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FOREIGN DIRECT INVESTMENT IN AN EMERGING ECONOMY: EXPLORING THE DETERMINANTS AND CAUSAL LINKAGES

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Abstract

The objective of the study was to examine the determinants of Foreign Direct Investment (FDI) from 1985 to 2015 in an emerging economy, Ghana. The study used a robust OLS regression and a Granger Causality Test to test for causal effects on a longitudinal data of thirty years. The study found, using a robust OLS regression model that, Natural Resource Endowment, Government expenditure, External debt and Infrastructure has significant predictive effects on FDI although the effect were more profound for natural resources and government expenditure. Using a granger causality approach, interest rate, natural Resource Endowment, Government expenditure, inflation, Infrastructure and international reserves were observed to granger cause FDI. The study recommends that policyholders and the government should also put in place measures that would maintain natural resources and spend on improving infrastructure and development as these attract foreign investments into the country.

Keywords: FDI, Granger causality, Co-integration, Error correction model
Classification code: E43, E44

1. Introduction

Foreign Direct Investment (FDI) is a major contributor to economic growth in many developing and developed economies. It is an important element that guides the direction, development and policies of an economy to bring development to the country. Due to globalization, more and more corporations are expanding across borders to other parts of the world. Initially, foreign direct investment was regarded as the movement of capital across countries (Kindleberger, 1969) but with time, this definition has been expanded. Djokoto and Dzaha (2012) have defined FDI to involve long-term relationship reflecting lasting interest and control of a resident entity in one economy by an enterprise resident of another economy. Piggott and Cook (2005) define Foreign Direct Investment (FDI) as the acquisition, establishment or increase in production facilities by a firm in a foreign country.

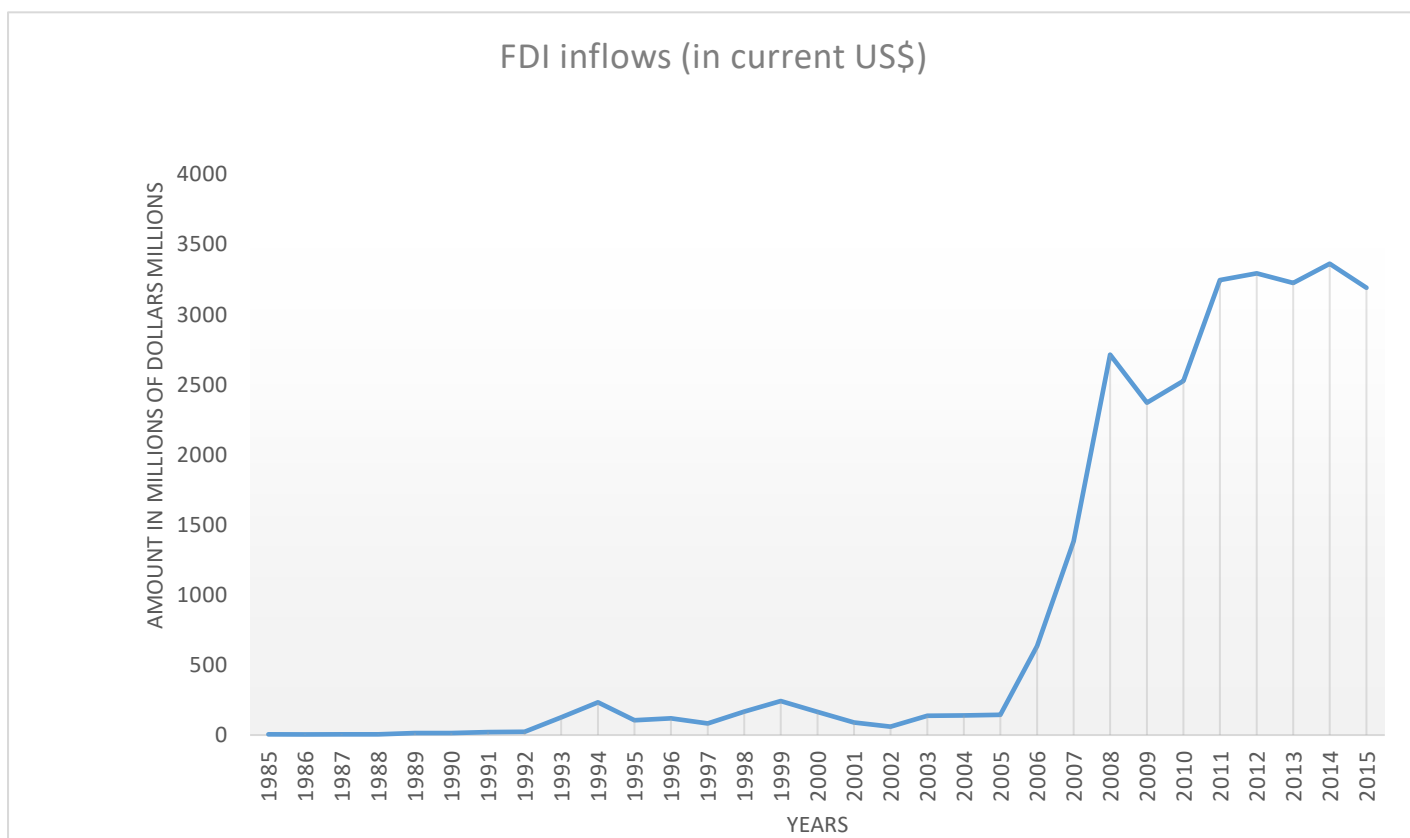
The most distinctive features of FDI are transfer of resources, capital formation abroad and acquisition of control, as agreed by Kindleberger (1969) and Krugman and Obstfeld (2009). It's been generally agreed that FDI has helped many poor countries grow economically through; the creation of developmental projects which enhanced the level of productivity and the provision of employment opportunities for the residents of the host country (Reisen and Soto, 2001; Travalini, 2009; Zvezdanovic, 2013). The amount of FDI inflow to different countries may vary, because different economies may be affected by different factors to attract FDI inflows (Sandhu & Gupta, 2016).

