stability; elimination of the licensing requirement; the opening of previously closed sectors; removal of tariff barriers that prohibit FDI inflows; abolishing exchange controls; and reducing opportunities for the foreign exchange black market (U.S. Library of Congress, 1998). In spite of these reform successes, there are still serious challenges that hamper the massive attraction of FDI inflows into Ghana as compared to other developing countries such as South Africa, Malaysia, and Thailand.

The historical trend of FDI inflows in Ghana can be shown in three main phases since 1983 (Tsikata *et al.,* 2000). The period 1983-88 witnessed sluggish inflows, averaging about $4

million per annum, and the highest and lowest inflows during the period being $6 million in 1985 and $2 million in 1984 respectively. The period 1989-1992 recorded moderate inflows averaging about $18 million per annum the highest and lowest being $22 million in 1992 and $14.8 million in 1990 respectively. The 1993-1996 was a period of significant, but oscillatory inflows, which peaked in 1994 at $233 million, but fell by more than 50% the following year to $107 million (Figure 1).
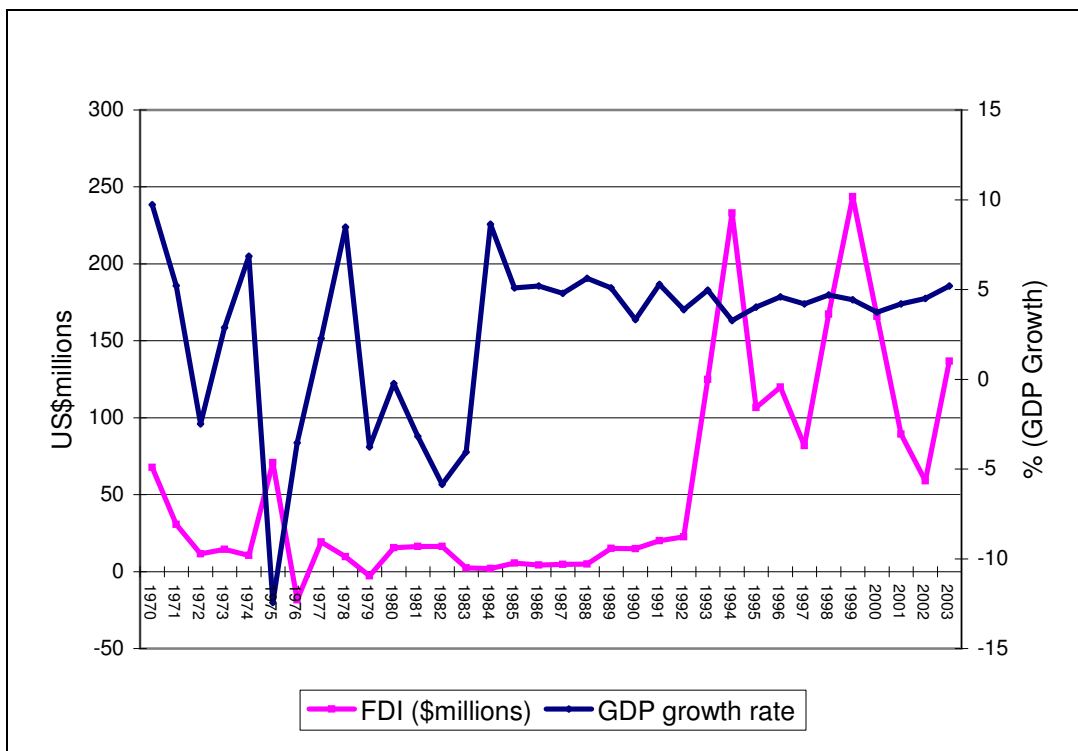

Figure 1: Trends in FDI Inflows and GDP Growth (1970 – 2003)

Source: World Development Indicators, 2004

An equally important feature of the FDI inflows according to Tsikata et al (2000) is the three-way nexus of economic growth, investment and political stability, which has emerged since the coup d'état of 1972. In 1972, a growth rate of 2.3% was recorded, accompanied by a

more than 60% drop in FDI (from $30.6 million in 1971 to $11.5 million in 1972). Similar trends were experienced after the 1979 and 1981 coup d'état when growth fell to as low as – 3.2%; there was also an outflow of $2.8 million of FDI. The state of the economy worsened further with a negative growth rates of -3.5% in 1981 to -6.9% in 1982; however inflow of FDI remained constant at $16.3 million. The relationship emerged again when parliamentary democracy was restored in 1992. The rate of growth of 5.3% in 1991 fell to 3.9% in 1992; this has been previously attributed to deficit financing undertaken to finance the democratic process. The FDI flow however, increased from $20 million in 1991 to $22.5 million in 1992 excluding investment in the mining sector (figure 1).

