# The Determinants of Stock Market Volatilities in Ghana

William Angko

Department of Banking and Finance, School of Business and Law, University for Development Studies, Wa Campus, Box UPW 36, Wa.

Email: angwillie@gmail.com/wangko@uds.edu.gh

## Abstract

The study aims at examining macroeconomic relationship between economic growth and stock market performance. Annual time series data covering the period 1990-2008 were extracted and interpolated into quarterly data. The ADF test statistics are used to test for stationarity in the variables. Johansen Cointegration and the error correction model techniques are employed to ascertain both short-run and long-run relationships between economic growth and stock market performance. The main findings of the study reveal that stock market performance exerts dominant effect on economic growth. Interesting also in the results is that, it takes time for this to take effect due to the presence of a lags values in the variables. The main determinants of economic growth in Ghana are identified to be lagged GDP, foreign direct investment and exchange rate. However, Inflation rate and interest rate are found to exert insignificant influence on economic growth. The main contribution of this study is its emphasis on macroeconomic relationship between economic growth and stock market performance in Ghana.

**Keywords**: Stock market volatities, capitalization, determinants, economic growth,

## 1. Introduction

The growing importance of stock market around the world has reinforced the belief that finance is an important ingredient for growth. All over the world, the role of long-term capital in the economic growth and development process of a nation cannot be over-emphasized. Financial intermediation through the capital markets has the potential of promoting greater efficiency and growth in the economy provided that a sound institutional legal and regulatory framework is in place. Most economists recognize that a well-organized capital market is crucial for mobilizing both in the domestic and international capital. Thus Brealey and Myers (1990) argue that the mechanism of financial intermediation deals with mobilizing financial resources and channeling them into feasible economic investment.

However, in many developing countries, capital has been a major constraint in economic development, since credits are always available just for a short-term. Also, Dailami and Alkim (1990) describe the provision of funds to finance domestic capital for nation as a key factor in the prospects of long term economic growth in developing countries. Dailami and Alkim(1990) observe that the reality of a much reduced supply of foreign funds from previous sources, such as commercial banks, compel governments in many developing countries to pay increased attention to capital market development as a way of improving domestic resource mobilization, enhancing the supply of long-term capital and encouraging the efficient use of existing assets crisis. Dailami and Alkim(1990) later contend that the ongoing debt is serving to focus attention on the importance of equity rather than debt, particularly in the financing of risky projects with long gestation periods.

The role of financial system is considered to be the key to economic growth. A well-developed financial system promotes investments by identifying and financing business opportunities, mobilizing savings, allocating resources efficiently, helping diversity risks and facilitating the exchange of goods and services (Mishkin 2001). Stock market performance has therefore assumed a developmental role in global economics and finance following the impact they have exerted in corporate finance and economic activity. Stock markets, according to Paudel (2005), due to their liquidity, enable firms to acquire much needed capital quickly, hence facilitating capital allocation, investments and growth.

Stock market activity is thus rapidly playing an important role in determining the level of economic activities in most countries. Thus stock markets have an important role to play in financial liberalization and deepening. As Pardy (1992) contends that apart from providing a means of diversifying risk for both capital raisers and investors, stock markets could play other roles. For instances, they are a mechanism for capital allocation and corporate monitoring and a means for government to exercise market based rather than directs fiscal and monetary policies. Engberg (1975) recognizes the need for capital market and how it can significantly raise the level of domestic savings and contribute to a more efficient allocation of such funds among competing uses. Engberg (1975) further observes that the unavailability of these range of financial assets mentioned above will induce people to increase their rate of current savings. The reason is that, capital market enables savers to achieves a better wealth composition and also permits adjustments to be made in the wealth composition with speed and at low cost whenever circumstances change. Moreover, competition among users of stock market Funds, including individuals, business and governments, will tend to increase the efficiency with which capital is

used, with direct effect on the growth rate of the economy.

A stock markets development has an important role to play in economic development. Shahbaz et al (2008) argue that stock market performance is an important wheel for economic growth as there is a long-run relation between stock market performance and economic growth. Stock market performance has the direct impact in corporate finance and economic development.

A growing body of literature has affirmed the importance of financial system to economic growth Financial market especially stock markets, have grown considerably in developed and developing countries over the last two decades. Furthermore, Claessens, et al (2004) stated that several factors have aided in the growth process of many nations, importantly improved macroeconomic fundamentals, such as more monetary stability and higher economic growth. General economic and specific capital markets reforms, including privatization of state-owned enterprises, financial liberalization, and an improved institutional frameworks for investors, have further encouraged capital market performance.

