

Causality Analysis of Foreign Direct Investment, Exchange Rate and Interest Rate Volatility in Ghana

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Abstract

Increasingly, Foreign Direct Investment is assuming a prominent role in the development and growth strategies of developing and emerging countries. Using a Vector Autoregressive (VAR) model, this study demonstrates theoretically that exchange rate volatility have an impact on Foreign Direct Investment. It then provides an empirical illustration of the bias this endogeneity can cause when regressing measures of exchange rate volatility on foreign direct investment. It is a detailed study that uses pairwise granger causality test. The study also establishes that a stable exchange rate improves Foreign Direct Investment inflow into the country and likewise a high FDI inflow improves stability of exchange rate in the country. It also demonstrates that interest rate volatility directly affects exchange rate and market attractiveness which then affects Foreign Direct Investment in the long run. The paper therefore concludes that government should implement policies that will stabilize both the exchange rate and the interest. The study therefore suggests policies that will improve FDI inflows.

1. 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 2004).

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 linkages in the production chain when foreign firms buy locally made inputs from local firms. Furthermore, inward FDI can increase its foreign exchange earnings, provide job opportunities and is also a source of both physical and human capital accumulation and finally FDI through taxes generates revenues needed by governments for infrastructure development.

Since Ghana changes its currency from the Pounds Sterling to the Cedi, the country's cedi has continually depreciated against major currencies like U.S dollar and the British pounds. The continual fall in the value of the Ghana Cedi, coupled with changes in Ghana's foreign policies caused a lot of political instability since independence (Olajide 1975). Even the various political Parties in the past sixteen years of democratic environment still talk about macroeconomic stability as one of their major economic objectives. For Africa to reduce poverty, then the issue of attracting FDI should be a major economic policy (ibid UNCTAD 2004), successive governments being aware of this situation always try to attract FDI through tax exemptions, privatization and removal of trade restrictions. However, what they have failed to consider is whether there exists a relationship between FDI inflows and macroeconomic stability. It is in this light that this study is conducted to verify if actually there is a casual relationship between stability of macroeconomic variables (specifically exchange rate and interest rate) and FDI inflows. This study will therefore add more to literature by showing the relationship between volatility of exchange rate, interest rate and FDI inflows.

Even though, policy makers believe that FDI is the single largest source of capital inflows for a developing country like Ghana, surprisingly the impact of exchange rate on foreign direct investment rarely enters debates over exchange rate management or monetary policy. One reason for this omission could be the lack of conclusive evidence regarding the impact of exchange rate on investment behavior of multinational firms. Various studies provide evidence that multinational firms are likely to consider the level and volatility of exchange rates before investing in overseas branches, but all these studies have yielded conflicting theoretical prediction and empirical results. The relationship between volatility of interest rate and exchange rate is also considered, as diverse research in various countries show that interest rate variability affects exchange rate variability which in turn affects foreign direct inflows. This study will therefore concentrate on the dynamic interlinks between foreign direct investment, volatility of exchange rate and interest rate in Ghana. Hence, this study would indicate if policy makers should include exchange rate and interest rate in their policy implementations as they try to implement policies that would influence the attraction of FDI inflows. The analysis will actually cover the period 1970 – 2005. The choice of this period is motivated by availability of data. However, having outlined the importance of FDI as the mainspring to reduce poverty in Ghana (ibid UNCTAD

2004), Policy makers give less attention on the effect of exchange rate volatility on FDI. It is therefore difficult to tell whether the improvement of FDI in the past few years had been a result of the stabilization achievement within the period or there had been no correlation between these variables as other studies have also proven. It is in this light that the study seeks to verify if actually exchange rate and interest rate which were pegged during the pre – SAP period to prevent them from being volatile have effect on FDI. The study will analyze the direction of FDI inflows into the country in relation to the direction of exchange and interest rate in the country.

The main objective of this study is therefore to determine whether interest rate volatility affects exchange rate volatility which in turn affects the volume of foreign direct investment inflows into the country. This objective is achieved by testing the following hypothesis

- (1) A stable exchange rate period will have a positive influence on FDI inflows
- (2) There is a bi – directional relationship of interest and exchange rate volatility on FDI

Data is retrieved from the IFS CD – ROM, World Bank CD – ROM, Ministry of Finance and Economic Planning, Internal Revenue Service (IRS), Ghana Statistical Service (GSS), Ghana Investment Promotion Council (GIPC) and the Customs Excise and Preventive Service (CEPS).

2.1 Overview of FDI before and after introduction of SAP in Ghana.

Foreign direct investment (FDI) inflows to low-income countries has not only received much attention in the past two decades due to its economic importance, but its overall flow to these countries have 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. Africa's share in the worlds' FDI inflows rose from one percent in 2000 to two percent in 2001 (UNCTAD 2002), with greater share going to the resource rich countries as Angola, Algeria, Egypt, South Africa and Nigeria.