2. METHODOLOGY AND DATA

2.1 Granger No-Causality Tests

The Granger no-causality test used in time series analysis to examine the direction of causality between two economic series has been one of the main subjects of many econometrics studies for the past three decades. Recent studies have shown 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 and the test statistic does not have a standard distribution (Gujarati, 1995).

Generally, causality between two economic variables has been tested using Granger and Sims causality test (see Granger 1969 and Sims 1972). Within a bivariate context, the Granger-type test states that "if a variable x Granger causes variable y, the mean square error (MSE) of a forecast of y based on the past values of both variables is lower than that of a

forecast that uses only past values of *y*. This Granger test is implemented by running the following regression:

$$\Delta y_t = \alpha + \sum_{i=1}^{p} \beta_i \Delta y_{t-i} + \sum_{i=1}^{p} \gamma_i \Delta x_{t-i} + \varepsilon_t \dots\dots\dots\dots\dots\dots(1)$$

and testing the joint hypothesis $H_0 : \gamma_1 = \gamma_2 = \cdots \gamma_p = 0$ against $H_1 : \gamma_1 \neq \gamma_2 \neq \cdots \gamma_p \neq 0$. Granger causality from the *y* variable to the coincident variable *x* is established if the null hypothesis of the asymptotic chi-square (χ^2) test is rejected. A significant test statistic indicates that the *x* variable has predictive value for forecasting movements in *y* over and above the information contained in the latter's past.

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. Another shortcoming of the test is that it is based on the asymptotic theory and therefore critical values are only valid for stationary variables that are not bound together in the long run by a cointegrating relationship (Granger, 1988). This makes the causality test results somewhat weak and conditional on the absence of cointegration between the relevant variables.

In cointegrated systems, such tests are more complex, since the existence of unit roots gives various complications in statistical inference[2]. Thus there is a high risk of making wrong

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[2] For detailed exposition see Toda and Phillips (1993), Toda and Yamamoto (1995), and Dufour and Renault (1998).

inferences about causality simply due to the incorrect identification of the order of integration of the series or number of cointegration vectors among the variables. Other alternative tests proposed by Mosconi and Gianini (1992) and Toda and Philips (1993) in an attempt to improve the size and power of the Granger no-causality test are unwieldy and do not lend themselves to easy application.

We avoid these difficulties by applying the more robust T-Y procedure developed by Toda and Yamamoto (1995) and extended by Rambaldi and Doran (1996) and Zapata and Rambaldi (1997) to test for the Granger no-causality in this study. According to Giles and Mirza (1999), Toda and Yamamoto (1995), and independently, Dolado and Lütkepohl (1996), proposed method is simple and gives an asymptotic chi-square (χ^2) null distribution for the Wald Granger no-Causality test statistic in a VAR model, irrespective of the system's integration or cointegration properties. Zapata and Rambaldi (1997) explained that the advantage of using the T-Y procedure is that in order to test Granger causality in the VAR framework (as in this study), it is not necessary to pretest the variables for the integration and cointegration properties, provided the maximal order of integration of the process does not exceed the true lag length of the VAR model.

According to Toda and Yamamota (1995), the T-Y procedure however does not substitute the conventional unit roots and cointegration properties pretesting in time series analysis. They are considered as complementary to each other.

The T-Y procedure basically involves the estimation of an augmented VAR($k+d_{max}$) model, where 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. The Granger no-causality test utilises a modified Wald (*MWald*) test for zero restrictions on the parameters of the original VAR(k) model. The remaining d_{max} autoregressive parameters are regarded as zeros and ignored in the VAR(k)model. This test has an asymptotic χ^2 distribution when the augmented VAR ($k + d_{max}$) is estimated. Rambaldi and Doran (1996) have shown that the *MWald* tests for testing Granger no-causality experience efficiency improvement when Seemingly Unrelated Regression (SUR) models are used in the estimation. Moreover, the *MWald* test statistic is also easily computed in the SUR system.

