Analysis of the determinants of foreign direct investment in Ghana

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Abstract

Purpose – The factors that determine foreign direct investment (FDI) are important to policy-makers, investors, the banking industry and the public at large. FDI in Ghana has received increased attention in recent times because its relevance in the Ghanaian economy is too critical to gloss over. The purpose of this paper is to examine the determinants of FDI in Ghana between the period of 1990 and 2015.

Design/methodology/approach – The study employed a causal research design. The study used the Johansen's approach to cointegration within the framework of vector autoregressive for the data analysis.

Findings – The study found a cointegrating relationship between FDI and its determinants. The study found that both the long-run and short-run results found statistically significant negative effects of inflation rate, exchange rate and interest rate on FDI in Ghana while gross domestic product, electricity production and telephone usage (TU) had a positive effect on FDI.

Research limitations/implications – The study found a cointegrating relationship between FDI and its determinants. The study found that both the long-run and short-run results found statistically significant negative effects of inflation rate, exchange rate and interest rate on FDI in Ghana whiles gross domestic product, electricity production and TU had a positive effect on FDI.

Practical implications – This study has potential implication for boosting the economies of developing countries through its policy recommendations which if implemented can guarantee more capital inflows for the economies.

Social implications – This study has given more effective ways of attracting more FDI into countries which in effect achieve higher GDP and also higher standard of living through mechanisms and in the end creating more social protection programs for the people.

Originality/value – Although studies have been conducted to explore the determinants of FDI, some of the core macroeconomic variables such as inflation, interest rate, telephone subscriptions, electricity production, etc., which are unstable and have longstanding effects on FDI have not been much explored to a give a clear picture of the relationships. Therefore, a study that will explore these and other macroeconomic variables to give clear picture of their relationships and suggest some of the possible ways of dealing with these variables in order to attract more FDI for the country to achieve its goal is what this paper seeks to do.

Keywords Cointegration, Determinants, Foreign direct investment, Autoregressive approach

Paper type Research paper

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1. Introduction
Foreign direct investment (FDI) is a vital ingredient in achieving sustained growth of any nation, including Ghana. FDI serves as a critical factor that helps to propel the economic growth of every nation (Coy and Comican, 2014). FDI is essentially an international investment where the investor gains significant influence in the management of an entity outside the investor's home country (Solomon, 2011). FDI under all circumstances has become an important force in the internationalization of investment activities in the global economy. For instance, the inflows of FDI globally totaled $1,114 bn in 2009 (UNCTAD, 2011).

The participation of developing countries in the total inflows of FDI has varied considerably over the last 25 years; increasing from 15 percent in 1980 to 46 percent in 1982, leveling off at slightly over 20 percent during the last four years. It must be pointed out, however, that the motives behind these international capital flows are still substantially different than those related to the inflows of FDI to developing countries, in spite of the changes that have taken place over the last decades. For example, the search for agricultural or mineral resources is much less important today than it was at the beginning of the twentieth century. On the other hand, the current movement of these flows is extremely complex, and is subject to a wide variety of factors related to the competitive environment in which the firms operate, to their specific characteristics and to economic factors in the home and host countries.

According to World Bank (2001), the past decade has witnessed a dramatic increase in FDI to developing countries; with FDI increasing from $24 bn (24 percent of the total foreign investment) in 1990 to $178 bn (61 percent of the total foreign investment) in 2000. This is good news, especially, for the countries that do not have access to international capital markets. However, Africa did not benefit from the FDI boom despite its efforts to attract FDI inflows. For example, from 1980–1989 to 1990–1998, FDI to Sub-Saharan Africa (SSA) grew by 59 percent. This compares disproportionately with high increase of 5,200 percent for Europe and Central Asia, 942 percent for East Asia and Pacific, 740 percent for South Asia, 455 percent for Latin America and Caribbean and 672 percent for all developing countries.

According to Gabriele *et al.* (2000), African countries increasingly adopt alternative strategies for mobilizing development finance. One notable strategy attempts to attract new inflows of FDI. They further indicated that this change in strategy reflects the following factors. First, both bilateral and multilateral lending institutions now focus more attention on transitional economies in Eastern Europe and emerging markets in Asia; thus depleting loanable funds available to African countries. Second, most African countries realize that debt service is a burden in their attempt to mobilize capital for domestic development projects. Third, excessive debt service burdens severely constrain the capacity of African Governments to provide quality social services (such as health, education and infrastructures) for the citizenry. Finally, their obligations to credit nations compromise the ability of these governments to act independently in the international political economy.

A number of domestic factors are important in attracting FDI to an economy. Autonomous increases in domestic money demand and increases in the domestic productivity of capital have been acknowledged by Ul Haque *et al.* (1997). Calvo *et al.* (1993) pointed out that improvement in external creditor relations, adoption of sound fiscal and monetary policies and neighborhood externalities are important for attracting FDI. Others included macroeconomic performance, the investment environment, infrastructure and resources and the quality of institutions. Chuhan *et al.* (1996) indicated that a stable macroeconomic environment improves credit worthiness and expands investment opportunities which in turn attract FDI. GDP growth rate and trade openness can be used to fuel the interest of foreign investors (Morisset, 2000). Bende-Nabende (2002) in a study using data on 19 SSA countries over the 1970–2000 showed that the most dominant long-run determinants of FDI in SSA were market growth, real effective exchange rates, market size and openness of the economy.

A FDI in Ghana refers to the monetary resources foreigners invest in companies or their subsidiaries listed on the Ghana Stock Exchange. Ghana's economy was poised for rapid growth through both domestic and external resources, especially foreign investment. The precedent already existed in the mining sector and in commerce and banking for enhancing the country's standing as a useful destination for FDI. After independence, major public investments were made in education (a number of Trust Secondary Schools and a third university at Cape Coast as well as the expansion of two existing ones), and in port facilities at Tema. The outstanding public investment, partly aimed at opening up the country for foreign investment, was the construction of the Akosombo Hydroelectric Dam (Tsikata *et al.*, 2000).

Despite the efforts by government to attract more FDI in the country, the results were not fruitful. In a bid to restore the trend, remedial policies were initiated to create an enabling environment for medium- and long-term growth. More specifically, in its Ghana Vision 2020: The First Step 1996–2000, the government identified its goal of formulating and implementing policies which would enable the attainment of a "middle-income country status and standard of living" by 2020. In part, this will entail a long-term average GDP growth rate of over 8 percent per annum and thereby increasing average real incomes fourfold. At the sectoral level, agriculture's share of GDP was projected to fall to below 20 percent, whilst that of industry was to rise to 37 percent by 2020. In the partial fulfillment of this "Vision," the government embarked on a vigorous program to promote the flow of FDI. Various delegations, headed either by President Rawlings himself or his top aides and cabinet members, toured Europe, North America and South and East Asia to increase FDI inflow.