## 1.1 Study Objectives

The main objective of the study is to examine the effect of Ghana Stock Exchange performance on economic growth in Ghana. The specific objectives of the study are to:

- Examine the performance of the Ghana Stock Market.
- Conduct empirical analysis of the stock market by investigating the link between the measures of its performance and economic growth.
- Determine and analyze the contributions of the stock market to the country's economic growth.
- Determine the direction of Causality between stock market performance and economic growth.

## 2. Literature Review

The role of long term capital in the economic development of a nation cannot be overemphasized. Most economic managers recognize that a well-organized capital market is crucial for both domestic and international capital mobilization. However in many developing countries like Ghana, capital has been a major constraint for development and growth. This chapter undertakes a review both theoretical and empirical literature on the effects of stock market performance on economic growth.

## 2.1 Theoretical Literature

In the last decade or two considerable interests in the development of stock markets is evidence by the well documentation of the role of such markets in economic development and growth. Theoretically, large number of literature argues that stock market performance boost economic growth, Greenwood and Smith (1997) show that large stock markets can decrease the cost of mobilizing savings thus facilitating investment in most productive technologies. Beneivenga et al (1996) and Levine (1991) argue that stock market liquidity (the ability to trade equity easily) is crucial for growth. Although many profitable investments require a long run commitment of capital, savers do not like to relinquish control of their savings for long periods. Liquid equity markets ease this tension by providing an asset to savers that they can quickly and inexpensively sell. Simultaneously, firms have permanent access to capital raised through equity issues. Moreover, Kyle (1984) and Holmestrom and Tirole (1993) argue that liquid stock markets can increase incentives for investors to get information about firms and improve corporate governance. Finally, Obstfeld (1994) show that international risk sharing through internationally integrated stock markets improves resource allocation and can accelerate the rate of growth.

From the point of view of Greenwood and Jovanovic (1990), King and Levine (1993), a new stock exchange can increase economic growth by aggregating information about firms' prospects, thereby directing capital to investment with returns. These effects of a stock market opening result in a measured increase in productivity. Stock exchanges exist for the purpose of trading ownership rights in firms and a new stock exchange may increase productivity growth for this reason as well. According to North (1991), the creation of a stock exchange can increase economic growth by lowering the costs of exchanging ownership rights in firms, an important part of some institutional stories of economic growth. Furthermore, Beneivenga and Smith (1992) state that a new stock market also can increase economic growth by reducing holdings of liquid assets and increasing the growth rate of physical capital, at least in the long run. In the short run, however, the equilibrium response of the capital stock to a new stock exchange can be negative because the opening of an exchange can increase households' wealth and raise their contemporaneous consumption enough to temporarily lower the growth rate of capital.

In principle, a well-developed stock market should increase saving and efficiently allocate capital to productive investments, which lead to an increase in the rate of economic growth. Stock market contributes to the mobilization of domestic savings by enhancing the set of financial instruments available to savers to diversify their portfolios. In doing so, they provide an important source of investment capital at relatively low cost (Dailami and Aktin, 1990).

Stock market is a very important constituent of capital market where the shares of various firms are traded.

Trading of the shares may take place in two different forms of stock market. When the issuing firm sells its shares to the investors, the transaction is said to have taken place in the primary market but when already issued shares of firms are traded among investors transaction is said to have taken place in secondary market. The stock market is working as the channel through which the public savings are channelized to industrial and business enterprises. Mobilization of such resources for investments is certainly a necessary condition for economic take off, but quality of their allocation to various investment projects is an important factor for growth. This is precisely what an efficient stock market does to an economy (Berthelemy and Varoudakis, 1996).

In the past decade, the world stock markets surged and emerging markets accounted for a large amount of this boom (Dermirgue- Kunt and Levine (1996). But recent research has begun to focus on the linkage between the stock markets and economic development. New theoretical work shows how stock market performance might boost long-run economic growth and new empirical evidence supports this view. Dermirgue-Kunt and Levine (1996), Singh (1997) and Levine and Zewos (1998) find that stock market performance or development plays an important role in predicting future economic growth. In a well-developed stock market share ownership provides individuals with a relatively liquid means of sharing risk when investing in promising projects. Stock markets help investors to cope with liquidity risk by allowing those who are hit by liquidity shock to sell their shares to other investors who do not suffer from a liquidity shock. The result is that capital is not prematurely removed from firms to meet short-term liquidity needs.

Moreover, stock markets play a key role in allocating capital to the corporate sector, which have real effect on developing countries, where bank loans may be limited to a selected group of companies and individual investors. This limitation can also reflect constraints in credit markets (Mirakhor and Villanueva, 1990) arising from the possibility that a bank's return from lending to a specific group of borrows does not increase as the interest rate it charges to borrowers rises (Stigliz and Weiss, 1981 and Cho, 1986).