2.2 The Model

Following Seabra and Flach (2005), the T-Y Granger no-causality test is implemented in this study by estimating the following bivariate VAR system[3] using the SUR technique:

$$ln\,GDPGR_t = \gamma_0 + \sum_{i=1}^{k+d} \alpha_{1i}\,ln\,GDPGR_{t-1} + \sum_{i=1}^{k+d} \beta_{1i}\,ln\,FDI_{t-1} + \varepsilon_{1t} \quad\text{...}(2a)$$

$$ln\,FDI_t = \gamma_0 + \sum_{i=1}^{k+d} \alpha_{2i}\,ln\,FDI_{t-1} + \sum_{i=1}^{k+d} \beta_{2i}\,ln\,GDPGR_{t-1} + \varepsilon_{2t} \quad\text{...}(2b)$$

where ln$GDPGR$ and lnFDI are, respectively, the natural logarithm of GDP growth (proxy for economic growth) and of foreign direct investment. k is the optimal lag order, d is the maximal order of integration of the variables in the system and ε_1 and ε_2 are error terms that are assumed to be white noise. Each variable is regressed on each other variable lagged from

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[3] The Toda and Yamamoto causality test is similar to the Granger causality test in that an augmented VAR with ($k+d_{max}$) lags in the *levels* of the variables is estimated in place of equation (1).

one (1) to the $k+d_{max}$ lags in the SUR system, and the restriction that the lagged variables of interest are equal to zero is tested.

From equation (2a), "*FDI does not Granger cause GDPGR*" (i.e. $FDI \nRightarrow GDPGR$) if $H_0 : \beta_{1i} = 0$ against $H_1 : \beta_{1i} \neq 0$, where $i \leq k$. Similarly, from equation (2b), "*GDPGR does not Granger cause FDI*" (i.e. $GDPGR \nRightarrow FDI$) if, $H_0 : \beta_{2i} = 0$ against $H_1 : \beta_{2i} \neq 0$ where $i \leq k$. Observe that the extra (d_{max}) lags are not restricted in all cases. According to Toda and Yamamoto (1995), this will ensure that the asymptotical critical values can be applied when we test for causality between integrated variables.

2.3. Data

The real GDP growth and foreign direct investment net inflows as percent of GDP (FDI ratio) data were taken from the World Bank's *World Development Indicators 2004* CD Rom. Annual time series data covering the period 1970-2002 for which data was available was used. The entire data is divided into two sub periods of pre-SAP (1970-1983) and post-SAP (1984-2002). The main focus of our analysis however is on the post-SAP period since the highly chequered history of the pre-SAP period in Ghana reduces its predictive power for future policy guidance. The natural logarithms of the variables were used for the estimations.

3. ESTIMATION RESULTS AND DISCUSSIONS

The estimation results are presented in the following four steps. Firstly, we establish the order of integration for both GDP growth and FDI in the model. Secondly, we find out the

optimum lag structure using the AIC, SBC and Likelihood Ratio (LR) information criteria. Thirdly, we conduct a cointegration test just to find out whether the two variables are bound together in the long run. Finally, we conduct the Toda-Yamamoto Granger causality test.

Before applying the T-Y no-causality test in the augmented VAR($k+d_{max}$), we first establish the maximal integration order (d_{max}) of the variables by carrying out an Augmented Dickey-Fuller (ADF) unit root tests on the GDP growth and FDI series in their log-levels and log-differenced forms. The results, reported in Table 1, indicate that real GDP growth and FDI ratio are non-stationary in their respective levels. Then again, after first differencing the variables, the null hypothesis of a unit root in the ADF tests were rejected at the 5% significance level for both series. Thus the two variables are integrated of order one, I(1).

Table 1: Results of ADF Tests for Unit-Roots in GDPGR and FDI

H_0: unit roots I (1). H_1: trend stationary I (0).				
			ADF test	Integration Order
Variables	*Lags*	*Levels*	*1st Difference*	*I(d)*
ln$GDPGR_t$	1	-3.119	-4.707**	1
lnFDI_t	1	-1.673	-3.737*	1

Notes: The optimal lags for conducting the ADF tests were determined by AIC (Akaike information criteria). *(**) indicate significance at the 5% (1%) levels. The MacKinnon critical values for the ADF test are -3.674 (5%), and -4.535 (1%).