The main motivation for this study stemmed from the fact that one of Ghana's development goals or aims is to push the country to become a higher middle-income earning country by the year 2020. This goal can only be realized if there is a high and sustainable rate of growth above 8 percent annually which can be aided by FDI in the country. Although studies have been conducted to explore the determinants of FDI, some of the core macroeconomic variables such as inflation, interest rate, telephone subscriptions, electricity production, etc., which are unstable and have longstanding effects on FDI have not been much explored to a give a clear picture of the relationships. Therefore, this study contributes to the literature by exploring the effects of telephone subscriptions and electricity production on FDI which has not been dealt with in Ghana using a different methodology (ARDL) to study the relationship between FDI and other macroeconomic variables to give clear picture of their relationships and to suggest some of the possible ways of dealing with these variables in order to attract more FDI for the country to achieve its goal is what this paper seeks to do.

Thus, as seen above, there seems to be a consistent fall of the inflow FDI in Ghana. For instance, according to International Monetary Fund, trend in FDI net inflow (percent of GDP) in Ghana can be seen in (Figure 1).

Base on the above trend, it is obvious that there is regular fall in FDI inflow in Ghana from 2008 to 2013 (except 2010 and 2011).

Currently, the major interest of Ghana is whether FDI can contribute to the aim of reducing poverty. This basically depends on how the inflows from FDI are spread among sectors, workers and households. Systematic evidence on the effects of FDI on income allocation and poverty in Ghana is lacking. Therefore, the general objective of the study is to investigate the determinants of FDI in Ghana over the period.

2. Literature review

2.1 Theoretical review

This portion indicates the theoretical underpinnings of the study. Specifically, the study reviews the product life cycle developed by Vernon (1996) and eclectic theory developed by Dunning (1993/2000), which explain the nature and the institution of FDI in the host country.

FDI

FDI

9.52   9.13

7.86   8.14   7.89

6.7

2008   2009   2010   2011   2012   2013
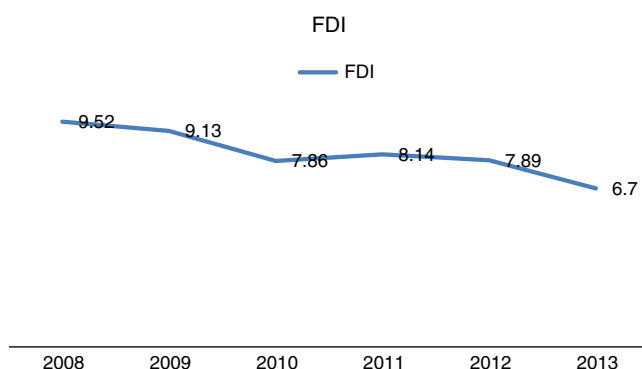
Figure 1.
Trend analysis of FDI
from 2008-2013

2.2 The product life cycle hypothesis

Vernon (1996) developed a theory of trade that attempted to explain the tendency for the production of new goods to be concentrated in the developed countries early in the life of the product, but to move to other economies later on. He also emphasized in his work that a firm tends to become multinational at a certain stage in its growth. He said in the early stages of product cycle, initial expansion into overseas markets is by means of exports. Because countries are at different stages of economic development, separated by "technology gap," new markets are available to receive new products through the demonstration effect of richer countries. Prior to the standardization of the production process, the firm requires close contacts with both its product market and its suppliers.

However, once the product has evolved in a standard form and competing products have developed, the firm may decide to look overseas for the lower cost locations and new markets. Here, it is not that factor inputs may be less expensive abroad but that considered scale economies from longer production runs may be obtained through the allocation of component production and assembly to different plants. The product cycle hypothesis is useful on several counts. First, it offers an explanation of the concentration of innovations in developed countries, and an integrated theory of trade and FDI. This theory helps to explain our argument that FDI inflows to any country depends on adequacy of some factors. Thus, the theory intends to address the apparent inadequacy of the comparative advantage framework in explaining trade and foreign investment and to concentrate on the issues of timing of innovation, effects of economies of scale and, to a lesser extent, the role of uncertainty. Product life cycle theory also seeks to explain how a company will begin by exporting its products and eventually undertake FDI as the product moves through its life cycle. Put differently, the theory indicates that a country's export eventually becomes its import and there are three stages in the life of a product, which are new product stage, maturing product stage and standardized product stage. With this, FDI occurs in the latter two stages (i.e. maturing product stage and standardized product stage).

2.3 Eclectic theory

This theory of FDI is suggested by Dunning (1993/2000) and it is often referred to as the OLI paradigm. The O, L, and I in the paradigm refer to three groups of conditions that determine whether a firm, industry or company will be a source or a host of FDI. These groups are ownership advantages, locational considerations and internalization gains. Ownership advantages are those advantages that are specific to the firm. The firm enjoys

such advantages over domestic as well as foreign competitors, so that expansion in the domestic market may be an alternative strategy. Such advantages include advantages in technology and in management and organizational skills, size and diversification, access to or control over raw materials, the ability to call on the political support of their government, access to finance on favorable terms, perhaps in foreign as well as domestic markets and the ease with which the firm can shift production between two countries.

Locational considerations encompass such things as transport costs facing both finished products and raw materials, import restrictions, the ease with which the firm can operate in another country, the profitability with which the ownership advantages may be combined with factor endowments in other countries, the tax policies in both source and host countries, and political stability in the host country.

Internalization gains concerns those factors which make it more profitable to carry out transactions within the firm than to rely on external markets. It is to be noted that such gains result from avoiding market imperfections (uncertainty, economies of scale, problem of control, the undesirability of providing full information to a prospective purchaser and so on). However, the existence of internalization gains obviously depends to some extent on the existence of ownership advantages. The essential element in the eclectic theory of FDI is that all the three types of conditions must be met before there will be FDI.

However, the eclectic theory provides no clear indication as to the relationship between trade and FDI flows. Ownership advantages, by themselves, imply less trade. If the firm invests due to ownership advantages, it is in place of exporting. Internalization, as already discussed, may lead to increased trade flows as different divisions import and export to other divisions along the verticalized process line. Location often implies a negative relationship. If FDI is chosen due to locational advantages, it would imply a decrease in trade. This is because exports are replaced by closer production in the host country market. Locational advantages relating to natural resources, however, imply an increase in trade as FDI extracts those resources for home country use. Yet, again, location seen in a regional context may lead to enhanced trade as the host country is used as a base through which the multinational corporations serve the entire region.