Through FDI, the investing firms are able to: acquire tangible assets, open and run their operation, and own stakes in other organizations. With this, a long-lasting relationship is built between the organizations and other economies. Generally, a threshold of at least 10 percent voting stake or share control is agreed upon, if it is a brownfield acquisition. FDI, aside stake control or ownership transfer, also leads management, technology and skills transfer within an organization (OECD, 2012). Globally, Foreign Direct Investments have increased year on year. The OECD (2012) posits that, global FDI outflows have grown about 12% to 24% annually since 2011.

Africa recorded an estimated USD \$87 billion in capital investment in 2014, representing a 65% increase over the 2013 estimates (Financial Times, 2015). Most of these investments, approximately USD \$33 billion, were channeled to Africa’s oil and gas sector. The rise in Africa’s FDI is attributed to improvement in security, good governance and strong economic growth experienced by African nations (Owusu, 2016).

FDI through multinational companies (MNCs) has been well researched within developing and developed economies. Some researchers have posit that FDI could be the solution to global problems such as reducing the poverty gap whiles others regard it as a very *important* tool through which these very problems are inflicted, (Piggott & Cook 2005).

Figure 1 Trend of FDI inflow to Ghana, from 1985 – 2015



Source: Authors own computation. Data from the WDI

Ghana’s FDI inflows have generally seen an upward trend. Comparing the data over the thirty years, there have been a substantial improvement in FDI inflows into the country although the growth has not

been smooth. For example Ghana's FDI inflow in 2015 was US \$ 2.7 billion but this reduced to US \$ 2.4 billion in 2016 (Business and Financial Times, 2017). Prior to 2015, the total amount of FDI inflow in to the Ghanaian economy in 2014, was US \$ 3.4 billion. Even though it is obvious the increased FDI inflows into Ghana are attributable to certain growth indicators in the economy (like discovery of petroleum, natural resource presence, infrastructure, deregulation of the banking sector, stabilization of energy crisis, GDP growth etc.), it's not very clear how these factors determine FDI inflows. Therefore, there is a need for a critical look at FDI inflows and possible determinants, specifically in developing economies. Also, whilst a lot of research has been conducted on FDI, the primary focus has been on its nexus with growth, therefore there is little evidence on its determinacy. Even with studies on its determinacy, most author have used a single measurement approach. The paper is unique in that it looks at the determinacy of FDI inflows in an emerging economic, using a two statistical measurements, therefore addressing the issue from two critical lenses. The study also seeks to provide more empirical results on FDI determinants.

The paper is arranged as follows; supporting theories are expressed in the next chapter, followed by a review of existing literature. The methodological framework is then elaborated and the regression models stated. Data transformations and manipulations done to the data are then stated. Next, the analysis and all associated discussions are presented. Afterwards, the findings are summarised and concluded with the appropriate references cited. Other tests run are presented in the appendix.

2. Literature Review

This paper uses a string of intertwining theories as theoretical underpinnings for the research. The reason for this partly is due to the variables used in the study; the variables are very varied. The theories are broadly under industrialization theory, which mostly borders on; perfect competition, monopoly, current strength, and internalization.

2.1 Industrial Organization Theory

Hymer (1960) was the first to carefully analyse issues concerning the benefits of large multinationals, market imperfections and control (Singh and Jun, 1995). His theory seeks to explain the idea of international production in an imperfect market (Hymer 1976). This theory supports international firms to compete with the domestic firms that are located in advantageous positions, principally because market imperfections allow. Some renowned writers who contributed to support the explanation of this theory were: Lemfalussy (1961), Kindleberger (1969), Knickerbocker (1973), Caves (1974), Dunning (1974), Vaitsos (1976) and Cohen (1975).

Industrial organization also relates to the advantages which arises from operating in an oligopolistic market and economies of scale (Piggott and Cook, 2005). Our study leans more to this approach in attracting FDI. Thus MNCs have economies of scale and due to market imperfections are able to move to local economies to fill a gap in the market. Market imperfections arise because no two nations have the same resources, needs and wants. We expect that natural resources in Ghana could be a determinant in attracting FDI. Also because there are loose trade restrictions, foreign firms have easy access to the local markets in our case.