## 2.2 Empirical Literature

The arguments for stock market activities were supported by various empirical studies, such as Levine and Zervos (1993); Atje and Jovanovic (1993); Levine and Zervos (1998). Although these studies emphasis the importance of stock market development in the growth process, they do not simultaneously examine banking sector development, stock market development, and economic growth in a unified framework. On the other hand Levine and Zervos (1993); Atje and Jovanovie (1993); Levine and Zervos (1998); Reusseau and Wachtel (2000) and Beck and Levine (2003) show that stock market development is strongly correlated with growth rates of real GDP per capital. More importantly, they found that stock market liquidity and banking development both predict the future growth rate of the economy when they both enter the growth regression. They concluded that stock markets provide different services from those provide by banks. This is also consistent with the work by Levine and Zervos (1995) and the argument by Demrgue-Kunt (1994) that stock market can give a big boost to economic development.

Stock exchange are expected to accelerate economic growth by increasing liquidity of financial assets, making global risk diversification easier for investors, promoting wiser investment decisions by saving-surplus unites based on available information, forcing corporate managers to work harder for shareholders' interests, and channeling more saving to corporations. In accordance with Levine (1991), and Benchivenga and Smith and Starr (1996) they emphasized the positive role of liquidity provided by stock exchanges on the size of new real asset investments through common stock financing. Investors are more easily persuaded to invest in common stocks, when there is little doubt on their marketability in stock exchanges. This in turn, motivates corporations to go to public when they need more finance to invest in capital goods.

Another important contribution of stock exchanges to economic growth is through global risk diversification opportunities they offer. However, Saint-Paul (1992); Deveraux and Smith (1994) and Obstfeld (1994) argue quite plausibly that opportunities for risk reduction through global diversification make high risk, high return domestic and international projects viable, and, consequently, allocate savings between investment opportunities more efficiently. Stock prices determined in exchanges, and other publicly available information help investors make better investment decisions. Better investment decisions by investors mean better allocation of funds among corporations and, as a result, a higher rate of economic growth. In efficient capital markets prices already reflect all available information, and this reduces the need for expensive and painstaking efforts to obtain additional information (Stiglitz, 1994). Form the point of view of Schumpeter (1912), technological innovation is the force underlying long-run economic growth, and that the cause of innovation is the financial sector's ability to extend credit to the entrepreneur.

The study done by Levine and Zervos (1998), find a positive and significant correlation between stock market development and long run growth. Greenwood and Smith (1996) show that stock markets lower that international risk sharing through internationally integrated stock markets improves resource allocation and accelerates growth. Bencivenga, et al. (1996) and Levine (1991) have argued that stock market liquidity, the ability to trade equity easily, plays a key role in economic growth; although profitable investments require long

round commitment to capital savers prefer not to relinquish control of their savings for long periods. Liquid equity markets ease this tension by providing assets to savers that are easily liquidated at any time.

Paudel (2005) also acknowledges that stock markets due to their liquidity enable firms to attain the much needed capital quickly, hence facilitating capital allocation, investment and growth. There is a significant positive impact of stock market development on economic growth in countries classified as upper middle income economies founded by Adjasid Biekpe (2005). Bahadur and Neupane (2006) concluded that stock markets fluctuations help in the prediction of the future growth of an economy. Ye Kyle (1984) argues that, an investor can profit by researching a firm, before the information becomes widely available and prices change. Thus investors will be more likely to research and monitor firms. To the extent that larger, more liquid stock markets increase incentives to research firms, the improved information will improve resources allocation and accelerate economic growth. The role of stock markets in improving informational asymmetries has been questioned by Stigliz (1985) who argues that stock markets reveal information through price changes rapidly, creating a free-rider problem that reduces investor incentives to conduct costly search. The contribution of liquidity itself to long-term growth has been questioned.

Demirguc-Kunt and Levine (1996) point out that increased liquidity may deter growth via three channels. First, it may reduce saving rates through income and substation effects, second, by reducing the uncertainty associated with investments, greater stock market liquidity may reduce saving rates because of the ambiguous effects of uncertainty on savings; third, stock market liquidity encourages investor myopia, adversely affecting corporate governance and thereby reducing growth. The one important study mentioned earlier is one by Levine and Zervos (1998) who are among the first to ask whether stock markets are merely burgeoning casinos or a key to economic growth and to examine this issue empirically, finding a positive and significant correlation between stick market development and long run growth. However, Levine and Zervos's use of a cross-sectional approach limits the potential robustness of their findings with respects to country specific effects and time related effects. The legal liberalization of the stock market increased the importance of the stock market. It does not only link the importance of the stock market to economic growth over time, but also interpret it in relationship to the universal banking system.