In a nutshell, the main idea of eclectic paradigm is that in order to invest abroad, a firm ought to have important advantages in terms of ownership, location and internalization. Ownership-specific advantages could be competitive in nature and firms could enjoy monopoly power, "possession of a bundle of scarce, unique and sustainable resources and capabilities, which essentially reflect the superior technical efficiency of a particular firm relative to those of its competitors" (Dunning, 2000). Location-specific advantages are the "immobile, natural or created endowments" which become an incentive to invest in a particular country. The internalization advantage gives international investors incentives to engage in foreign investment activities rather than franchising or licensing. The positive spillovers of FDI to host nations and their economies according to the theory can come in the form of an increase in national income, savings, financial resources (significant means of funding), higher employment rate, new technology and managerial know-how, improvements in human resources, increases in competition and economic development (Chowdhury and Mavrotas, 2006; Moghaddam and Redzuan, 2012). This theory helps to explain our assertion that foreign investors will be interested in extending FDI if these initial conditions are in place which every developing country needs.

2.4 Empirical review
2.4.1 Effect of inflation, interest rate, real effective exchange rate and market size (GDP) on FDI. Saini and Singhania (2017) investigated the potential determinants of FDI in developed and developing countries based on panel data analysis using static and dynamic modeling

for 20 countries (11 developed and 9 developing), over the period 2004–2013. They found that real GDP growth, per capita income, domestic inflation, commercial interest rates, trade openness, exchange rate and external indebtedness play a significant role in shaping the trends of foreign capital inflows.

Reenu and Sharma (2015) conducted a study on the determinants of FDI inflows in the post liberalization period in India using annual data from 1991 to 2010 by employing an ordinary least square (OLS) regression analysis. Their results indicated that market size, trade openness, interest rate and inflation are the major determinants of FDI inflows.

Kandiero and Chitiga (2014) found a negative correlation between FDI inflows and real exchange rate appreciation after examined 38 African countries.

Kaur and Sharma (2013) used a multiple regression to study FDI determinants in India. In their findings, they indicated that trade openness, inflation and forex reserves are the major determinants that affect FDI inflows. Inflation and exchange rate had negative impact on FDI and GDP, forex reserves, openness and external indebtedness had positive impact on FDI.

Singhania and Gupta (2011) used a dummy variable to account for FDI policy changes along with tracing the impact of macroeconomic variables like GDP, inflation rate, foreign trade, money supply growth and patents on FDI inflows in India. The study found that only GDP, inflation rate and scientific research had impact on FDI inflows. It was also found that the dummy variable for FDI policy changes done during 1995–1997 also had a significant effect on the inflows.

Kyereboah-Coleman and Agyire-Tettey (2008) tried to examine the relationship between exchange rate volatility and FDI inflows in Ghana. Their empirical results found that volatile exchange rate has a negative effect on FDI inflows which means that volatility of exchange rate which is a measure of risky reduces the inflow of FDI into the country. They conclude that exchange rate plays an important role in attracting FDI.

Ozturk (2007) carried out an extensive review of FDI literature and found evidence that financial market regulations and stable banking systems are significant determinants for FDI. The World Investment Prospects Survey 2008–2010 (UNCTAD, 2008) reported that of 226 companies surveyed, 50 percent of respondents expressed concern about the risk of a major global economic downturn and financial instability. Thus, the health of the banking system within a stable economic platform in Ireland is seen as important for foreign investment.

Bende-Nabende (2002) in a study using data on 19 SSA countries over the 1970–2000 showed that the most dominant long-run determinants of FDI in SSA were market growth, a less restrictive export-orientation strategy, the FDI policy liberalization, real effective exchange rates, market size and openness of the economy.

Bende-Nabende (2002) aims to provide an empirical assessment on the macro-locational determinants of FDI in SSA through the assessment of cointegration or rather long-run relationships between FDI and its determinants. The study comprises 19 SSA countries over the 1970–2000 period and employs both individual country data and panel data analyses techniques. The empirical evidence suggests that the most dominant long-run determinants of FDI in SSA are market growth, a less restrictive export-orientation strategy and the FDI policy liberalization. These are followed by real effective exchange rates and market size. Bottom on the list is the openness of the economy. Thus, as far as SSA is concerned, their long-run FDI positions can be improved by improving their macroeconomic management, liberalizing their FDI regimes and broadening their export bases.

Lemi and Asefa (2003) address the relationship between economic and political uncertainty and FDI flows in African countries. The authors stress the following contributions of their paper: the first study in formally dealing with the role of political and

economic uncertainty in affecting FDI in Africa using generalized autoregressive heteroscedastic model to generate economic uncertainty indicators. The study analyzed FDI from all source countries – overall US FDI, US manufacturing FDI and US non-manufacturing FDI – and their responses to uncertainty. Whereas previous studies disregarded how the role of uncertainty differs from industrial groups and source countries, the period of analysis and sample countries were large enough for the result to be robust, which other studies did not consider. Schoeman further analyzed how government policy (mainly deficit and taxes) affects FDI through the estimation of a long-run cointegration equation for FDI in South Africa during the past 30 years. Of special importance were the deficit/GDP ratio, representing fiscal discipline and the relative tax burden on prospective investors in South Africa.

2.4.2 Effect of infrastructure (electricity production and telephone usage) on FDI. According to Morisset (2000) and Asiedu (2006), the common perception among many observers is that FDI in African countries is largely driven by their natural resources and the size of their local markets. In an econometric study on 29 SSA countries for the period 1990–1997, Morisset (2000) found that both market size and natural resources availability have a positive influence on FDI inflows, with an elasticity of 0.91 and 0.92 using panel data and 1.4 and 1.2 using cross-section data, respectively. Panel regressions presented in Asiedu (2006) for 22 SSA countries over the period 1984–2000 showed that a standard deviation of one increase in the natural resource variable resulted in a 0.65 percent increase in the ratio of FDI to GDP, and a standard deviation of one increase in the market size variable resulted in a 2.61 percent increase in FDI/GDP. However, Moreira argued that natural and mineral resources were not the only determinants of FDI to the region. Even though the African countries that have been able to attract most FDI are those with natural and mineral resources as well as (relative) large domestic markets, many other factors influence investment decisions in Africa.

Asiedu (2002) identified return on investment, infrastructure development and openness to trade as relevant in influencing FDI to Africa. Specifically, higher marginal product of capital and better infrastructure did not drive. FDI to SSA and, although openness to trade had a positive impact on FDI to SSA, the impact was lower than non-SSA countries.