Next we employed the AIC, SBC and Likelihood Ratio (LR) information criteria to establish and select the optimum lag length of the VAR(k). Table 2 presents the output of the choice criteria for selecting the order of the VAR model. The Adjusted LR test statistics adjusted for the small samples rejects the zero lag. On the basis of the results, the AIC selects 3 lags and the SBC selects 1 lag. The maximised SBC's one (1) lag order for the VAR model is selected due to our small sample of series in order to preserve some degrees of freedom for the estimations.

Table 2: Test Statistics and Choice Criteria for Selecting the Order of the VAR Model

Order	LL	AIC	SBC	Adjusted LR test
3	4.299	-9.701	-16.312	$\chi^2(4) = 3.4073\ (0.492)$
2	-0.056	-10.056	-14.778	$\chi^2(8) = 7.9915\ (0.434)$
1	-4.141	-10.141	-12.974	$\chi^2(12) = 12.2916\ (0.423)$
0	-26.313	-28.313	-29.258	$\chi^2(16) = 35.6307\ (0.003)^{***}$

Note: (.)*** is significant at 1% level. AIC=Akaike Information Criterion, SBC=Schwarz Bayesian Criterion, LL=Log likelihood

Following that the two series are integrated of order one, the cointegration[4] (long-run) relationship between them was also established using the Johansen maximum likelihood (ML) cointegration test. The results of the cointegration analysis indicated that there is a long

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[4] Two time series variables are said to be cointegrated if each of the series taken individually is non-stationary with integration of order one, i.e. I(1), while the linear combination of the series are stationary with integration of order zero, i.e. I(0).

run relationship between GDP growth and FDI for the whole sample period and the post-SAP period. The pre-SAP period however showed no cointegration relationship.

Table B2: Johansen ML Cointegration Test Results for GDPGR and FDI

Cointegration with restricted intercepts and no trends in the VAR Stochastic Matrix

Null hypothesis	Maximum Eigenvalue	5% critical value	Trace Statistic	5% critical value
1970 – 1983				
r = 0	12.0355	14.8800	16.5430**	17.8600
r<= 1	4.5075	8.0700	4.5075	8.0700
1984 – 2002				
r = 0	20.4052**	15.8700	28.5822**	20.1800
r<= 1	8.1770	9.1600	8.1770	9.1600
1970 – 2002				
r = 0	21.0157**	14.8800	25.8593**	17.8600
r<= 1	4.8436	8.0700	4.8436	8.0700

** denotes rejection of the null hypothesis at 5% significance level.

Using the established maximal order of integration (d_{max}=1) and the selected VAR length (*k=1*), the following augmented VAR(*2*) model was estimated using the SUR technique:

$$ln\,GDPGR_t = \gamma_0 + \sum_{i=1}^{2}\alpha_{1i}\,ln\,GDPGR_{t-1} + \sum_{i=1}^{2}\beta_{1i}\,ln\,FDI_{t-1} + \varepsilon_{1t}...(3a)$$

$$ln\,FDI_t = \gamma_0 + \sum_{i=1}^{2}\alpha_{2i}\,ln\,FDI_{t-1} + \sum_{i=1}^{2}\beta_{2i}\,ln\,GDPGR_{t-1} + \varepsilon_{2t}...(3b)$$

Finally, we conducted the T-Y Granger causality test using a modified Wald (MWald) test to verify if the coefficients $\beta_{11} and \beta_{21}$ of the lagged variables are significantly different from zero in the respective equations (3*a*) and (3*b*). The results of the T-Y causality test are reported in Table 4 for all the estimated periods.

Table 4: Toda-Yamamoto Granger No-causality Test Results

VAR($k+d_{max}$) = 2	1970 – 1983	1984 – 2002	1970 – 2002
Null Hypothesis (H$_0$):	MWald	MWald	MWald
FDI $\not\Rightarrow$ GDPGR	2.612 (0.106)	49.644(0.000)***	0.2891 (0.591)
GDPGR $\not\Rightarrow$ FDI	0.0977 (0.755)	0.368 (0.544)	0.0600 (0.806)

Note: The figures in parentheses are the asymptotic p-values. (.) *** denotes 1% significance level.