Ghana has a checked history of political and economic development which reflects in the erratic inflows of FDI with respect to changes in political and policy regimes and uneven growth patterns. Since the early 80's, Ghana had to implement several economic reform policies such as the structural adjustment program in 1983 and recently the enhance Highly Indebted Poor Countries (HIPC) initiatives (Ibrahim 2005). These policies were primarily adopted to reverse the post-independence economic decline but also to reduce the impact of the 1980 debt crisis and, facilitate the attraction of value-added FDI inflows to Ghana. Several quantitative analyses available to us reveal that, adoption of the SAP, the main economic reform programme, has led to an increase in the number of multinationals who have invested in Ghana. Other studies have also concluded that Ghana's SAP has recorded some degree of successes in many areas, including the lowering of inflation, promotion of environment of financial stability, elimination of licensing requirement; the opening of previous closed sectors, removal of tariff barriers that prohibit FDI inflows; abolishing exchange rate controls and reduction in the opportunities of foreign exchange rate black market (U.S library of congress 1988). In spite of these 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 in Ghana had been shown in three main phases since 1983 (Tsikata et. al 2000). The period 1983-1988 witnessed sluggish inflows, averaging about \$ 4 million per annum, with the highest and lowest inflows during the period being \$6 million in 1985 and \$ 2 million in 1984 respectively. The period between 1989-1992 recorded moderate inflow averaging about \$8 million per annum, the highest and lowest being \$22 million in 1992 and \$14.8 million in 1990 respectively. From 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. However, the GIPC quarterly report in January 2007, volume 2; issue 4; also tells us that in recent years, wholly foreign-owned businesses have steadily improved their share in registered projects from 30% in 1994 to 61% in 2006. The report continues that, FDI contents in investment projects have remained high (in excess of 75%) over the years as this could be an indication of investors' confidence in the Ghanaian economy, an attribute that has gained ground in recent times.

2.2 Ghana's currency and exchange rate history from 1957 to 2007

Although Ghana gained political independence in 1957, it was not until 1965 that it initiated an action to have its own currency, the Cedi. Hitherto, Ghana's currency was the Ghana pound with shillings and pennies as the minor units. The Ghana pound, £G, exchanged at par with the pound sterling of the United Kingdom, and was equivalent to US\$2.80.

Reinforcing the need not to tie financial development to export development, and thus the need for a Central Bank for Ghana to be able to issue fiduciary currency and to make money a productive factor in economic development, Kwame Nkrumah argued that

“ In the modern world, a central bank plays a very important and decisive role in the life of a country. It is of absolute and paramount importance that a central bank should be set up. It is essential to our own independence that we have a government-owned bank and that the central bank follows a policy designed to secure our economic independence and to further the general development of our country”.(Nkrumah 1961).

On July 19, 1965, Ghana's currency was decimalized and called the cedi and made equivalent to 100 old pennies. At this stage however, it was merely a name change without an alteration in the external value of the currency, and the cedi was equivalent to US\$ 1.17. Then on February 23, 1967, the currency unit was consequently referred to as New Cedi, was exchanged for the old Cedi at a rate of N ¢ = ¢ 1.20. Since there was a pro rata change in the external exchange rate, the effective foreign exchange price of the New Cedi remained unchanged. The exchange rate of the New Cedi against the US dollar became N ¢ 1=US\$ 1.40 or N ¢ 0.71=US\$ 1. This is the currency whose exchange rate is the subject of proposed study. The first phase, between 1967 and 1982, was the gradual reduction in convertibility in a fixed exchange rate regime, and removal of convertibility of the US dollar within a quantity-controlled regime.

The first phase, 1967-1983 was characterized by a fixed exchange rate. the table below shows the exchange rate of the cedi to the US dollar.

Table 2.1 Exchange rate of the Cedi to the US dollar

Year	Cedi-Dollar	Year	Cedi- Dollar	Year	Cedi-Dollar	Year	Cedi-Dollar
1960	0.71	1972	1.28	1984	50.00	1996	1754.39
1961	0.71	1973	1.15	1985	60.00	1997	2272.73
1962	0.71	1974	1.15	1986	90.00	1998	2325.58
1963	0.71	1975	1.15	1987	176.00	1999	3535.14
1964	0.71	1976	1.15	1988	229.00	2000	7047.65
1965	0.71	1977	1.15	1989	303.89	2001	7321.94
1966	0.71	1978	2.75	1990	344.83	2002	8438.82
1967	1.02	1979	2.75	1991	390.63	2003	8852.32
1968	1.02	1980	2.75	1992	520.83	2004	9054.26
1969	1.02	1981	2.75	1993	619.67	2005	9130.82
1970	1.02	1982	2.75	1994	1052.63		
1971	1.82	1983	30.0	1995	1449.28		

Source: Bank of Ghana records and Ghana Statistical Service, Accra.