2.2 Perfect Competition Theory

The early efforts on this theory of FDI was by MacDougall (1958). MacDougall propounded a model on the basic assumption that, the market is a perfectly competitive place. Kemp (1964) reviewed and elaborated MacDougall's theory and came out with a bi-economy model, where the cost of capital was equal to its marginal productivity. Kemp and MacDougall recognised the fact that, when there was free movement of capital between two economies, there exist equal marginal productivity of capital between the two countries. The two authors later found out that, if a country decides to invest in another, the investing country earns higher income in the long-run, even though its output will fall in the short-run (Nayak and Choudhury, 2014). Thus this theory supports the assertion that firms can increase their marginal productivity of capital in the long run by expanding across borders.

2.3 FDI Theory Based on Strength of Currency

One of the authors who first made an attempt to present the theory of FDI based on the strength of a country's currency was Aliber (1970). He advanced his theory of Foreign Direct Investment making reference to the purchasing power of the various currencies of the countries. Thus, the differences in the strength between the currency of the investing country and that of the host economy. Aliber after testing his hypothesis and coming out with the results to be consistent with FDI that, stronger and stable currencies attracts FDI inflow to their countries as compared to countries with weaker currencies. However, Aliber's theory does not provide explanation for investment between two economies that have equal strength of currency. This does not apply in our case as there are currency differences between developed economies that send FDI not developing ones; the currency strength of the foreign firms give them a high purchasing power in local economy encouraging them to do business there.

2.4 Internalization Theory of FDI

The concept of internalisation was introduced first by Coase in the 1937. However, Buckley and Casson (1976) were the first to blend ISAs with the analysis of FDI in 1976 (Piggott and Cook, 2005). Buckley and Casson (1976) provided a detailed explanation of FDI placing emphasis on the technology and intermediate inputs. The internalisation theory moved away from international investment between countries to industry-based and firm-based determinants of FDI (Henisz, 2003). The internalisation theory is based on three (3) assumptions, (Nayak and Choudhury, 2014) these include:

1. Firms maximize profits in a market that is imperfect
2. When markets in intermediate products are imperfect, there is an incentive to bypass them by creating internal markets.
3. Internalization of markets across the world leads to MNCs

Piggott and Cook, 2005 identified the incentives of the theory to be dependent on the connection of Factors:

1. industry-specific factors, such as economies of scale and external market structure
2. region-specific factors, such as geographical distance and cultural differences
3. nation-specific factors, examples, political and fiscal conditions, leading to possible transfer pricing
4. firm-specific factors, examples, management skills and expertise.

Firms can also internalise through backward and forward integration, also known as vertical and horizontal integration. That is; the product of one functional department can be assimilated and used as a raw material for production by another unit (Nayak and Choudhury 2014).

Buckley and Casson (1976) identified five types of market imperfections that result in internalization: (a) the co-ordination of resources requires a long-time lag, (b) the efficient exploitation of market power requires discriminatory pricing, (c) a bilateral monopoly produces unstable bargaining situations; (d) a buyer cannot correctly estimate the price of the goods on sale; and (e) government interventions in international markets creates an incentive for transfer pricing.

This study buttresses on internalization theory and the industrialization theory. Other theories that could explain FDI include the production cycle model and the eclectic paradigm.

2.5 Empirical Review

The determinants of Foreign Direct Investment has been examined by a number of researchers with different economies and different economic conditions. After reviewing most of them, it becomes that the factors that would influence FDI in one country may not necessarily be the same in other country. According to Onyeiwu and Shrestha (2004), the biggest recipients of FDI in Africa are the Oil producers. Despite the general decline in the global figures of FDI, FDI coming to Africa has been increasing. This is evidenced in the results of some research carried out on the inflow of FDI. Where the average yearly inflow of FDI in to Africa during 1991 to 1995 was \$3.8 billion, compared to \$2.8 billion during 1986 to 1990 and \$1.7 billion during 1981 to 1985 (UNCTAD, 1995: xviii).

Major determinants of FDI that have been researched include: Availability of Natural resources, Exchange volatility, Openness of the economy, the market size of the country, international reserves, Infrastructural development, Political stability, external debt of the economy, Corporate taxes, Trade and democracy, Agglomeration, labour cost and productivity, Skills of human capital, Institutional quality, Investment Regulation, and International Treaties and Guarantees, Commodity price index, World stock market index, Monetary union, economic liberation, High government expenditure, and remittances (Awolusi et.al, 2016, Anyanwu, 2011, Moreira, 2009 and Kariuki, 2015).

But as alluded to earlier, it is impossible for any two countries to have all the variables and its effect on FDI to be the same.

According to Onyeiwu and Shrestha (2004), where a study was carried out on twenty-nine (29) African countries, there is a positive relationship between economic growth, trade openness quality of infrastructure and the inflow of FDI to these twenty-nine African countries. Ghana was part of these Countries studied. They observed that, inflation affect cost of Capital and the level of productivity, while higher interest rates attracts investment in to the country. Again, external debt comes as a result of policymakers not been able to manage the resources that would affect macroeconomic conditions of the country (Onyeiwu and Shrestha, 2004). Finally, a country that is highly indebted would not be able to attract FDI. The highly indebtedness of Ghana as a country can be a major reason why the inflow of FDI is low whilst higher corporate taxes and political instability were again found to be an obstacle to the inflow of FDI in these African countries.