3. Methodology
3.1 Model specification
Following Dunning (1993/2000), Vernon (1996), Vijayakumar *et al.* (2010), Asiedu (2006), the simple model for this study relating FDI and the other variables is specified as:

$$FDI_t = f\left(\mu INF_t^{\beta 1}, INT_t^{\beta 2}, EXR_t^{\beta 3} GDP_t^{\beta 4}, EP_t^{\beta 5}, TU_t^{\beta 6}, e^{\varepsilon t}\right). \tag{1}$$

Equation (1) is restated as:

$$FDI_t = f\left(e^{\left(\mu INF_t^{\beta 1}, \ INT_t^{\beta 2}, \ EXR_t^{\beta 3} GDP_t^{\beta 4}, \ EP_t^{\beta 5}, \ TU_t^{\beta 6}, \ e^{\varepsilon t}\right)}\right), \tag{2}$$

where FDI_t is the FDI at time t; FDI will be measured as the log of FDI stock; INF_t is the inflation rate at time t, which is measured as the annual percentage change in consumer prices; INT_t is the interest rate at time t which is measured using the Bank of Ghana's monetary policy rate; EXR_t is the exchange rate at time t which is measured as the average exchange rate divided by a price deflator; GDP_t is the real GDP rate at time t, which is measured as the nominal GDP adjusted for inflation; EP is the electricity production measured as the total number of gigawatt hours (Gwh) generated into electricity plants and

CHP plants; and TU is the telephone usage measured as all mobile subscriptions divided by the country's population and multiplied by 100; ε_t is the error term; $\mu = \beta_0$, and $e = 1$. β_1, β_2, β_3, β_4, β_5 and β_6 are the parameters to be determined. By taking the logarithm of Equation (2), we arrive at:

$$\ln DFI_t = \beta_0 + \beta_1 INF_t + \beta_2 INT_t + \beta_3 \ln EXR_t + \beta_4 \ln GDP_t + \beta_4 \ln GDP_t + \beta_6 TU_t + \varepsilon_t. \quad (3)$$

Differencing Equation (3) as a result of nonstationarity nature of the variables, gives Equation (4), the FDI equation is then stated as:

$$\Delta \ln FDI_t = \beta_0 + \beta_1 \Delta INF_t + \beta_2 \Delta INT_t + \beta_3 \Delta \ln EXR_t + \beta_4 \Delta \ln GDP_t$$
$$+ \beta_5 \Delta \ln EP_t + \beta_6 \Delta TU_t + \varepsilon_t, \quad (4)$$

The *a priori* signs of the explanatory variables are:

$$\beta_1 < 0, \quad \beta_2 < 0, \quad \beta_3 > 0, \quad \beta_4 > 0, \quad \beta_5 > 0, \quad \text{and} \quad \beta_6 > 0.$$

The vector autoregressive (VAR) representations of the variables of interest are specified below:

$$Y_t = \delta + \gamma_1 Y_{t-1} + \ldots \gamma_p Y_{t-p} + v_t, \quad (5)$$

where Y_t is a (K^*1) vector of endogenous variables; δ is a (K^*1) vectors of intercepts; γ_p are the (K^*K) fixed VAR coefficients matrices and $v_t = (v_{1t}, \ldots, v_{kt})$, is an unobserved error term. It is to be noted that K is the number of variables.

3.2 Sources of data
In this study, FDI is the dependent variable and all the other macroeconomic variables are the independent variables. All the variables used in the models were based on the existing literature reviewed on the topic, economic theory and whether they fit well in the models in statistical terms. The time span covered in the study is from 1990 to 2015 and quarterly time series data were used. This was done through the interpolation method. The data on FDI were obtained from the World Bank Development Indicators , while series on real GDP, real effective exchange rate, electricity production, TU, and inflation were obtained from the World Bank. Series on interest rates were obtained from the Bank of Ghana. Here, the quarterly series data were generated through interpolation.

3.3 Estimation techniques
3.3.1 Unit root test. This study started by exploring the stationarity properties of the series using the augmented-Dickey–Fuller (ADF) and Philip–Perron (PP) tests procedure. This test is done in the first place in order to avoid spurious regression which is a common problem among most of the macroeconomic variables whose data generation processes follow a time trend. The ADF test procedure tests the null hypothesis that the variables have unit root or are non-stationary as against the alternative hypothesis that the variables are stationary. The study then resorts to the VAR framework to estimate the long-run and short-run relationships between FDI and the associated explanatory variables.

3.4 Tools for data analysis
The study will employ both descriptive and quantitative analyses. Charts such as graphs and tables will be employed to aid in the descriptive analysis. Unit roots tests will be carried out on all variables using the ADF and PP tests to ascertain their order of integration in order to do away with spurious regression. Additionally, the study will adopt the Johansen's

cointegration econometric methodology within the VAR framework to test for cointegration of the variables in order to obtain both the short- and long-run estimates of the variables involved. Also Granger causality test will be conducted to determine the direction of causality between the dependent variable and the independent variables. All estimations were carried out using Eviews 9.0 software packages.

4. Results and discussion
4.1 Descriptive statistics
The study first conducted the descriptive statistics of the relevant variables involved in the study which is presented in Table I. In Table I, the results show that all the variables have positive average values (means). The minimal deviation of the variables from their means as shown by the standard deviation gives indication of fast FDI (fluctuations) of these variables over the period. In terms of skewness, all of the variables are positively skewed with the exception of TU, which is negatively skewed.

The Jarque–Bera statistic which indicates the null hypothesis that all the series are drawn from a normally distributed random process cannot be rejected for FDI and the associated explanatory variables.

4.2 Results of the unit roots test
In order to examine the determinants of FDI in Ghana, the stationarity status of all the variables including the control variables in the openness model specified for the study were determined. This was done to ensure that the variables were not integrated of order two (i.e. I(2) stationary) so as to avoid spurious results.

First of all, to statistically determine the stationarity properties, the (ADF) and PP tests were applied to all variables in levels and in first difference in order to formally establish their order of integration. The Schwartz–Bayesian criterion (SBC) and Akaike information criterion (AIC) were used to determine the optimal number of lags included in the test. The study presented and used the p-values for making the unit roots decision which arrived at a similar conclusion with the critical values. The results of both tests for unit roots for all the variables at their levels with intercept and trend and their first difference are presented in Tables II and III, respectively.

From the results of unit roots test in Table II, the null hypothesis of unit roots for all the variables cannot be rejected at levels. This means that all the variables are not stationary at

	FDI	INF	INT	LNEXR	LNGDP	LNECP	TU
Mean	7.556	1.787	5.841	3.580	5.967	3.035	2.672
Median	7.368	1.7634	5.268	3.598	5.326	2.952	2.673
Max	8.971	1.023	3.689	3.232	15.384	2.376	2.708
Min	6.859	2.428	8.949	3.983	1.620	3.775	2.645
SD	0.545	0.348	1.339	0.142	3.149	0.314	0.116
Skewness	0.979	0.420	0.739	0.384	1.059	0.749	−0.040
Kurtosis	2.780	1.914	2.485	2.943	3.784	2.813	1.875
Jarque–Bera	15.164	4.926	10.208	2.472	21.254	9.490	5.297
Probability	0.003	0.085	0.006	0.029	0.000	0.008	0.076
Sum	754.63	168.71	484.06	357.99	596.68	303.49	267.216
Sum SD	29.448	11.962	177.54	1.993	981.70	9.7866	0.026
Observations	104	104	104	104	104	104	104

Table I.
Descriptive statistics of the variables

Notes: Max, maximum; Min, minimum; Sum SD, sum of squared deviation
Source: Computed using Eviews 9.0 Package

levels since their p-values for both ADF and PP are not significant at all conventional levels of significant.