The next phase, covering the 1983-1990 period was characterized by fixed with adjustable pegs, and partial removal or restrictions on capital account transactions under IMF supported stabilization programmes. The third phase, starting with the introduction of inter-bank market transactions in 1992 continued until the present, is also characterized by a flexible exchange rate regime where supply and demand factors ostensibly determine the exchange rate, and the monetary authorities seem not to intervene in the market.

Ghana operates a free-floating exchange rate policy regime. There are no restrictions on conversion and transfer of funds provided there is documentation to prove the source of funds. Ghana's local currency, previously the Cedi, can be exchanged for Dollars and major European currencies. The exchange rate for January 2005 was around 9, 130.82 Cedis per USD and the largest bill was 20,000 Cedis.

2.3 Theories and empirical evidence of effects of bilateral exchange rate (or volatility of exchange rate) on FDI

Impact of exchange rate on FDI can be explained by two principal effects. The first is the changes in volatility of exchange rates and the second is changes in the bilateral level of the exchange rate between countries. Froot and Stain (1991) presented a view of an imperfect capital market, showing why country's currency appreciation may actually increase foreign investment by a firm. This view was however in contrast to an earlier existing believe that the exchange rate would not alter the decision by a firm to invest in a foreign country. Froot and Stain(1991) analyzed how exchange rates through the imperfect capital market affect FDI. The key contribution provided by Froot and Stain (1991) is a parsimonious model based on informational imperfections that generate a link between economywide FDI and aggregate variables, such as the real exchange rate. They conducted a simple statistical test within the period under consideration which suggested that, a 10 percent dollar depreciation was associated with additional FDI inflows of about \$5 billion. Moreover, they argued that the correlation was not just a recent development, once one accept that there is a link between wealth positions and investment, the relationship between exchange rate and FDI follows immediately. This means foreigners will hold more of their wealth in non-dollar denominated form; a depreciation of the dollar would increase the relative wealth position of foreigners and hence lower their relative cost of capital.

Blonigen (1997) also studied inward FDI on Japanese economy when exchange rate changes. He however explained different processes whereby changes in exchange rate affect FDI for a host of countries. The objective of his research was to test the assertion that a depreciated of a country's currency may allow increase in sale of such transferable assets to foreign firms operating in global markets versus domestic firms that may not have such access. He used industry-level on Japanese mergers and acquisition FDI into the U.S to test this objective. His studies found a strong support of increased U.S acquisition FDI by Japanese firms in response to real dollar

depreciations relative to the YEN as predicted Blonigen found that this exchange rate effect the acquisition FDI where primarily for high technology industries where firms' specific assets were likely of substantial importance. Numerous studies have found consistency in short-run movement in exchange rates and its impact on inward FDI. Grubert and Mutti (1991) Swenson, and Kogut and Chang (1996) all have their empirical evidence supporting the hypothesis of Blonigen (1997), and Froot and Stein (1991).

Some researchers however had an opposing view to Blonigen (1997) and Froot and Stein ideas of exchange rates on FDI inflows. Campa (1993) used the options theory of Dixit (1989) to establish why greater exchange rate uncertainty increases the options for firms to wait until investing in a market and thereby depressing the current FDI. The objective of the paper was to test whether firms expanding to the US market deterred their investments to enter that market during the 1980's due to fluctuations of the U.S real exchange rate. They assumed that a firm had to incur an investment of a certain amount in U.S dollars to enter that market. That investment is sunk and cannot recover upon exit. The firm entering the market was assumed to be risk neutral. More so, it faced a certain price in U.S dollars but its returns in home currency fluctuate due to an uncertain bilateral exchange rate. They also assumed that the firms have two-year perfect forecast expectations of the ex-post value of the exchange rate for the next 2 years. They used a two-year static expectation and assumed that firms take the behavior of the exchange rate in two years previous entry as the appropriate estimate of the future. The exchange rate expressed in units of foreign currency per dollar, followed some sort of stochastic processes. The stochastic process for the exchange rate is known by the producer. The data used in the analysis consisted of a panel based on 61 U.S. wholesale trade industries for the period 1981 to 1987. The exchange rate variables were computed using monthly data. In order to make all bilateral exchange rates comparable they computed exchange rate indexes taking 1980 as the base year. In both cases they realized that the standard deviation of the exchange rate had a significant negative effect on the level of entry in the industry. Therefore, a higher level of uncertainty decreased the number foreign firms entering the U.S. market. This therefore indicates that the level of the exchange rate has a significant positive effect as expected, and this was different from the negative relationship of Froot and Stein (1991).