Two recent studies using time series data on the Ghana Stock exchange are one by Kyereboah and Agyire-Tettey (2007). The study found that interest rate exerts an insignificant impact on stock market performance. This is so because changes in interest rate are much slower than the rate of growth in the All-Share index. Lending rate and inflation rate negatively on the stock market where as exchange rate positively on Ghana stock market performance. The other study using similar data on the Ghana stock exchange employed an EGARCH model to estimate the macroeconomic factors that affect volatilities in stock prices in Ghana. Adjasi (2006) found that cocoa prices, interest rate increase volatilities in stock prices. Higher Gold price, oil prices, and money supply reduce volatilities. From the above review, it may seem that the effect of capital markets on economic growth has been a controversial subject. Some studies indicated significantly the effect of stock market development on economic growth. Others did not. Similarly others reported positive impact of stock liquidity on economic growth and some did not.

## 3.0 OVERVIEW OF THE GHANA STOCK EXCHANGE

Ghana Stock Exchange was incorporated in July 1989, as a private company limited by guarantee under Ghana's companies code 1963 (Act 179). It was given recognition as an authorized stock exchange under the Exchange Act of 1971 in October 1990 and first trading on the floor was in November 1990. In April 1994 it was converted into a public company limited by guarantee. This simply means that it a legalized market place where shares and stocks of firms or companies and the Government can be bought and sold, and also a market for secondary securities (i.e. shares/stocks that have already been issued and are in the hands of investors).

Currently GSE has thirty-five (35) ordinary shares (companies), one (1) preference share, two (2) corporate bonds and three (3) government debts. All types of securities are listed. The criteria for listing includes capital adequacy, profitability, spread of shares, years of existence and management efficiency. GSE All share index is the main index of the Exchange. Since its inception, the performance of the Ghana Stock market has varied considerably. For instance in 1993, the GSE was the 6th best index performing emerging stock market with a capital appreciation of 116%. In 2008 the GSE All Share Index was up 60%. As at 31st December, 2008, the GSE's market capitalization was GH¢17.9 billion an increase of 44%.

The manufacturing and brewing sectors currently dominate the exchange. A distant third is the banking sector while other listed companies fall into the insurance, mining and petroleum sectors. Most of the listed companies on the GSE are Ghanaian. However there are some multinationals too. Potential changes at the Exchange include the introduction of automated trading and the listing of some of the state banks. These changes are aimed at making the Exchange more relevant, efficient and effective.

### 3.1 Governance Structure

The GSE is governed by a council with representation from six constituencies namely licensed dealing members, listed companies, the banks, insurance companies, money market and the general public. The Managing Director of the Exchange is an ex-officio member of the governing council. The council sets the policies of the Exchange. Its functions include prevention of fraud and malpractices, maintaining good order amongst members, regulating stock market business and grants listing. It also maintains public confidence in the market and promotes the Exchange. Thus the Stock Exchange provides an alternative for investing idle funds for greater returns such as dividends, interest and capital. Both government bonds and corporate bonds are traded in the Ghana stock exchange. The figure 1 and 2 presents the trends in both government and corporate bonds traded in the market. Figure 1 depicts fluctuations in the value of corporate traded bonds than that present in figure 2 for value of government traded bonds.

### 3.2 Membership

There are two (2) categories of membership namely Licensed Dealing Members and Associate Members. Licensed dealing members are corporate bodies licensed to deal in listed securities while Associate members are individuals or corporate bodies which have satisfied the exchange's membership requirements but not licensed to deal in securities.

Currently, the Exchange has eighteen (18) Licensed Dealing Members (stock broking firms); thirty six (36) Associate Members, forty-eight (48) Authorized Dealing Officers and seventeen (17) Registered Government Security Dealers (GSE Hand Book)

### 3.3 Objective of GSE

The Ghana Stock Exchange has the following objectives:

- To provide the facilities and the framework to public of Ghana for purchase and sale of bonds, stocks/shares and other securities and for the investment of money (i.e. it functions as primary and secondary market).
- To control the granting of quotations on the securities market in respect of bonds and other securities of any company, corporation, government municipality, local authority or other body corporate.
- To regulate the dealing of members
- To make such rules and do all such things as may be considered desirable for, incidental or conducive to, the attainment of the above objective (GSE Handbook).