However, Table III shows that at first difference all the variables are stationary, and this rejects the null hypothesis of the existence of unit roots. The study rejects the null hypothesis of the existence of unit roots in D(FDI), D(INF), D(INT), D(LNEXR), D(LNGDP), D(LNECP), D(TU) and at the 1 percent level of significance.

From the above analysis, one can therefore conclude that all variables are integrated of order 1 $I(1)$ and in order to avoid spurious regression, the first difference of all the variable must be employed in the estimation of the short-run equation.

4.3 VAR lag order selection criteria
One other problem in the estimation of VAR models is the selection of an appropriate lag length. The lag length plays a crucial role in diagnostic tests as well as in the estimation of VAR models for cointegration, impulse response and variance decomposition. The results of the VAR lag selection criteria are presented in Table IV.

Appropriate lag length (p) is chosen using standard model selection criteria (AIC and SBC) that ensure normally distributed white noise errors with no serial correlation. It can be observed from the VAR lag selection criteria presented in Table IV that there are asterisks attached to some statistics of the five lag selection criteria (AIC, LR, SC, FPE and HQ). Tracing these statistics against the first column labeled "lag" shows that they coincide with lag 2. This implies that the appropriate lag length chosen is 2.

4.4 Granger causality test
This is to find out whether the direction of causality the study conducted the pair-wise Granger causality tests. Table V presents the pair-wise Granger causality results.

VAR	ADF	PV	[Lag]	PP	PV	[BW]
LFDI	−2.1092	(0.5342)	[1]	−2.1487	(0.5125)	[5]
INF	−1.1801	(0.9927)	[2]	−1.1611	(0.9124)	[5]
INT	−2.3778	(0.4345)	[0]	−2.3645	(0.2974)	[2]
LNEXR	−1.8325	(0.6812)	[1]	−2.0551	(0.5639)	[5]
LNGDP	−3.8261	(1.2103)	[2]	−3.1613	(0.0984)	[3]
LNECP	−2.1635	(0.5041)	[1]	−2.3245	(0.4167)	[0]
TU	−1.5756	(0.7955)	[3]	−1.4960	(0.8246)	[3]

Source: Computed using Eviews 9.0 Package

Table II.
Test for the order of integration (ADF and Phillips–Perron): levels with (intercept and trend)

VAR	ADF	PV	Lag	IO	PP	PV	BW	IO
D(LFDI)	−7.9991	(0.0000)***	[2]	I(1)	−8.0695	(0.0000)***	[4]	I(1)
D(INF)	−4.1483	(0.0077)**	[5]	I(1)	−4.1483	(0.0000)***	[4]	I(1)
D(INT)	−10.068	(0.0000)***	[0]	I(1)	−10.065	(0.0000)***	[1]	I(1)
D(LNEXR)	−6.0434	(0.0000)***	[2]	I(1)	−5.8451	(0.0035)***	[4]	I(1)
D(LNGDP)	−8.1328	(0.0000)***	[0]	I(1)	−8.1884	(0.0000)***	[4]	I(1)
D(LNECP)	−5.7627	(0.0000)***	[5]	I(1)	−14.948	(0.0000)***	[4]	I(1)
D(TU)	−8.1328	(0.0000)***	[0]	I(1)	−8.1884	(0.0000)***	[4]	I(1)

Notes: IO, order of integration; D, first difference; PV, p-value. **,***Significance at 5 and 1 percent levels, respectively
Source: Computed using Eviews 9.0 Package

Table III.
Test for the order of integration (ADF and Phillips–Perron): first difference with (intercept and trend)

Lag	LogL	LR	FPE	AIC	SC	HQ
0	−517.2578	na	0.000131	10.92204	11.10902	10.99762
1	318.1425	1,531.567	1.00e−11	−5.461302	−3.965432*	−4.856647
2	419.1685	170.4813	3.45e−12*	−6.545176*	−3.740420	−5.411448*
3	448.2040	44.76312	5.44e−12	−6.129250	−2.015608	−4.466448
4	488.1941	55.81956	7.10e−12	−5.941544	−0.519016	−3.749670
5	542.4164	67.77791*	7.28e−12	−6.050343	0.681071	−3.329395
6	582.0268	43.73641	1.09e−11	−5.854724	2.185576	−2.604704
7	617.2856	33.78970	1.99e−11	−5.568450	3.780736	−1.789356
8	668.2137	41.37912	3.04e−11	−5.608620	5.049452	−1.300453

Notes: LR, sequential modified LR test statistic (each test at 5 percent level); FPE, final prediction error; AIC, Akaike information criterion; HQ, Hannan–Quinn information criterion. *Indicates lag order selected by the criterion
Source: Computed using Eviews 9.0 Package

Table IV.
VAR lag order
selection criteria

Null Hypothesis	F-statistic	Probability
INF does not Granger cause FDI	5.04350	0.00019**
FDI does not Granger cause INF	0.96398	0.44467
INT does not Granger cause FDI	4.86580	0.00027**
FDI does not Granger cause INT	0.89291	0.48974
LNEXR does not Granger cause FDI	2.29920	0.05211*
FDI does not Granger cause LNEXR	1.68941	0.14605
LNGDP does not Granger cause FDI	4.14804	0.00025**
FDI does not Granger cause LNGDP	1.11417	0.35915
LNECP does not Granger cause FDI	3.17249	0.00279**
FDI does not Granger cause LNECP	3.42963	0.00146**
TU does not Granger cause FDI	3.64459	0.02993**
FDI does not Granger cause TU	5.31035	0.00655**

Notes: *,**Denote rejection of null hypothesis at 10 and 5 percent levels of significance, respectively
Source: Conducted using Eviews 9.0 package

Table V.
Granger causality
between FDI and
its determinants

The results of the Granger causality test in Table V show that inflation (INF) Granger causes FDI at 5 percent level of significance. However, the results failed to reject the null hypothesis that FDI does not Granger cause inflation (INF). This means that inflation predicts FDI but not the other way round. Thus, there is unidirectional causality between FDI and inflation. In the empirical literature, the result is in consonance with the findings of Djokoto and Dzeha, Mamun and Nath, Akbar and Naqvi, who also found a unidirectional causality.