Djokoto and Dzeha (2012), using Ghana as a case for developing countries to determine the sought of factors that gravitate FDI into Ghana. They also studied the effects of FDI on Ghana and identified natural resources, exchange rates and purchasing power parity exchange rates, Exchange rate volatility, adequate reserves, Inflation, size and Growth of the economy, Trade and Democracy to be the major determinants of FDI in Ghana. Trade, natural resource endowment and economic growth and size influence FDI inflow positively whilst foreign exchange volatility was found to have a negative linear relationship with the inflow of FDI in Ghana. They found out that inflation can have both a positive and negative effect on investment. Finally, nominal exchange rate and purchasing power parity have a negative relationship with FDI inflow to Ghana, they are insignificant at 10%.

Theoretical and empirical studies have showed that, there is a linear positive relationship between the inflow of FDI and both economic growth and social infrastructure in the Ghanaian economy, sub-

Saharan Africa and developed economies (Armah, 2016). Also the recent decline of FDI inflow in Ghana is as a result of the deficit in both social infrastructure and low economic growth (Armah, 2016). Using time series analysis with data from India, Sandhu and Gupta (2016) found that, there is a significant relationship between the explanatory variables and the inward flow of FDI in the Indian economy, and goes further to explain that the determinants of FDI varies with respect to different economies of a period of time. Also from Sandhu and Gupta (2016), the most important and significant determinants of FDI in the Ghanaian economy are market Interest rates and exchange rates (Emmanuel and Luther, 2014).

Again, with a panel of thirty-eight (38) developing economies including Ghana, Demirhan and Masca (2008) find that, from 2000 – 2004, labour cost and productivity relate to the inflow of FDI positively. However, labour cost, productivity and risk are not statically significant to the flow of FDI in these observed countries. Corporate taxes are however found to be inconclusive as a determinant of FDI. According to Demirhan and Masca (2008), the empirical relationship between political instability and FDI is not too clear. Mainly because, it has been proven in some economies to have a negative relationship with FDI inflow while it has no effect in other countries. Demirhan and Masca (2008) also support the fact that, Gross Domestic Product (GDP) growth, trade Openness, telephone and quality infrastructure are statically significant and positively related to the inflow of FDI in Africa. Openness to trade, exchange rates, market size, and political risk are the same determinants of FDI in inflow in the Nigerian economy as in Ghana (Etim, Onyebuci & Udo, 2014).

Moreira, (2009) indicates that, an economy that has high supply of skilled labour, adoptable human capital and low cost of production attracts Foreign Direct Investment in to its country. Moreira (2009) further finds that liberalized FDI regulation and restrictions contribute to the amount of FDI inflow in the economy. Using a study on Africa over a period of 1969 to 2007, Moreira (2009), identified certain institutional quality indicators that can influence the inflow of FDI to African countries. These included: rule of law, expropriation risk, and repudiation of contracts by government, corruption in government, and quality of the bureaucracy. Kariuki (2015) also finds a positive and significant relationship between commodity price index performance and FDI inflow in Africa. A good performance at the stock markets also has significant impact on the inflow of FDI in Africa. Kariuki (2015) identified financial risk, economic risk and political risk to be part of the explanatory variable of the study, making her find align with existing literature on the determinants of foreign Direct Investment. The past inflow of FDI can also influence the size of FDI coming into the country currently. This was confirmed when a Fixed effect model is applied on a panel of 35 AU countries (ibid).

Awolusi, Pelsler and Adelekan (2016) and Owusu-Antwi, Antwi and Poku, (2013) had similar findings about the determinants of FDI inflow in Ghana and other economies in the world. Both conclude that, natural resources, trade openness, GDP growth rate, quality infrastructure, market size and economic stability, all have a positive and significant relationship with the inflow of FDI into the Africa economies and other countries. However, according to Awolusi et. al (2016), there was no significant relationship between FDI inflows and monetary union to the African economies and no relationship was found between FDI inflows and market size to the Asian countries

Acheampong and Osei (2014), found out that, from 1980 – 2010, in the long-run, infrastructure and political stability has positive significance on FDI inflow in Ghana; the strength of the Ghana Cedi is an important factor to attract FDI inflow to Ghana and natural resources have a short-run significance to the inflow of FDI in to the Ghanaian economy. Gyebi, Owusu and Etroo (2013) also found out that the determinants of FDI inflow in Ghana include availability of natural resources, labour force, market size, regulatory and institutional environment, strategic plan of parent company and other macroeconomic and political environment and the positive relationship between GDP growth rate and inflow of FDI.