### 3.4 Regulations of GSE

The GSE has various regulations; under the securities industry Law, (1993), the apex regulatory body is the Securities and Exchange Commission (SEC). Thus SEC is the regulatory body for the securities market. The securities law (1993) vests the commission with the primary regulatory functions that are aimed at ensuring that there is an orderly growth and development of an efficient, fair and transparent securities market in which investors and the integrity of the market are protected.

The functions of the commission include:

- Maintaining surveillance over securities to ensure orderly, fairly and equitable dealing in securities.
- Registering, licensing, authorizing, or regulating the stock Exchange investment advisors, securities dealers, etc.
- Protecting the integrity of the securities market against any abuse arising from the practice of insider trading.

These functions were intended to achieve three (3) main objectives of securities regulation namely:

- To protect the interest of investors
- To ensure a fair, efficient and transparent securities market.
- To reduce systematic risk.

### 3.5 GSE Listing Regulations

A company is said to be listed when its shares/securities are approved to be bought and sold the stock Exchange. In order to get your newly issued shares listed on the GSE, you need to communicate your intention early to the GSE and work with the Exchange so that your prospectus will satisfy the Exchange's listing requirements before the public flotation. These requirements are stipulated in GSE Rule Book.

There are two (2) lists with fairly easy requirements. The first official list (FOL) – the company must have a stated capital of at least ¢100 million after the public floatation. The second official (SOL) – the company must have a stated capital of ¢50 million after the public floatation. Shares issued to the public must not be less than 25 of the number of shares issued by the company. All shares must be fully paid for. Except in very exceptional circumstances the Exchange will refuse listing in respect of partly paid shares.

Finally, the spread of share holders existing at the close of an offer should be in the GSE's opinion adequate with at least fifty (50) shareholders after the public offer.

### 3.6Trading on the GSE

Trading on the Exchange floor commenced on the 12th November 1990 and was officially launched on the 11th January 1991. Automated trading takes place daily from Monday to Friday.

The GSE Automated Trading System (GATS) is computer based. It automatically submits trades onto the trading system. The system is designed to match order placed by stockbrokers to buy and sell shares. Thus stockbrokers post investors orders to buy and sell shares in an electronic order book. These orders are matched automatically i.e. the system determines who buys what at which price and from which seller.

The automated trading on the Exchange which is supervised by the GSE is done through three ( 3) alternative levels of access namely

- On the trading floor of the GSE
- At the office of the stockbroker through the Wide Area network (WAN)
- Through the internet

All these are done under the supervision of the GSE.

Automated trading on the GSE is to improve market efficiency and transparency. It also enables more shares to be traded to improve liquidity on the market. It also positions the GSE to compete favourably on the international market, attract more investors and issuers. Settlement period is T + 3 business days. However, where possible T + 0 or same day settlement is allowed.

Trade commissions have been partially liberalized. A minimum of 1.5% and a maximum of 2.5% are charged as commission on the value of shares traded. This is toward full liberalization in the future. From the figure 3 and 4 below, it can seen that the Volume of stock traded in the market increased gradually from 222 000 Ghana Cedis in December 1990 to 30,717,090 and 531,660,000 Ghana Cedis in 2008 respectively. This show a tremendous increased in the volume of stocks traded between 1990 and 2008. A similar increased is seen in the value of stock traded in the market within the stated periods. The available data presented in figure4 below shows that, the value of stock traded increased from 0.0064 million Ghana Cedis in 1990 to 5.06 million Ghana Cedis in year 2000 and finally in 2008 to 365.51 million Ghana Cedis.

### 3.7 GSE Contribution to the Economy

The GSE is no exception considering contributions stock markets played in economies worldwide. The important contributions of the GSE to the Ghanaian economy can simply be summarized as follows;

- It promotes economic growth through improved efficiency in savings mobilization by issuing securities publicly quoted by companies and the government.
- It promotes a culture of savings or thrift. The very fact tat institutions savers can safely invest. In addition earned return is an incentive to people to consume less and save more. The GSE also assists in the transfer of savings to investment in productive enterprises as an alternative to keeping the savings idle.
-  Another contribution offered by the GSE in the Ghanaian economy is the assistance in the efficient and rational allocation of capital which is a scarce resource. The fact that capital is scarce means systems have to be developed where capital goes to the most deserving user.
- The GSE also promotes higher standards of accounting, resource management and transparency in the management of business. This is because financial markets encourage the separation of owners of capital from managers of capital. This separation is important it has been recognized that the best business people with best ideas may not have the money.
- Another major role by the GSE to the economy is the facilitation of access to finance of different types of users by providing flexibility for customization. This is made possible by allowing the different users to raise capital in ways that are suitable to their specific needs. For example in 2008, SIC, UT Financial Services and Golden Star Resources raise funds by issuing new shares. HFC Bank Ltd, SPPC and CFAO raised additional capital through additional issues.
- The GSE contributes to the economy by providing investors with an efficient mechanism to liquidate their investments in securities. This is a very important role due to the fact that investors are certain of the possibility of selling out what they hold as and when they want. It also serves as a major incentive for investment as it guarantees mobility of capital in the purchase of assets.
- There are other contributions of the Exchange to the economy. The mass participation of the public helps in reducing economic inequality and the market also provides employment as evident with eighteen (18) stock broking firms licensed to deal on the Exchange. There are also thirty-five (35) companies operating on the market.