From the results in Table V, it is clear that there is causality from interest rate to FDI. This means that in Ghana, there is unidirectional causality between FDI inflows and interest rate. This result is consistent with that of Zhang, who in exploring the existence of bi-directional causation between FDI and interest rate for a sample of 11 Latin American and East Asian countries for a 30-year period, Zhang found a causal relation running from INT to FDI for five countries. It is also in consonance with the study by Esso who re-examined the relationship between FDI and interest rate in the case of ten Sub-Saharan African countries. Thus, the study suggests that interest rate significantly causes FDI in three countries, while FDI causes interest in two countries.

This study, however, contradicts the study conducted by Ericsson and Irandoust who examined the causal effects between FDI and interest rate for four OECD countries.

Their results found no causal relationship between interest rate and FDI in Denmark and Finland. It also contradicts the study of Adnan who examined the causal relation between FDI and interest rate for Liberia.

There is also a unidirectional causality between FDI and log of exchange rate. This is an indication that log of exchange rate is a critical variable in achieving FDI.

The results indicate a bi-directional causality between log of gross domestic growth and FDI at 5 percent level of significance. It is evident from the result that causality from FDI to log of GDP is stronger than the causality from log of GDP to FDI. This is in line with the long-run findings. It also gives credence to the fact that log of GDP is a real boaster for every economy in attracting FDI including that of the Ghanaian economy. Nevertheless, FDI in the economy also creates income for achieving higher GDP.

The Granger causality test results also suggests that the null hypothesis of electricity production does not Granger cause FDI is rejected at 5 percent level of significance, implying log of electricity production does Granger cause FDI. However, the null hypothesis that FDI does not Granger cause log of electricity production is no rejected, implying FDI does not Granger causes log of electricity production. Thus, a unidirectional causality has been identified from electricity production to FDI at the 5 percent significance level.

The unidirectional causality between TU and FDI is in line with the findings of Asiedu (2006) for Ghana and Chimobi (2010) for Nigeria. Asiedu (2006) found a unidirectional causality between TU and FDI running from TU to FDI. Chimobi (2010) identified a unidirectional causality between TU and FDI running from telephone to FDI. However, the study deviates from the results obtained by Gokal and Hanif (2004) who found a unidirectional causality between TU and FDI for Fiji running from FDI to TU inflation.

4.5 Tests for cointegration
This section presents the result on the Johansen cointegration analysis. In the face of non-stationary series with a unit roots, first differencing appears to provide the appropriate solution to our problems. However, first differencing has eliminated all the long-run information which economists are invariably interested in. According to Johansen (1991), cointegration can be used to establish whether there exists a linear long-term economic relationship among variables of interest. It is in the same vein that Pesaran and Shin (1999) added that cointegration enable researchers to determine whether there exists disequilibrium in various markets. In this regard, Johansen (1991) asserts that cointegration allows us to specify a process of dynamic adjustment among the cointegrated variables and in disequilibrated markets.

Given that the series are $I(1)$, the cointegration of the series is a necessary condition for the existence of a long-run relationship. Under the assumption of linear trend in the data and an intercept and trend in the cointegration equation, the results of both the trace and maximum-eigenvalue statistic of the Johansen cointegration test are presented and displayed in Tables VI and VII, respectively. It is evident from Tables VI and VII that both the trace statistic and the maximum-eigenvalue statistic indicate the presence of cointegration among the variables. Thus, the null hypothesis of no cointegrating relationship or vector ($r = 0$) is rejected since the computed values of the trace and the maximum-eigenvalue statistics of 180.2803 and 67.08254 are greater than their respective critical values of 158.49 (1 percent) and 54.71 (1 percent), respectively. That is, applying the Johansen test to the quarterly series spanning from 1990:Q1 to 2015:Q4 leads to conclude that there exits at most one cointegrating relationship. This confirms the existence of a stable long-run relationship among FDI and the explanatory variables.

On the basis that there is one cointegrating vector among the variables, the estimated long-run equilibrium relationship for FDI was derived from the unnormalised vectors. From the unnormalized cointegrating coefficients, the seventh vector appears to be the one on

Hypothesized no. of CE(s)	Eigenvalue	Trace statistic	5 percent Critical value	1 percent Critical value
None**	0.499212	180.2803	146.76	158.49
At most 1	0.273951	113.1978	114.90	124.75
At most 2	0.253972	82.14437	87.31	96.58
At most 3	0.194515	53.72418	62.99	70.05
At most 4	0.162728	32.74204	42.44	48.45
At most 5	0.105896	15.51428	25.32	30.45
At most 6	0.046873	4.656729	12.25	16.26

Notes: Trace test indicates 1 cointegrating equation(s) at both 5 and 1 percent levels, respectively. (**)Denotes rejection of the hypothesis at the 5 percent (1 percent) level
Source: Computed using Eviews 9.0 Package

Table VI.
Johansen's cointegration test (trace) results

Hypothesized no. of CE(s)	Eigenvalue	Max-eigen statistic	5 percent Critical value	1 percent Critical value
None**	0.499212	67.08254	49.42	54.71
At most 1	0.273951	31.05343	43.97	49.51
At most 2	0.253972	28.42019	37.52	42.36
At most 3	0.194515	20.98214	31.46	36.65
At most 4	0.162728	17.22776	25.54	30.34
At most 5	0.105896	10.85755	18.96	23.65
At most 6	0.046873	4.656729	12.25	16.26

Notes: Max-eigenvalue test indicates 1 cointegrating equation(s) at both 5 and 1 percent, respectively. (**)Denotes rejection of the hypothesis at the 5 percent
Source: Computed Using Eviews 9.0 Package

Table VII.
Johansen's cointegration test (maximum-eigenvalue) results

which we can normalize the FDI. The choice of this vector is based on sign expectations about the long- run relationships as indicated by theory.

The derivation of the long-run relationship was done by normalizing on FDI and dividing each of the cointegrating coefficients by the coefficient of FDI. The long-run relationship is specified as:

$$FDI = 0.0232T - 0.5442INF - 0.2885INT - 0.0808LNEXR$$
$$+ 0.0583LNGDP + 0.5034LNECP + 0.4642TU. \tag{6}$$

The error-correction term of Equation (6) can be expressed as:

$$ECM = FDI - 0.0232T + 0.5442INF + 0.2885INT + 0.0808LNEXR$$
$$- 0.0583LNGDP - 0.5034LNECP - 0.4642TU. \tag{7}$$

From Equation (5), it can be observed that all the variables are significant and they represent the long-run effects on FDI. Starting with the trend, it exerts a positive effect on FDI. This means that holding all other factors constant in the long run, as time passes by, FDI will grow by about 0.0322 percent each quarter. This is justified by the fact that as time passes by technology and behavior of economic variables change which will naturally impact on the investment activities.