Anyanwu, (2011) stated in his article that, countries with high remittances attracts heavy Foreign Direct Investment. That higher financial development has negative effects on FDI inflow in Africa. Anyanwu (2011) and Owusu-Antwi, Antwi, Ashong and Owusu-Pepurah (2016) have both establish the fact that;

there is a positive relationship between market size, trade openness, Higher government expenditure, Natural resource endowment and agglomeration and FDI inflows in Africa. According to Zenasni and Benhabib, (2013), there is a linear positive relationship between the rate of return on investment, human capital and the size of FDI that flow into an economy.

3. Research Methodology

The study incorporated a quantitative research method using yearly secondary data. Data was collected from the World Bank, World Development Indicators (WDI), Bank of Ghana (BOG), Ghana Investment Promotion Center (GIPC) and the International Monetary Fund (IMF). The data spanned a period of thirty years (1985 to 2015). Then, we incorporated a string of regression models, co-integration tests and Granger causality tests to answer of objectives of the study.

3.1 Model Specification

Based on preliminary studies, the equation function of the study is;

$$FDI\ inf = f(Determnants).....Eqn\ 1$$

Specifically, model becomes;

$$FDI\ inf_t = \alpha_t + \beta_1 (GDPPC)_t + \beta_2 (INTR)_t + \beta_3 (GOV.EXP)_t + \beta_4 (NAT.RESC)_t + \beta_5 (EXT.DEBT)_t + \beta_6 (INFR)_t + \beta_7 (INFLA)_t + \beta_8 (INT.RESC)_t + \varepsilon_t.....Eqn\ 2$$

Where FDI (Foreign Direct Investment) is a function of GDP Per Capita (GDPPC), Interest Rate (INTR), Government Expenditure (GOV.EXP), Natural Resource Endowment (NAT.RESC), External Debt (EXT.DEBT), Infrastructure (INFR), Inflation Rate (INFLA), and International Reserves (INT.RESC). ε is the error term and t is the time subscript whilst β represents the coefficients.

Table 1 Description of Variables

Symbol	Meaning and interpretation	Source	Expectation
FDI	FDI inflows coming into the country (Ghana).	World Bank database	
GDPPC	GDP per capita. It is how much an individual consumer spends as compared to the expenditure of the total population on goods and services?	World Bank database	+ve
INTR	Interest rate. It is the cost of borrowing funds that is expressed as a percentage of the principal amount. Treasury bill is used as a proxy.	World Bank Database	+ve/-ve
GOV.EXP	Government expenditure. It is the amount of money government spends on transfer payments, investments consumables and goods and services to secure future benefit on behalf of the nation. Variable is expressed as a percentage of GDP.	World Bank Database	+ve/-ve
NAT.RESC	Natural Resource Endowment. It is the minerals and natural resources that a country owns, which can influence business entities and other economies to invest in the host country. Variable is measured by natural resource rents expressed as a percentage of GDP.	World Bank Database	+ve
EXT.DEBT	Part of an economy's debt that is borrowed from foreign lenders and international financial institutions.	World Bank Database	+ve/-ve

INFR	Physical systems, structure and facilities of a nation (Airports, road networks, electricity, telecommunication facilities). Infrastructure is proxied by electricity production (kWh).	World Bank Database	+ve
INFLA	Inflation as measured by the consumer price index reflects the annual percentage change in the cost to the average consumer of acquiring a basket of goods and services that may be fixed or changed at specified intervals, such as yearly.		-ve
INT.RESC	International reserves. A country's external assets-including foreign currency deposits and bonds held by central banks and monetary authorities.	World Bank Database	+ve/-ve

3.2 Data Transformation

After running preliminary test on our data, we found out that they were highly correlated, collinear and non-stationary which would significantly affect our results adversely. We tried logging the variables, and using rates or percentages rather than actual figures, but the problems were not adequately solved. Therefore, to correct for this adequately, we used first differencing technique to difference some of our variables (FDI, GDPPC, EXT.DEBT and INT.RESC); these variables were in their actual values (in currency) so we found the difference by deducting the actual values by its previous (lag). To correct for scaler biases, we divide the data point by its lag. The mathematical equation therefore becomes;

$$datapoint = \frac{x_t - x_{t-1}}{x_{t-1}}$$

4 Data Analysis and Interpretation

4.1 Summary statistics

The table below presents the descriptive statistics of the variables used. In all, the number of observations ranged from 30 and 28 for the variables. The variables that were first differenced and corrected for scaler biases have the letter "d." preceding them.

Table 2 Descriptive statistics

Variable	Observations	Mean	Std. Dev.	Min	Max
d.FDI	30	0.4856039	1.120487	-0.5429185	4.555556
d.GDPPC	30	0.0022379	0.0011109	0.0004318	0.0041064
INTR	28	0.2566964	0.1094599	0.096	0.4788
GOV.EXP	31	0.124815	0.0325328	0.0931153	0.2088796
NAT.RESC	31	0.1067713	0.0446506	0.0417697	0.2000188
d.EXT.DEBT	30	0.0882066	0.2225792	-0.2163279	0.7310315
INFR	29	87.54797	13.61173	53.41072	100
INFLA	31	0.2145101	0.1212838	0.0872684	0.5946155
d.INT.RES	28	0.1569819	0.4273176	-0.46849	1.3112

FDI grew averagely about 48% year on year within the period understudy with a standard deviation of 112% which shows high variations within the years. The highest growth was 455% and the lowest was -54%.