The performance of the Ghana economy in terms of GDP growth rates is depicted in figure 3 below. It can be seen in figure 5 below that there was a downward trend in GDP growth between 1990 and 1995 and thereafter, GDP growth experienced fluctuations until 2008 though it grew steadily. The Ghana Stock market has significantly influenced the growth and development process of Ghana. Trends in the growth rates are shown in

the figure 5 below.

## 4. METHODOLOGY

There is a large literature on econometric modeling and forecasting volatilities in emerging stock markets, however, few of such studies in the literature focused on the Ghana Stock Exchange (GSE). The relationship between stock market performance and economic growth has been the central issue in the literature. This study therefore examines the association and causality between stock market and economic development based on Levine and Zervos's (1996) study on stock development and long term growth. Despite the fact that many studies are based on cross-country comparison of stock market development, this study employed annual time series data on Ghana for the period 1990 to 2008.

The study also employed the Engle and Granger causality test procedure to determine the direction of causality between stock market development and economic growth and to also determine how they evolve over time. The study will further examine the relationship between stock market performance and economic growth. Cointegration technique introduced by Granger (1981) and developed by Engle and Granger (1987) and Johansen for multivariate time series analysis has become a useful framework for analyzing long-run relationships amongst time series variables.

### 3.1 Model Specification

Koutsoyiannis (1977) recommended that the first and most important step the econometrician has to take in attempting the study of any relationship between variables is to express this relationship in mathematical form. This particular adopted a prior model specification with some few modification from the Dermirquc-Kunt and Levine (1996) specification in analyzing the effect of stock market performance on economic growth.

Thus, given that MC = stock market Capitation rate as a measure of stock market development, Specifically, we post the following model;

Linear function model (linear variable and parameters):

$$Y = f(MC, FDI, INT, EXR, INFL) \tag{1}$$

Where;

Y measures of economic growth in terms of GDP growth rates and also serves as the dependent variable while the independent variables are, prevailing interest rate (INT), Foreign Direct Investment (FDI), Inflation rate (INFL), Exchange rate (EXR) and Market capitalization(MC).

Since we are interested in the effects of other macroeconomic variables together with stock market capitalization rate (MC) on economic growth in Ghana, the study estimated the above general model.

Linearizing and taking the natural logarithm of both sides of the equation (1), we have

$$LogY_i = a + b_1 LogMC_i + b_2 LogFDI_i + b_3 LogEXR_i + b_4 LogINT_i + b_5 INFL_i + e_i \tag{2}$$

Where, $e_t : (0, d^2)$, a white noise

$b_i$ s are the parameters or coefficients to be estimated in the model

Let

LogMC = LMC

LogY =   LY

LogINF =LXR

LogINT = LINT

LogFDI = LFDI

Thus, the estimable equation becomes;

$$LY_i = a + b_1 LMC_i + b_2 LFDI_i + b_3 LEXR_i + b_4 LINT_i + b_5 INFL_i + e_i \tag{3}$$

### 3.2 DATA SOURCES

The data for the study consists of annual time series from 1990 to 2008 and interpolated into quarterly data by eviews. All the macroeconomic data stock market developments were extracted from International Monetary Fund- 2009 World Economic Outlook whereas the other variables were extracted from World Development Indicators CD-ROM.

### 3.3 Variable Definitions

Previous studies by Dermirguc-Kunt and Levine (1996) used broader indicators of stock market development to included stock market size, market liquidity, market concentration, institutional development, and extent of integration with world capital markets. For the purpose of this particular study, we adopted market capitalization as a measure of stock market performance. This measure equals the total market value of listed shares divided by GDP. The assumption behind this measure is that it is less arbitrary than any other measure of stock market development.