Arbensee (2007) studied the impact of inward FDI on Ghana using general equilibrium analysis. He focused his analysis on the impact of a surge in FDI inflow and commercial trade policy simulations on the welfare of households and selected macroeconomic indicators in Ghana prior to 1980. Final domestic demand for output of a sector was treated as private consumption demand. The domestic demand for the output of a sector was calculated as the sum of the domestic intermediate demand plus domestic consumption demand. He also assumed that all consumers have identical preferences so that behaviour is modeled by a "representative" consumer. The method of analysis used is a counterfactual simulation, implemented in general algebraic modeling system (GAMS). The paper assessed their impact using a computable general equilibrium (CGE) model for the Ghanaian economy. This was some of his findings; exchange rate depreciated which caused exports to increase. This led to improvement in the trade deficit causing it to decline by some percentage points. He also found out that, if tariff levels are reduced, domestic demand for import would be increased thereby raising domestic import. In currency terms, quantity of domestic currency would shoot up thereby causing the currency to depreciate. There would be a multiplier effect on exports as a result of the depreciated currency, the demand for exports would go up causing a rise in export levels and subsequently a reduction in trade deficit. The paper revealed that a policy that ensures increase in FDI inflow and that which reduces tariff levels were complementary policies that enhance household welfare in Ghana. The model could not however explain the different degree of impact on the different household groups. This was because the disaggregation of the households in the model was not based purely on income category. However a typical Ghanaian household consist of more than one income categories, that is it was common for urban civil servant to generate additional income elsewhere (e.g. income from rent) than relying only on income from employment. Even if income was only generated from employment, it was worth noting that in a typical Ghanaian household there may be more than one individual who was an active member of the labour force.

2.4 theories and empirical evidence of the effects of interest rate (or volatility of interest rate on FDI

Although there are few theories that explain effects of interest rate volatility on FDI, there are quite a number of theories that explain how net present value (NPV) affects the decisions of foreign investor, Tobin also showed how interest rates affect the decision of investors in his Tobin-q analysis.

The "text book" decision rule for firm investments has historically been based on cost-benefit analysis: invest in a project when the present value of inflows exceeds its costs; if alternatives are mutually exclusive, the firm should maximize NPV. In the late 1970's, however, this rule began to be modified with references to options theory. Often, an investment today buys options to invest later, and the analyses of such an investment must account for the value of these options. In brief, projects that have negative NPVs on stand-alone basis may have positive NPVs once the value of options purchased is included. The issue of FDI timing has received relatively little attention. Buckley and Casson (1981) showed that the switch from one mode of market servicing to another (e.g. form licensing to FDI) should not necessarily be made as soon as its NPV is positive. NPV may be

maximized by deferring the switch. Unlike recent theory, which is derived from option values and uncertainty, their model is driven by the relationship among different costs and market growth.

The work of Klein and Rosengren (2002) on the role of relative access to credit and its effect on FDI is noteworthy. They researched into why Japanese firms into the United States were declining while FDI by other countries into the United States was rising. The focus of the study was to examine the possible link between FDI in the United States by Japanese firms and the health of the respective firms' main bank in Japan. The dependent variable which they chose to be the first difference of FDI was obtained by first collapsing the firm-level data set, in which each observation was represented as the number of FDI projects by an individual firm in a particular year. The focus on the first difference of FDI was to capture how changes in the financial conditions of the banks influence changes in FDI patterns by firms associated with those banks. They estimated each equation using ordinary least squares (OLS), with robust standard errors calculated by relaxing the assumption of independence of the observations for a given year. They finally applied panel data on the various banks linking FDI by firms to their main bank.

Thus, they provided evidence of the real effects of a loan supply shock, since Japanese firms that relied on the most troubled banks were less likely to engage in FDI into the United States, controlling for the profitability and stock valuation of the firm. It was shown that firms' ability to raise external financing was impaired by the deteriorating financial condition of Japanese banks, so that FDI declined most for firms that were reliant on the most troubled Japanese banks. These strong relationships between firms and banks of Japan, was generalized for Japanese FDI to the rest of the world, but they commented that the analysis was based on Japan and U.S because data were available that enable them to construct a unique data set ideally suited for testing RAC. Evidence based both on bank-level panel data linking FDI by firms to their main bank and on a panel data set of individual firms strongly support the RAC hypothesis, indicating a statistically and economically important relationship between bank health and the ability of Japanese firms to invest in the United States. Russ (2007) paper of exchange rate volatility and first-time entry by multinational firms, found out that, source country interest rate volatility for instance, pushes up the foreign price level, which increases the one-time upfront co-ordination costs of transferring technological and management know-how to a new country for the first time. Her findings on interest rates were not different from Klein and Rosengren (2002) on the health of banks and its investors.

From the literature, most of the studies conducted in the advanced world suggested that depreciation of the local currencies led to a more FDI inflows (Froot and Stein 1991). Campa (1993), Koldstad (1995) and others however had different views to Froot and Stein (1991). Giving these mixed findings concerning exchange rate depreciation or stability in attracting FDI inflows, it could be seen from their studies that, their outcomes depended on the methodology used. Most of the studies talks about investors more concerned about the sunk cost they would incur and profit they would make, therefore exchange rate and interest rate stability will reduce the investment risk of these investors and hence they will be happy to invest in such environment. The next two chapters will use data from Ghana to ascertain whether the Ghanaian case supports Froot and Stein (1991) or Campa (1993) and Koldstad (1995) or no such relationship exists between the three variables under consideration.