GDPPC also grew averagely 0.22% with a standard deviation of 0.1%. Interest rates was also averagely 25% and it varied by about 11% year on year. The highest growth rate was 48%. Government expenditure also grew averagely by about 12.5% with the highest growth rate being 21% and the lowest 9%. The variation was low at 3% which indicates that generally, government expenditure in Ghana increased. Natural resource rent payments averaged about 11% of GDP and this figure varied by little (of about 4.5%). The highest rent received was about 20% of GDP and the lowest was about 4%.

External debt grew averagely by 8.8% but the figure was very spurious (22%). It is also interesting to note that external debt grew as high 73% in 2008 which is the highest growth rate in our data set, although between 2000 and 2002, external debt reduced by 6%, 1% and 12% respectively. This confirms partly the high standard deviation. Electricity production, which is a proxy for infrastructure, also average 87.54 kWh and it varied only by 13.6 through the dataset. At full peak times, annual electricity production was 100 kWh and it slumped to 53.41 at low periods.

Average inflation rate was also 21% and it varied by 12% with the years understudy. Ghana's international reserves also grew averagely by 15.7% but the figure varied widely by a rate of about 43%. At the highest point, reserves grew by 131% and the lowest point, it reduced by 48%.

4.2 Pairwise Correlation

We run a pairwise correlation, using Bonferroni-adjusted significance level to give a more significant results. The results are presented in the table below;

Table 3 Correlation matrix

	d.FDI	dgdg	INTR	GOV.EXP	NAT.RESC	d.EXT.DEBT	INFRA	INFLA	d.INT.RESC
d.FDI	1								
d.GDPPC	0.1046	1							
INTR	-0.1854	0.1835	1						
GOV.EXP	-0.0389	-0.6091	-0.1555	1					
NAT.RESC	-0.2251	-0.5171	-0.1583	0.7967	1				
d.EXT.DEBT	0.2404	-0.124	-0.3781	-0.1972	-0.1048	1			
INFR	-0.1437	0.1227	0.5486	-0.1526	-0.4225	-0.1859	1		
INFLA	-0.1665	0.4062	0.6753	-0.2912	-0.1995	-0.1041	0.488	1	
d.INT.RESC	0.1601	0.271	-0.2664	-0.111	0.159	-0.0419	-0.2539	-0.0851	1

From the second column (d.FDI) we see that the dependent variable is weakly correlated with the independent variables. To check for multicollinearity, we do a VIF test (see appendix). The mean VIF is 2.45 which is below 4.0, therefore falls within the acceptable region. Also, the VIF for the individual variables were between 3.6 and 1.40. Therefore it is safe to conclude that the variables are not multilinear.

FDI is weakly negatively correlated with interest rate, government expenditure and natural resource, infrastructure and inflation rate but positively correlated with GDP per capita,

external debt and international reserves. Thus when government expenditure grows and interest rates go up, FDI begins to fall.

GDP per capital is also positively correlate with interest rate, inflation and international reserve but negatively correlated with government expenditure, natural resources and external debt.

Inflation reduces international reserves as seen by the negative correlation. Infrastructure is also negatively correlated with international reserves, which is expected because infrastructure improves when funds from other sources (like the country's reserves) are committed into it. External debt is also negatively related to international reserves, infrastructure and inflation. This is also expected because when external debts are low, more resources would be diverted into infrastructure and stored in reserves. In could also drive prices and lead to inflation when there's more money in circulation. When government spends more, it would likely pay more of its external debts, hence the negative relationship. Rise in interest rates also negatively affects the country's external debts are interest charges would go up, government expenditure and natural resources.

4.3 Regression Results

After testing for heteroscedasticity using the Breusch-Pagan / Cook-Weisberg test for heteroscedasticity (Appendix 2), we found that our standard errors may be biased therefore we used robust standard errors in our regression to correct for this. We run 2 regressions; an OLS regression (model 1) and an OLS regression with robust standard errors (Model 2).

Table 4 Regression results

VARIABLES	Robust standard errors	
	(1) d.FDI	(2) d.FDI
d.GDPPC	229.8 (284.4)	229.8 (210.2)
INTR	2.002 (3.147)	2.002 (3.445)
GOV.EXP	36.87** (13.58)	36.87* (21.06)
NAT.RESC	-31.25*** (10.34)	-31.25* (15.58)
d.EXT.DEBT	2.116* (1.153)	2.116* (1.141)
INFR	-0.0271 (0.0224)	-0.0271* (0.0144)
INFLA	-0.357 (2.897)	-0.357 (2.513)
d.INT.RESC	0.867 (0.597)	0.867 (0.736)
Constant	0.396	0.396

	(2.347)	(1.535)
Observations	26	26
R-squared	0.442	0.442

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

The R squared for the regression models is 44.2% for both models which is quite high. This tells us the models have a strong predictive power. The number of observation is 26 for both models.