Inflation is negative and statistically significant. Thus, the coefficient of 0.5442 means that 1 percent increase in inflation would lead to approximately 0.5442 percent increases

in FDI holding, keeping all other variables constant. This implies that inflation experience by the country really impact negatively on FDI. This is consistent with theoretical expectation of the classical views on the role of exchange rate volatility in the macro economy. It is also consistent with other empirical studies such as Vijayakumar *et al.* (2010).

According to economic and investment theories, inflation induces FDI by shocks from the both local and global levels, and by affecting other macroeconomic variables. For Ghana, the result obtained suggests that inflation targeting policy adopted as part of the structural reforms in the 2000s in Ghana though helped yet has also affected the economy.

In the long run, interest rate is statistically significant and it exerts a negative effect on FDI in Ghana. The coefficient of 0.2885 percent implies that in the long-run 1 percent increase in interest rate will lead to approximately 0.2885 percent decrease in FDI. This means that increasing interest rate leading to higher cost of borrowing can affect initiatives to attract FDI frequently and which derives from the belief that foreign investment produces externalities in the form of technology transfers and spillovers. Romer (1993), for example, argues that there are important "idea gaps" between rich and poor countries. He notes that foreign investment can ease the transfer of technological and business know-how to poorer countries. These transfers may have substantial spillover effects for the entire economy Vijayakumar *et al.* (2010).

The log of exchange rate (LNEXR) which served as an exogenous variable was statistically significant and it exerted a negative impact on FDI. This means that 1 percent increase in exchange rate in the long run would lead to 0.0808 percent decrease in FDI. Thus, the negative and significant effect of exchange rate on FDI is an indication that exchange rate is a key channel through which the economy can be in distress.

The negative impact is in conformity with the findings by Bende-Nabende (2002) and Garibaldi. Most African countries have embarked on exchange rate reduction policies that are dominated by austerity measures. In most cases, these policies were implemented without evaluating the impact of exchange rate on FDI. Thus, it is imperative to bring in adequate corrective measures to be adapted to the peculiar economic structures and the behavior of agents in Africa that would allow us to capture the full impact of exchange rate on FDI and other economic aggregates.

Also, log of GDP with a coefficient of 0.0583 has a positive and significant impact on FDI. Specifically, the result indicates that a 1 percent increase in GDP will increase FDI by 0.06 percent holding all other things constant. A higher level of GDP represents a boom in an economy. If LDCs are streamlining their investment regulatory framework, implementing policies which promote macroeconomic stability and improve infrastructure, they can achieve a higher level of FDI.

The results, however, contradict the findings by Erbaykal and Okuyan, and Chimobi (2010). Erbaykal and Okuyan showed no statistically significant long-run relationship between GDP and FDI for Turkey.

The coefficient of electricity production (LNECP) of 0.5034 shows that a 1 percent change in electricity production would result in a 0.5034 percent increase in FDI, holding all other factors constant. The sign of the electricity production support the theoretical conclusion that natural resources capital contribute positively to FDI attraction since the coefficient in this long-run equation is positive and significant. This positive relationship between electricity production and output is consistent with the expectation of the classical economic theory. It is consistent with conclusions reached by Morisset (2000) and Asiedu (2006) in the case of Ghana.

Finally, TU is positive and significant with a coefficient of 0.4442 indicating an increase in FDI by this amount if there is a 1 percent increase in the TU. This is consistent with the arguments of Morisset (2000) and Asiedu (2006).

4.6 Short-run relationship

Engle and Granger (1987) argued that when variables are cointegrated, their dynamic relationship can be specified by an error-correction representation in which an error-correction term (ECT) computed from the long-run equation must be incorporated in order to capture both the short-run and long-run relationships. It is expected to be statistically significant with a negative sign. The negative sign implies that any shock that occurs in the short run will be corrected in the long run. The larger the ECT in absolute value, the faster the convergence to equilibrium. Given that our variables are non-stationary but cointegrated, estimation of the VECM, which included a first differenced VAR with one period, lagged ECT yielded an over-parameterised model as presented. As the values of the variables are stationary, the model was estimated using the OLSs. The approach of general-to-specific modeling was employed to arrive at a more parsimonious model, where insignificant variables were deleted using the t-ratios. Rutayisire (2010) argued that this process of moving from the general to the specific brings about a simplification of the model that makes estimations more reliable and increases the power of the tests.

The results from the vector error-correction model as depicted in Table VIII suggests that the ultimate effect of previous periods' values of FDI on current values of FDI in the short run is positive and significant at lag 5. The result below shows that the estimated coefficient of the ECT has the expected sign and it is significant. This is an indication of joint significance of the long-run coefficients. According to Kremers *et al.* (1992) and Bahmani-Oskooee (2001), a relatively more efficient way of establishing cointegration is through the ECT.

From the results in Table VIII, the estimated coefficient of the ECT is −0.1723 which implies that the speed of adjustment is approximately 17 percent per quarter. This negative and significant coefficient is an indication that cointegrating relationship exists among the variables under study. The size of the coefficient on the ECT denotes that about 17 percent of the disequilibrium in the economy caused by previous years' shocks converges back to the long-run equilibrium in the current year. Thus, the study discerns that the variables in the model show evidence of moderate response to equilibrium when shocked in the short run.

Variable	Coefficient	SE	t-statistic	Prob.
ECT(−1)	−0.1723	0.0718	−2.4002	0.0190
D(LFDI(−5))	0.3870	0.1598	2.4221	0.0180
D(INF(−1))	−0.5888	0.2117	−2.7813	0.0069
D(INT(−5))	0.1164	0.0325	3.5826	0.0006
D(LNEXR(−3))	−0.3636	0.2101	−1.7301	0.0881
D(LNGDP(−1))	−0.0136	0.0060	−2.2760	0.0257
D(LNECP(−4))	0.4497	0.1321	3.4039	0.0011
D(TU(−2))	−0.5604	0.2128	−2.6340	0.0103
C	0.1251	0.0250	5.0062	0.0000
R^2	0.6022	Mean dependent var	0.0146	
Adjusted R^2	0.5432	SD dependent var	0.0834	
SE of regression	0.0721	Akaike info criterion	−2.1175	
Sum squared resid	0.2544	Schwarz criterion	−0.9192	
Log likelihood	142.4616	F-statistic	1.7253	
Durbin–Watson stat	2.0055	Prob (F-statistic)	0.0328	
Diagnostic test				
Jarque–Bera	0.6556 (0.7205)			
LM test: F-statistic	1.3142 (0.2725)			
ARCH test: F-statistic	0.1677 (0.9738)			
RESET test: F-statistic	0.8674 (0.3559)			
Log likelihood ratio	1.2338 (0.2667)			

Table VIII.
Results of error-correction model (VECM)

It is theoretically argued that a genuine error-correction mechanism exists whenever there is a cointegrating relationship among two or more variables. The rule of thumb is that the larger the error-correction coefficient (in absolute term), the faster the variables equilibrate in the long run when shocked (Acheampong, 2007). However, the magnitude of the coefficient in this study suggests that the speed of adjusting to long-run changes is slow.