3.1 Background to the choice of econometric model

Economists frequently formulate an economically well-specified model as the empirical model and apply statistical methods to estimate its parameters. In contrast, statisticians might formulate a statistically well-specified model for the data and analyze the statistical model to answer the economic questions of interest. In the first case, statistics are used passively as a tool to get some desired estimates, and in the second case, the statistical model is taken seriously and used actively as a means of analyzing the underlying generating process of the phenomenon in questions. The general principle of analyzing statistical models instead of applying methods can be traced back to R.A Fisher. It was introduced into econometrics by Haavelmo (1944). This is useful since few observed macro economic variables can be assumed fixed or predetermined a priori.

Most of the empirical literature noted above attempted to analyse exchange and interest rate volatility effects on FDI using other econometric framework like the structural equation framework, OLS and general equilibrium analysis assuming implicitly or explicitly variables stationarity and ergogeneity. The assumption of stationary variables appears to be troublesome in view that, macroeconomic data usually exhibit unit root.

Simultaneity bias or endogeneity problem may also raise special concern in investment, interest rate and exchange rate. In this regard, we may exemplify by pointing out a potential endogeneity on the part of the two variables commonly featured on the right-hand side of investment equations; exchange rate and interest rate volatility. While the whole of the multiplier analysis rests on the behavioral relationship where exchange rate and interest rate variability affects FDI. The reverse of FDI affecting exchange rate and interest rate through economic growth provides a battle ground and controversies since there is no strict economic theory for these relationships.

Endogeneity and non stationary problems may be overcome by adopting a system of equations such as the vector

autoregressive (VAR) system, modeling technique introduced in the seminal work of Sim (1980). The central feature characterizing the VAR technique is that it poses less restrictive structural modeling as it reduces the a-priori endo-exogenous division of variables; all variables entering equations can assume to be endogenous. Although VAR modeling poses the problem that it underlies no strict economic theory since all variables affect, and in turn being affected by all variables, it can provide an economically meaningful relationships when combined with causality analysis. Granger causality test is one of the most interesting and widely used VAR applications. The intuition behind it is simple: if previous values of variable X significantly influence current values of variable Y, then one say X causes Y. the methodology employed in this study blends different, yet related concepts underlined above. Co-integration analysis is combined with either VAR technique to account for problems of nonstationarity and endogeneity in order to estimate relevant coefficients and parameters that describe long-run and short-run interactions of FDI, exchange rate and interest rate.

3.2 Choice variables for model estimation

In estimating the model, bilateral exchange rate will be considered and the chosen currency will be the U.S dollar. This is because, it is the commonest foreign currency traded in the various foreign exchange markets in Ghana over the period under consideration. More so, the GIPC 2006 fourth quarterly report classified all investment projects on the Ghanaian economy into various countries, the U.S economy was the fifth largest that invested in the country. However, the first, second and fourth largest countries that invested in were India, china and Lebanon respectively, investors from all these countries have to convert their currencies into U.S dollars before they can invest in the Ghanaian economy. Hence the market rate of the Ghanaian cedi to the U.S dollar is an appropriate exchange rate to use to calculate the volatility of the exchange rate.

The measurement of exchange rate volatility is similar to those used in much of the literature. The volatility variable VOLAT is constructed for a given year as a sample “standard deviation” of the change in the logarithm of the nominal average monthly exchange rate (E):

Equation 3.1

$$VOLAT_Y = \left[\frac{1}{m} \sum_{i=1}^m (E_{t-i-1} - E_{t-1})^2 \right]^{\frac{1}{2}}$$

Where $m=11$ and Y is a yearly time index in the case of Ghana. Interest rate volatility is similarly measured, the only variable to be changed in the equation to represent E which is the logarithm of the nominal average monthly exchange rate with R which is the logarithm of the nominal average monthly interest rate.

The prime rate is used as a proxy for the nominal lending rate when considering volatility of interest rate. This is because data on nominal lending rate for the period under consideration could not be attained. However correlation test between the prime rate and the few lending rate years attained from world-bank CD-ROM shows that the two variables are highly positively correlated. Per capita income is used as a proxy for market attractiveness and (export + import)/ GDP is also used as a proxy for trade openness. Finally, FDI inflow proceeds (measured in US dollars) will be used as a measure of foreign direct investment inflows that occurs in the country.