GDPPC is positively related to FDI but the relationship is not significant. And the same applies to interest rate; the relationship is positive but not significant at 5% significance level.

Government expenditure is significant in both models (5% in model 1 and 10% in model 2). Thus when government expenditure grows by 1%, FDI increases by 37% signalling that government expenditure is a good predictor of FDI. However a high standard error of 14% and 21% on both models 1 and 2 signals a high variation in the coefficient.

Natural resource endowment negatively attracts FDI inflows and it is significant at 1% in model 1 and 10% in model 10. This is expected because of the proxy used; if rents payments on natural resources increases, FDI inflow would decrease. Thus if rents increase by 1%, FDI inflows would reduce by 31%. However, the standard deviations are high also in the case, signalling high variation in the coefficient. This finding is supported by Djokoto and Dzeha (2012) who confirmed that the influence natural resources is significant in attracting FDI into the Ghanaian economy.

External debt also significantly and positively affects FDI, at 10% significance level. We expect that this is because Ghana take on more external debt for development purposes, therefore attracting more foreign investments as a result. However the coefficient is very small showing that the effect on FDI is not profound as the others.

Infrastructure has a negative and significant (at 10%) effect on FDI. Thus a 1 kWh increase in electricity will mean FDI reduce by 0.02. We try to explain the finding this way; the more the country develops, the more it becomes like the western world, therefore there would be less opportunities for them. The idea is, most foreign investments and businesses choose Ghana because it is a developing economy, therefore has more business opportunities. For developed economies, the markets are saturated.

Inflation also has a negative effect on FDI. However the relationship is not significant therefore we do not predict the results as a significant effect on FDI.

Therefore from the regression analysis, FDI is significantly predicted by Natural Resource Endowment, Government expenditure, External debt and Infrastructure. Of these, government expenditure and Natural resource seems to more profoundly affect FDI than the others.

4.4 Granger test

To conduct a granger causality test, we first do a co-integration test as it is one of the assumptions that must be met (Appendix 3).

We run the granger causality test using the first difference of the variables.

Now the model now becomes;

$$\begin{aligned}
d.FDI = & \alpha + \beta_1 d.GDPPC_{(t-1)} + \beta_2 INTR_{(t-1)} + \beta_3 GOV.EXP_{(t-1)} \\
& + \beta_4 NAT.RESC_{(t-1)} + \beta_5 d.EXT.DEBT_{(t-1)} + \beta_6 INFR_{(t-1)} \\
& + \beta_7 INFLA_{t-1} + \beta_8 d.INT.RESC_{(t-1)} + \varepsilon \dots \dots \dots \text{Eqn 3}
\end{aligned}$$

Where; (t-1) is the first lag of the variable and “d.” means the variable is first differenced. To run a granger causality test, we first run a VAR (Vector Auto Regression) model was run using two lags, to find out whether the first and second lags do cause FDI inflow. Next, we do a granger test on the VAR model.

The decision rule is;

H_0 ; The excluded variable (in column 2) does not granger cause FDI inflow. That is, the first and second lags of the independent variable do not granger cause FDI.

H_1 ; The Excluded variable granger causes FDI inflow or first and second lags of the independent variable granger causes FDI. That means, for each of the relationship in the table above with a P value less than 0.05 granger causes FDI.

Below are the results from the Granger causality test, after the test was run;

Table 5 Granger causality results

Equation	Excluded	chi2	df	Prob > chi2
d.FDI	d.GDPCC	2.0773	2	0.354
d.FDI	INTR	11.28	2	0.004
d.FDI	GOV.EXT	47.122	2	0.000
d.FDI	NAT.RESC	50.836	2	0.000
d.FDI	d.EXT.DEBT	.45068	2	0.798
d.FDI	INFR	29.634	2	0.000
d.FDI	INFLA	4.7613	2	0.092
d.FDI	d.INT.RESC	45.163	2	0.000
d.FDI	ALL	166.4	16	0.000

Considering the P values from the Granger causality test, it can be seen that interest rates, Government expenditure, Natural resources, infrastructure, inflation and international reserves granger causes FDI inflow in Ghana. GDP per capita and external debt do not granger cause FDI. Again, all the independent variables when tested, collectively granger causes FDI inflow.

5. Conclusion

The study sought to examine a number of variables to see if they determine FDI. Two approached were adopted; a regression model and a granger causality test. After conducting the regression, the results showed that Natural Resource Endowment, Government expenditure, External debt and Infrastructure

significantly predicted FDI, whilst the rest did not; GDP per capita, interest rate, inflation and international reserves did not have significant relationships.

Using a granger causality approach, interest rate, natural Resource Endowment, Government expenditure, inflation, Infrastructure and international reserves granger cause FDI. But, GDP per capital and external debt do not.

6. Recommendations

Following the above summary and conclusions, the following recommendations are worth considering; Government should preserve natural resources of the country, so as to attract more foreign capital investments. Also government spending should be geared towards development. Macroeconomic variables like inflation rates should also be kept low. Also measures must be put in place that will enhance the quality of infrastructure in the country, in order to make life comfortable and conducive to attract foreigners to invest in the Ghanaian economy. This can be in the form of improved airports, good road network systems, portable drinking water, good accommodation facilities, and uninterrupted supply of electricity.