From the results, the null hypothesis that "*FDI does not Granger causes GDPGR*" (i.e. *FDI $\not\Rightarrow$ GDPGR*) were not rejected for both the overall sample period and the pre-SAP period. On the other hand, we rejected the no-causality hypothesis for the post-SAP period. We also clearly accepted the null hypothesis that "*GDPGR does not Granger causes FDI*" (i.e. *GDPGR $\not\Rightarrow$ FDI*) in all the sample periods.

Overall, we find clear evidence of a one-way causality from FDI to GDPGR only for the post-SAP period. However there is generally no evidence of causal relationship between FDI and GDPGR either way for the pre-SAP period and the entire period respectively.

Following Shan *et al* (1997), we also estimated the model and tested for causality using other lag orders.[5] The causality test results were significantly the same. These results are available on request from the authors.

4. CONCLUSION

The main objective of this paper was to test the direction of causality between foreign direct investment inflows (FDI ratio) and economic growth (GDP growth) for Ghana focusing mainly on the pre- and post-SAP periods. The study has employed the T-Y Granger causality test procedure, an innovative and more efficient econometric methodology to test the direction of causality between the FDI inflows and GDP growth over three set periods consisting of:

1. a thirty-three year period of macroeconomic data availability i.e. 1970 – 2002,

2. a pre-SAP period of political instability and economic decadence, i.e. 1970 – 1983, and

3. a period of political stability and economic focus i.e. 1984 – 2002.

At the outset we envisaged three possible types of relationship between the variables: 1) Growth-driven FDI, i.e. the case when the growth of the host country attracts FDI; 2) FDI-led growth, i.e. the case when the FDI improves the rate of growth of the host country; 3) the two way causal link; and; 4) the absence of any causal link.

Our empirical findings based on the Toda-Yamamoto Granger causality test clearly suggest identical results for the first two set periods, namely the entire block period of 1970-2002 and

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[5] According to Pindyck and Rubinfeld (1991) it is best to run the test for a few different lag structures and make sure that the results are not sensitive to the choice of the lag length.

the pre-SAP period of 1970-1983. In both cases there was no evidence of either Growth-driven FDI or FDI-led growth. Concerning the results for the post-SAP period, i.e. 1984-2002 where the economy has enjoyed a relative political stability and economic focus, we found out evidence of FDI-led growth. Thus FDI has been improving GDP growth of Ghana. The study, however, still failed to confirm Growth-driven FDI, i.e. GDP growth in Ghana has not been attracting FDI inflows.

The fact that Growth-driven FDI was not identified in any of the three set periods clearly shows that economic growth is just a necessary, but not a sufficient condition to attract FDI inflows. It is therefore very important to pay increased attention to the overall role and the quality of growth as a vital determinant of FDI along with the quality of human capital, infrastructure, institutions, governance, legal framework, ICT, tax systems, etc., in Ghana. In consequence, the provision of an enabling environment that captures the above listed parameters would provide a better incentive to attract FDI inflows than the usual piecemeal approaches such as petitioning via investment tours, organization of trade-expos and myriad special initiatives aimed at attracting specific investments into the country.

The absence of FDI-led growth in the pre-SAP as well as the entire block periods can also be explained. Firstly, FDI inflows to the country have generally been very minimal probably under the threshold that can generate the needed growth impacts. Secondly, that over 70% of FDI inflows to Ghana has gone into the mining sector (Ibrahim, 2005). Given the structure of the Ghanaian economy and the fact that the mining sector is not capable of creating the necessary linkages that could fuel the growth process of the economy, it is generally

acknowledged that much of the inflows rather have to be directed into the manufacturing and agricultural sector if the economy is to gain the full benefit of FDI inflows.

Finally from our findings the conservative view that the direction of causality runs from FDI to economic growth is confirmed in the case of Ghana since the structural adjustment programme (SAP). This lends support to the validity of policy guidelines which emphasize the importance of FDI for growth and stability in developing countries under the assumption of 'FDI-led growth'. Understanding the direction of causality between the two variables is crucial for formulating policies that would encourage more private investors in Ghana, especially in the era of '*the golden age of business*es' declared by the current government.

Future research in this area should analyze the causal link in a multivariate VAR system to take account of other vital determinants of FDI and GDP growth. This is likely to improve upon our results and may even provide more sturdy conclusions.

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