3.3 VAR model and co-integration analysis

The VAR model for the system is expressed as;

Equation 3.2

$$FDI_t = A_1 D_1 + \sum_{i=1}^n a_{1i} E_{t-i} + \sum_{i=1}^n b_{1i} R_{t-i} + \sum_{i=1}^n c_{1i} FDI_{t-i} + \sum_{i=1}^n d_{1i} M_{t-i} + T + \varepsilon_{1t}$$

$$E_t = A_2 D_2 + \sum_{i=1}^n a_{2i} E_{t-i} + \sum_{i=1}^n b_{2i} R_{t-i} + \sum_{i=1}^n c_{2i} FDI_{t-i} + \sum_{i=1}^n d_{2i} M_{t-i} + T + \varepsilon_{2t}$$

$$R_t = A_3 D_3 + \sum_{i=1}^n a_{3i} E_{t-i} + \sum_{i=1}^n b_{3i} R_{t-i} + \sum_{i=1}^n c_{3i} FDI_{t-i} + \sum_{i=1}^n d_{3i} M_{t-i} + T + \varepsilon_{3t}$$

$$M_t = A_4 D_4 + \sum_{i=1}^n a_{4i} E_{t-i} + \sum_{i=1}^n b_{4i} R_{t-i} + \sum_{i=1}^n c_{4i} FDI_{t-i} + \sum_{i=1}^n d_{4i} M_{t-i} + T + \varepsilon_{4t}$$

Where M is market attractiveness, T is trade openness, R is interest rate volatility and E is exchange rate volatility. However, T is treated as exogenous variable since the decision of a country to employ liberalization lies within the policies of the country and therefore FDI can not affect the country's tax policies on trade. $\varepsilon_{1t}, \varepsilon_{2t}, \varepsilon_{3t}, \varepsilon_{4t}$ are uncorrelated white noise. The determination of the lag length of the model will also depend on efficiency criterion (like the Akaike Information Criterion (AIC) and the Swartz criterion (SBC) of the model which is estimated at different lag length). Finally Granger Causality test will be applied on the VAR to look at the causal relationships between the variables.

4.1 Unit Root test using ADF estimation method

Testing for unit roots in data conventionally precedes co-integration analysis. Augmented-Dicky Fuller (ADF) test is employed to determine the degree of integration of variables. We run ADF test equation;

$$\Delta y_t = \alpha + \beta T + y_{t-1} + \sum_{i=1}^k \lambda_i \Delta y_{t-1} + \mu_t$$

The number of k lags removes any serial correlation in the variable, however too much of the k lags removes the efficiency of the ADF estimation.

A series of test is run with different lags introduced and also changing of the deterministic component in the ADF equation with E-Views. Both the Akaike information criterion (AIC) and Swartz information criterion

(SBC) helps us to select the best lag length for the ADF model. The result of the ADF test is reported in the table 1 below. From the table, k represents the number of lags that makes the model efficient from the values obtained from the AIC. LFDI and LM respectively show log of FDI and log of Market attractiveness. DLFDI, DVOLTE, DVOLTI, DT and DLM respectively show first difference of LFDI, VOLTE, VOLTI, T and LM.

Table 4.1: Unit Root test using ADF procedure

Variable	K	ADF	Deterministic term	AIC critical values
LFDI	3	-0.68	No trend but intercept	-3.64(-2.95)
D(LFDI)	3	-3.89**	No trend but intercept	-3.64(-2.95)
VOLTE	1	-2.99**	No intercept and no trend	-2.63(-1.95)
T	1	-1.09	No trend but intercept	-3.64(-2.95)
D(T)	1	-2.96**	No trend but intercept	-3.64(-2.95)
VOLTI	4	-2.58	No trend but intercept	-3.66(-2.96)
D(VOLTI)	4	-3.46*	No trend but intercept	-3.67(-2.97)
LM	1	-2.55	No trend but intercept	-3.64(-2.95)
DM	1	-4.35**	No trend but intercept	-3.64(-2.95)

(**) represents 1%(5)% significance level respectively

(*) represents 5% significant level

For VOLTE, T & LM, lag length of 1 yielded the best efficient model given the values of AIC and SBC. For the case of FDI, lag length of 3 gave the best AIC selection lag while lag length of 4 was the best lag for VOLTI. The ADF test equation for all except VOLTE depended on intercept but no trend as a deterministic component of the model. However the test equation that yields an efficient equation for VOLTE does not consider determining component.

From table 4.1, it is seen that all the variables except VOLTE are integrated of order one. Both T and VOLTI are significant under five percent significant level while the ADF test statistics for VOLTE, LFDI and M shows one percent significance level. The graphs of the series provided in the appendix affirm the deterministic components that are used in the ADF test equation. The presence of unit root for four of the variables justifies the adoption of VAR modeling technique. Technically, endogenous variables under VAR system are explained by the lagged values of the variables and lagged values of all other variables in the system.