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Appendix

1. VIF test

The Variance Inflation Factor measures how much the variance is inflated, which in effect tests for multicollinearity as variables with inflated variances are multicollinear.

We conducted a VIF test on our independent variables (variables of interest). The findings are presented in the table below;

VIF table

Variable	VIF	1/VIF	
government~r	3.63	0.275715	
NatrualRes~P	3.50	0.285812	
Inflationr~l	2.83	0.353071	
interestrates	2.78	0.360203	
Infrastruc~y	2.04	0.490405	

dgdp	1.98	0.504963	
dexternald~t	1.48	0.674863	
dinternati~s	1.40	0.714944	
Mean VIF	2.45		

The VIFs for each of the predictors were between 3.6 and 1.4, which are low. The standard practice that VIFs of 4 and above need to be further investigated, whilst those exceeding 10 are signs of serious multicollinearity requiring correction. Since all our variables have VIFs less than 4, there are not correlation in our variables.

2. Test for Heteroscedasticity

As a pre-estimation test, we test for heteroscedasticity by conducting the Breusch-Pagan / Cook-Weisberg test for heteroscedasticity. This test checks if the standard errors are biased or not. A biased standard error indicates that the independent variables may be heteroscedastic. The null hypothesis is the variance the errors are constant and the alternate hypothesis is the variance are not constant. The test results are presented below;

Breusch-Pagan / Cook-Weisberg test for heteroskedasticity

Ho: Constant variance

Variables: fitted values of dfdi

chi2(1) = 8.75

Prob > chi2 = 0.0031

The P value is less than 0.05 which means it is significant so we reject the null hypothesis and conclude that the errors do not have a constant variance. To correct for this we have to use models with robust standard errors.

3. Johansen tests for cointegration

We perform the Johansen test for cointegration rather than the Engle–Granger test, because the former tests for more than one cointegrating relationship so is more generally applicable.

The decision rule is;

Rank 0 - H_0 ; there are no cointegration among variables H_1 ; there are cointegration among variables

Rank 1 - H_0 ; there is 1 cointegration among variables H_1 ; there are no cointegration among variables

Rank 2 - H_0 ; there are 2 cointegrations among variables H_1 ; there are no cointegration among variables

Rank 3 - H_0 ; there are 3 cointegrations among variables H_1 ; there are no cointegration among variables

Rank 4 - H_0 ; there are 4 cointegrations among variables H_1 ; there are no cointegration among variables

Rank 5 - H_0 ; there are 5 cointegrations among variables H_1 ; there are no cointegration among variables

Rank 6 - H_0 ; there are 6 cointegrations among variables H_1 ; there are no cointegration among variables

Rank 7 - H_0 ; there are 7 cointegrations among variables H_1 ; there are no cointegration among variables

Rank 8 - H_0 ; there are 8 cointegrations among variables H_1 ; there are no cointegration among variables

Rank 9 - H_0 ; there are 9 cointegrations among variables H_1 ; there are no cointegration among variables

We conduct a Johansen tests for cointegration and present the results below;

Table 1

Maximum rank	parms	LL	eigenvalue	Trace statistic	5% Critical value
0	9	163.5739	.	253.8659	192.89
1	26	202.44144	0.95537	176.1308	156.00
2	41	229.83418	0.88824	121.3453*	124.24
3	54	249.39208	0.79084	82.2295	94.15
4	65	263.73682	0.68260	53.5400	68.52
5	74	274.1944	0.56682	32.6249	47.21
6	81	280.76861	0.40900	19.4764	29.68
7	86	286.08052	0.34620	8.8526	15.41

8	89	289.67262	0.24976	1.6684	3.76
9	90	290.50683	0.06456		

Table 2

Maximum rank	parms	LL	eigenvalue	max statistic	5% critical value
0	9	163.5739	.	77.7351	57.12
1	26	202.44144	0.95537	54.7855	51.42
2	41	229.83418	0.88824	39.1158	45.28
3	54	249.39208	0.79084	28.6895	39.37
4	65	263.73682	0.68260	20.9152	33.46
5	74	274.1944	0.56682	13.1484	27.07
6	81	280.76861	0.40900	10.6238	20.97
7	86	286.08052	0.34620	7.1842	14.07
8	89	289.67262	0.24976	1.6684	3.76
9	90	290.50683	0.06456		

The decision rule is reject the null when the trace statistic is higher than the critical value, and conclude that the alternative hypothesis is true. So we compare the trace statistics as against the critical values for each rank.

Therefore we reject the hull hypothesis for ranks 0 and 1. Rejection of the null for rank 0, inherently tells the variables are cointegration. In rank 2, the trace statistics is less than the critical value, therefore we fail to reject the null hypothesis (at rank 2) and conclude that there are two cointegrations among the variables. Thus we conclude our variables are cointegrated or have a long run association.

For comparison we present the maximum values in table 2 as well. We fail to reject the null hypothesis is rank two.