### 3.3.1. Economic growth

Real income has been found to be highly correlated with the size of the stock market. We use the log GDP per capita to measure Economic growth. According to demand driven hypothesis, the expansion of an economy will create new demand for financial services. Such increase in demand will exert pressure to establish larger and more sophisticated financial institutions to satisfy the new demand for their services.

### 3.3.2 Stock Market Capitalization (MC)

This variable captures the performance of the market and it is one of the independent variables in our regression analysis. We measure stock market development by market capitalization as a proportion of GDP[1]. This measure equals the total market value of listed shares divided by GDP. Its selection is motivated by data availability and also based on the Dermirguc-Kunt and Levine (1996) model.

### 3.3.3 Foreign Direct Investment Inflows (FDI)

Foreign capital inflows can make significant contributions to the host country's economic growth and development by lessening and cushion shocks resulting from low domestic saving and investment. The Balance of Payments Manual published by the International Monetary Fund in 1993 defines Foreign Direct Investment as an investment made to acquire lasting interest in enterprises operating outside of the economy of the investor. Increase in FDI inflow is hypothesized to have a positive effect on economic growth. Foreign direct investment flows serve as additional source of raising funds to supplement investment and domestic savings.

### 3.3.4 Interest Rate (INT)

The relationship between interest rates and economy growth is well established. An increase in interest rate will increase the opportunity cost of holding money and invesors substitute holdings interest bearing securities for share hence falling stock prices. Lower interest rates reduces the opportunity cost of borrowing funds hence increases investment that certainly translates into economic growth (increased incomes). The Treasury bill rate is used as a measure of interest rate in this study because investing in Treasury bill is seen as opportunity cost for holding shares. High-treasury bill rates encourage investors to purchase more government instruments and makes funds available for investment.

### 3.3.5 Inflation (INF)

High rates of inflation increase the cost of living and a shift of resources from investments to consumption. This leads to a fall in the demand for market instruments which lead to reduction in the volume of stock traded. Also the monetary policy responds to the increase in the rate of inflation with economic tightening policies, which in turn increases the nominal risk-free rate and hence raises the discount rate in the valuation model.

### 3.4 Estimation Procedure

Econometric modeling using time series data usually violates many of the general assumptions underlying the usual Least Squares (OLS) regression. For the general econometric model equation as shown above, the ordinary Least Squares, though it has the best linear unbiased estimator (BLUE), it assumes that the variables are stationary at their levels. If the considered variables are not stationary at their levels, then OLS regression is will often result in "seemingly good regression", the usual Spurious regression suggesting economically meaningless regression. In the presence of this problem, the regressions usually have very significant coefficients but have no economic meaning based on economic theory. Since OLS assumes that the disturbances are white noise, the implication could be that the residuals are inconsistent with the assumption.

### 3.4.1 Unit roots test (ADF Test)

From theory, for time series to be cointegrated they must be of the same order but not stationary i.e. become stationary after taking the first difference - I(1)] but with the residuals being I(0). Occasionally one may find I(2) series but for this study it was expected that the time series variables would be I(1) since most macroeconomic variables are known to be integrated of order one-I(1). The Augmented Dickey-Fuller test statistic is employed to test for the order of integration of the considered time series variables with the inclusion of only a constant. Since most economic variables have the tendency to increase over time, the test for stationarity or unit roots is justifiable in that most macroeconomic variables becomes stationary after differencing them

### 3.4.2 Cointegration Test (Johansen Test)

Most time series variables are classified as being integrated of order d, denoted as I (d), that is, if the series must be differenced d times in order to become stationary then it contains d unit root. The economic interpretation of cointegration is that, two or more series are linked to form a long run equilibrium even though they may be non-stationary (they may contain stochastic trends). If the variables are non-stationary then they will never move closer to each other over time and the difference between them will be stationary (stable). Cointegration in econometric modeling is used to mimic the existence of this long run equilibrium to which this economic variables converge over time.

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[1] Countries with highly concentrated markets have markets that are undeveloped. So market capitalization is hypothesized to be highly correlated with market concentration, market size, market liquidity and number of listed companies.

When two or more series have unit root (non-stationary), they may also be cointegrated. In the presence of unit roots, we test for cointegration of these variables to capture the long run equilibrium relationship between the variables. Otherwise, no equilibrium exits. If the series are cointegrated, then we have information about their long run behaviour of the variables and the coefficients are interpreted as the long run multipliers. The Johansen test for cointegration procedure will be employed. Using the Granger representation theorem, if one is modeling cointegrated variables using general to specific approach, one can focus on ECMs when testing down from general Model to the preferred specific model. ECMs are useful since the short-run and long-run effects are separated and clearly distinguished and can be readily estimated. The models are balanced if the variables are cointegrated and therefore the problems of spurious regressions are avoided. The number of cointegration equation will be determined and analyzed using the Vector Error Correction Model.