4.2 Choice criteria for the selection of the order of the VAR model

In trying to estimate the VAR model, it is very prudent to consider the best lag length that makes the model more efficient. The Log L, AIC, SBC, LR, FPE and HQ are presented as follows:

Table 4.2: Test statistics and choice criteria for selecting the order of the VAR model

Lag	Log L	LR	FPE	AIC	SBC	HQ
0	5.2841	NA	0.0001	-0.2076	-0.0589	-0.1726
1	29.9511	40.3641	3.97e-05	-1.6319	-1.0368*	-1.4917
2	37.2082	9.8960	4.93e-05	-1.4739	-0.4320	-1.2281
3	45.6765	9.2382	5.99e-05	-1.4245	0.0627	-1.0779
4	52.5817	5.6498	9.91e-05	-1.2347	0.6994	-0.7791
5	79.4403	14.6501	3.72e-05*	-2.8582*	-0.4778	-2.2974

* indicates lag order selected by the criterion

LR=sequential modified LR test statistic (each test at 5% level)

FPE=final prediction

AIC= Akaike information criterion

SBC= Schwarz information criterion

HQ= Hannan-Quinn information criterion

AIC, SBC, HQ, FPE, information criterion and LR test statistic is used to select the optimum lag length of the VAR (k). Various VAR estimations with different lags were estimated, the LR test and the SBC information criterion selected VAR estimation with one lag while the FPE, AIC and HQ information criterion selected VAR estimation with five lags suggested by FBE, AIC and HQ information criterion. The one lag VAR system is preferred to the five lag VAR system in order to save some degrees of freedom.

From table 4.2, it is realized that LR test keeps on falling from 40.3642 till it reaches a minimum of 14.6501 at lag 5 and the LR test select lag 1. The magnitude of FPE falls from no lag to one and starts to increase from one lag to lag 4. The FPE then falls again at lag 5; it selects this lower magnitude at lag 5. The AIC also alternates in magnitude and absolute terms as well as selecting higher absolute magnitude lag length of 5. Similarly SBC select lag length of 2 which gives a higher magnitude of 1.0368 in absolute terms. HQ also selects a higher magnitude of 2.2974 in absolute terms at lag 5. Higher AIC, SBC, FPE and HQ information criteria gives indication of how efficient the estimated VAR will be. Hence these selection criteria reported by E-Views show that either lag length one or five makes the VAR model efficient. As earlier said VAR (1,1) is selected to save more degrees of freedom. AR root test which is not reported shows that no root lies outside the unit circle. Hence

VAR (1,1) satisfies the stability condition.

4.3 Long-Run Weak Exogeneity and Granger Causality

The study adopted the pairwise Granger Causality test reported by E-Views. For each equation in the VAR, the output displays χ^2 (Wald) statistics for the joint significance of each of the other lagged variables in that equation. The results of the Granger Causality test are reported in table 4.3 below.

From the results, the null hypothesis that volatility of interest rate does not granger cause FDI was rejected for the entire sample period. However the remaining null hypotheses over the same sample period were not rejected. A test for Pre-SAP period is conducted and it shows that volatility of interest rate Granger Cause FDI, again the rest of the hypothesis were not significant under 5% level and therefore were not rejected. Finally a test for Post-SAP period shows that, none of the variables Granger Cause the other variable at 0.05 level.

Overall, volatility of interest rate is significant at 5% for both overall sample and Pre-SAP period; hence volatility of interest rate can be assumed to be weakly exogenous. Volatility of exchange rate is insignificant for both entire sample and Pre-SAP period and the null hypothesis that volatility of exchange rate does not Granger Cause FDI can only be rejected at 10% significant level for Post-SAP period. Hence volatility of exchange rate must be treated as endogenous variable. FDI is insignificant for all the variables and hence must be treated as endogenous variable in the model.

Table 4.3: Pairwise Granger Causality test.

Causality analysis	$\chi^2(1)$	Prob.
1970-2005		
VOLTE \nRightarrow FDI	2.5909	0.1173
VOLTI \Rightarrow FDI	7.6188	0.0095
VOLTI \nRightarrow VOLTE	0.7901	0.3810
FDI \nRightarrow VOLTE	0.6646	0.4210
FDI \nRightarrow VOLTI	1.0116	0.9148
VOLTE \nRightarrow VOLTI	0.3992	0.5320
1970-1983		
VOLTE \nRightarrow FDI	0.8944	0.3646
VOLTI \Rightarrow FDI	6.2912	0.0291
FDI \nRightarrow VOLTE	0.0141	0.9076
VOLTI \nRightarrow VOLTE	0.5595	0.4702
FDI \nRightarrow VOLTI	1.8030	0.2064
VOLTE \nRightarrow VOLTI	0.8212	0.3843
1984-2005		
VOLTE \nRightarrow FDI	10.4750	0.0641
VOLTI \nRightarrow FDI	2.6618	0.1184
FDI \nRightarrow VOLTE	0.8977	0.3547
VOLTI \nRightarrow VOLTE	0.0528	0.8207
FDI \nRightarrow VOLTI	0.1059	0.7483
VOLTE \nRightarrow VOLTI	0.6117	0.4433

\nRightarrow Means does not Granger Cause.

\Rightarrow Means Granger Cause

5. Conclusion

The causality analysis show that the future path of FDI can be explained by exchange rate only after the country liberalizes. This is economically meaningful, since before liberalization, the country was in a fixed rate regime and hence there was nothing like volatility of rates. The causality test suggests that exchange rate should be treated as endogenous variable in FDI determination while interest rate be treated as exogenous variable.