The current value of FDI is affected by the past quarter values of FDI. Specifically, FDI at lag 5 is significant with a coefficient of 0.3870. It exerts a positive effect on FDI in the fifth quarter. This is expected in that previous growth and expansion in FDI serves as an indication of prosperity and may further attract more investment leading to more growth.

Inflation, which is one of the focus explanatory variables in this study, is significant at lags 1 and it exerts a negative effect on FDI just as the long-run effect .This implies that in the short-run inflation is reducing welfare in Ghana. This is consistent with the study by Vijayakumar *et al.* (2010).

In the short run, interest rate is significant at lag 5 where it exerts a negative effect on FDI in the fifth quarter with coefficient of 0.1164. Thus, in the fifth quarter, a 1 percent increase in interest rate would lead to 0.1164 percent decrease in FDI. The negative effect of interest rate reemphasizes the fact that Ghana in some way has not benefited from the spillover effect of interest rate in the country.

Also, short-run increases in exchange rate exert a negative and statistically significant impact on FDI. This means that an increase in exchange rate in the short-run exerts a negative impact on FDI. This is consistent with the long-run result.

The results also show that log of GDP which has a positive and significant impact on FDI. Specifically, a 1 percent increase in log of GDP will cause growth in FDI to increase by 0.0136 percent holding all other factors constant. This result confirms the findings of Garibaldi who argued that a higher GDP in a country can increase the level of living standard in their economic if it serves as a means to achieve further high level of economic growth.

The coefficient of log of electricity production is still positive and significant just as the long-run estimate. Thus in the short run, a 1 percent increase in electricity production would lead to approximately 0.45 percent increase in FDI in the fourth quarter. The sign of the electricity production supports the theoretical conclusion that natural resources positively contributes to greater openness both in the short and long runs since the coefficient of the variable in these two periods is positive and significant. Similarly, the growth in TU is positive and significant at 5 percent significance level. A 1 percent increase in the TU in the short run would increase FDI by 0.5604 percent all other things being equal. This is consistent with the studies by Morisset (2000) and Asiedu (2006).

4.7 Variance decomposition analysis
Following the VAR estimation, the study decomposed the forecast error variance by employing Sim's recursive Cholesky decomposition method. The forecast error variance decomposition provides complementary information for a better understanding of the relationships between the variables of a VAR model. It tells us the proportion of the movements in a sequence due to its own shock, and other identified shocks (Enders, 2004). Thus, the variance decomposition analysis will enable us identify the most effective instrument for each targeted variable based on the share of the variables to the forecast error variance of a targeted variable. The results of the forecast error variance decomposition of the endogenous variables, at various quarters are shown in Table IX. In explaining the forecast error variance of FDI in Table IX, it is observed that in the short-term horizon (two years) innovations of exchange rate and TU are the most important sources of variations besides FDI its own shock.

Throughout the medium-term and long-term horizon, the innovations to exchange rate (LNEXR) and TU serve as the important sources of variations to FDI. The source of least

Qrt	S.E.	FDI	INF	INT	LNEXR	LNGDP	LNEP	TU
1	0.140335	100.0000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
2	0.211043	91.20039	0.547904	0.581836	5.538333	0.159009	0.075690	1.896843
3	0.266684	80.34593	1.438895	1.297706	11.87096	0.360893	0.059910	4.625702
4	0.311228	73.66403	2.385294	1.636792	14.47390	0.558388	0.048101	7.233500
5	0.347414	69.59288	3.361718	1.767761	14.75156	0.856552	0.070132	9.599404
6	0.377964	66.46109	4.360024	1.882228	14.16403	1.364203	0.118666	11.64976
7	0.404598	63.67513	5.315830	2.070638	13.29866	2.139099	0.180775	13.31987
8	0.428310	61.10408	6.147508	2.367582	12.35824	3.171015	0.243429	14.60815
9	0.449676	58.70955	6.803809	2.783028	11.44230	4.399886	0.296115	15.56531
10	0.469037	56.46714	7.275294	3.315727	10.60966	5.740101	0.332839	16.25924

Table IX.
Result of variance
decomposition of FDI

Note: Cholesky ordering: FDI INF INT LNEXR LNGDP LNECP TU
Source: Eviews output

forecast error variance of FDI is the innovations of log electricity production (LNECP) throughout the short-term, medium-term and long-term horizons. The most effective instrument for FDI seems to be log of exchange rate.

5. Conclusions and policy recommendations
The study has empirically examined the determinants of FDI in Ghana using the data set for the period 1990–2015. The empirical evidence revealed the following findings: both the long-run and short-run results found statistically significant positive effects of the log of GDP, log of electricity production and telephone on FDI in Ghana. The study also found a negative and significant effect inflation, interest rate and log of exchange rate on FDI both in the long and short runs. This reemphasizes the potential effects of these variables on FDI in Ghana. From the results of the forecast error variance decomposition, the most important variable for FDI is log of exchange rate and the least variable for FDI is electricity production. The Granger causality test results revealed a unidirectional causality between inflation, interest rate, log of exchange rate, log of GDP and FDI. However, there was a bi-directional causality between electricity production, TU and FDI.

Based on the findings from the study, the following recommendations are proposed.

First, given that the study found a negative causal effect of exchange rate on FDI, the government should pursue more pragmatic policies such as exchange rate targeting strategy that will stabilize exchange rate policies in order to enhance FDI attraction. This can be done in the form of regularly monitoring the exchange rate by the Bank of Ghana. Second, another policy implication of the study is that the Bank of Ghana and other regulators need to ensure that low inflationary rate is maintained in the Ghanaian economy. This can be done through by targeting the inflation rate by Bank of Ghana and this will stabilize the economy. Third, Ministry of Communications in Ghana and other private partners need to expand the country's telephone subscriptions. This will help to attract more FDI into the services sector of the country. This can be done through heavy investments in the economy.

Fourth, the government in collaboration with the electricity company of Ghana, Volta River Authority, and other private partners should expand electricity production in the country. This will reduce the rampant power outage in the country and in turn serve as a signal to investors.

Fifth, the study recommends that, the Government of Ghana needs to increase the country's per capita GDP to attract more FDI into the services and manufacturing sectors of the economy.

Finally, financial institutions in Ghana need to also consider reducing their interest rate to attract borrowing from the private sector so as to boost development in the financial sector leading to more growth in the economy.

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