The study has been able to demonstrate that in FDI determination, exchange rate is an endogenous variable that depends on other factors. Thus a favourable FDI inflows will also lead to a stable exchange rate and thus it is proper for policy makers in attempt of trying to stabilize the exchange rate should also look at other measures that will increase FDI inflows since an increase in FDI in flow will in itself help to stabilize the exchange rate or reduce the level of volatility of the exchange rate of the country.

This finding is economically meaningful since a large part of the countries FDI are in the form of extraction of

natural resources. Although the proceeds of these FDI inflows may have negative effect on future generations if these proceeds are not managed well since most of these natural resources are non renewable, however the present generation benefit from these FDI inflows into the country since there is less importation of raw materials of such multinational corporations in their operations in the country but they however gives the nation a large export proceeds and hence reducing volatility of exchange rate in the country. The causality test suggests that interest rate is an exogenous variable. This is also economically meaningful since most of these MNCs does not borrow from the domestic capital market and thus an increase in FDI will not have any effect on the domestic interest rate in the short run.

In summary, one can therefore conclude from this study that the stabilization of the country's currency over the last five years is a step in the right direction to improve the inflow of FDI. Since the empirical evidence suggests that if the country is able to reduce the volatility of exchange rate and interest rate in the near future, FDI inflows will also be increase and as Frimpong (2005) and other researchers have found a positive correlation between FDI in Ghana and economic growth. The aim of policy makers to achieve a middle income status by the year 2020 may be a reality if the effect of exchange rate and interest rate in attracting FDI inflows are considered by monetary policy makers in their policy debates.

Future research should try to treat exchange rate as endogenous variable in estimating FDI determinant model. Future research should also consider the use of country specific data of FDI, so as to make application of panel data analysis possible in order to attain more robust results since FDI inflows into the country in recent years by the East Asian countries are on the increase. The effects of macroeconomic variables like exchange rate and interest rate on foreign direct investment inflows have little been researched into in Sub-Saharan African economies. Therefore this topic is an area rich for future studies and research.

References

- Arbenser, Lawrence, (2007), A General Equilibrium Analysis of the Impact of Inward FDI on Ghana. <http://www.issier.org/FDI%20on%20Ghana>
- Avinash, Dixit, (1989), Hysteresis, import penetration and exchange rate pass-through. *The Quarterly Journal of Economics*, 104: pp.205-228
- Blonigen, Bruce, A. (1997). Firm-Specific Assets and the Link Between Exchange Rates and Foreign Direct Investments. *American economic review*; 87(3); page: 447-465
- Buckley, Peter, J. & Mark C., S. (1981). The Optimal Timing of Foreign Direct Investment. *The economic journal*, vol. 91, no. 361; Page: 75-87
- Froot, Kenneth A. & Jeremy C., S. (1991). Exchange Rates and Foreign Direct Investment: An imperfect Capital Markets Approach. <http://www.jstor.org/stable/29737961>
- Grubert, Harry & John, Mutti, (1991). Taxes, Tarrifs and Transfer Pricing in Multinational Corporation Decision Making. *Review of economics and statistics*, 74(2): pp. 285-293
- Ibrahim, A. (2005). Sectoral Analysis of Foreign Direct Investment in Ghana. BOG Research Paper, Research Department, Bank of Ghana.
- Klein, Mathew W. & Eric, Rosengren S. (2002). Troubled Bank, Impaired Foreign Direct Investment: The Role of Relative Access To Credit. *The American Economic Review* 92(3),pp. 664-682.
- Kogut, Bruce & Sea, Jin, Chang, (1996). Platform investment and volatile exchange rate: Direct investment in the US by Japanese Electronic companies. *Review of economics and statistics* 78(2): pp 221-231
- Niles, Russ, Katherine (2007), Exchange Rate Volatility and First Time Entry by Multinational Firms. <http://www.econ.ucdavis.edu/faculty/knruss/ftentry.pdf>
- Olajide, Aluko, (1975), After Nkrumah: Continuity and change in Ghana's Foreign Policy. <http://www.jstor.org/about/terms.html>
- Sim, C., A. (1980). Macroeconomic and reality. *Econometrica* 48; page: 1-48
- Tsikata, G., K., Yaw, A., & Gyasi E. M. (2000). Determinants of foreign direct investment in Ghana. *Overseas Development Institute*
- UNCTAD, (2002), United Nation Congress on Trade And Development. Investment Policy Review of Ghana: <http://www.unctad.org>
- UNCTAD, (2004), Economic development of Africa: Rethinking the Role of Foreign Direct Investment. *UNCTAD/GDS/AFRICA/2005/1, United Nations, Geneva*
- U.S Library of Congress (1990). Country Studies. Ghana. <http://countrystudies/us/ghana>

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