### 3.5 Causality Test (Engle and Granger)

The cointegration technique pioneered by Engle and Granger (1987), Hendry (1986) and Granger (1986) made a significant contribution towards testing Granger causality. According to this technique, if two variables are cointegrated, finding of no causality in either direction, one of possibilities with the standard Granger and Sims tests, is ruled out. So long as two variables have a common trend, causality (in the Granger sense, not in the structural sense), must exist in at least one direction, (Granger, 1988, Miller and Russek, 1990). This Granger (or temporal) causality can be detected through the vector error-correction model derived from the long run Cointegrating vectors. In chapter five, we report regression results from the pairwise causality test.

### 4. RESULTS

This chapter is focused mainly on the empirical analysis of the relationship between economic growth and the performance of the Ghana Stock Exchange. The chapter starts with the formal test for unit roots using the ADF test statistic and the Johansen test procedure for cointegration. The formal model is estimated in both the over parameterized and parsimonious error correction model. The study further conducted the Engle and Granger causality test between economic growth and stock market capitalization.

### 4.1 Diagnostic Tests of Long Run Model

Table 1 below shows the summary descriptive statistics of the variables used for the study using annual data that are interpolated into quarterly data from the period 1990 to 2008. The Jarque-Bera statistics for normality shows that all the variables are not randomly distributed at 5% level of significance. The summary statistics shows that, the difference between the maximum and minimum values is wide apart and the standard deviation is also high indicating a high level of fluctuations in GDP growth rate. There is also evidence of skewness, which means that the right tail is particularly extreme, an indication that the market has non-symmetric growth.

### 4.2 Results of Units roots test

The study carried out the Augmented Dickey-Fuller test for unit roots with only a constant. Under this tests, a variable is stationary (contains no unit roots) if the ADF test statistic tests statistic is less than the conventional 5% critical value. The results of the unit roots test based on both the Augmented Dickey- Fuller test statistic with the inclusion of only a constant are displayed in the appendix. The result shows that all the variables are stationary at their first difference. In other words, all the variables are integrated of the same order I(1). This implies that all the variables contain unit roots (non stationary) at their level at both 1% and 5% significance level.

### 4.3 Correlation matrix between GDP and Stock Market Capitalization

The correlation matrix in table 3 below found a strong positive correlation between the log of GDP (measure of economic growth rate) and the performance of the Ghana stock market. The result established a correlation coefficient between the two variables to be 0.952. Furthermore, the graphical representation reveals that logs of GDP positively correlate with the stock market capitalization. However, we cannot infer that correlation means causality. Although the graph indicates that both LGDP and LMC move closely together, there are a few fluctuations in the stock market performance over the same period.

### 4.4 Engle and Granger causality between GDP and Market capitalization

In order to formally establish a directional causality between log of GDP and stock market capitalization in Ghana, the study employed the Engle and Granger causality procedure. The result is displayed by the Pairwise Granger Causality Tests below. Under the Null hypothesis that LMC does not Granger cause LGDP and LGDP does not Granger cause LMC, Since the probability value in both cases are less than the 5% level of significance (0.05), we do not reject the null hypothesis and conclude that there is directional causality between LGDP and LMC or the other way run. However, there is a positive correlation between LGDP and LMC as shown by the correlation matrix and graph. In conclusion, this correlation is a possible indication that, both GDP and market capitalization may be moving together but we cannot say much about causality. Our study attempts to measure the effect of market capitalization on economic growth in Ghana.

## 4.5 Testing for Cointegration

The study used the Johansen test procedure to investigate the number of cointegration relationships that exist between the variable using the maximum Eigenvalue. The speed of adjustment to long rum equilibrium will be captured by an error correction model. It can be clearly seen from the Johansen hypothesized cointegration relationship displayed in table 5 above that there is a unique cointegration relationships between the variables. This is what the model tries to evaluate. The results of the normalized cointegration coefficients are also shown in appendix. The result from table 6 further suggests that the growth equation which normalized the log of stock market capitalization and the other macroeconomic variables to zero are all statistically significant and provide useful explanation for economic growth in Ghana. The study estimated a vector error correction model to evaluate the relationship between economic growth and stock market performance in Ghana. This has enabled us capture the long run relationship between the variables. This is done by simply be introducing the error correction factors to reconcile both the short run and long run relationship. This error correction term (ECT) measures the speed to which GDP adjust to its long run equilibrium after disequilibrium. This then provides us with information about the proportion of disequilibrium error accumulated in the previous periods that are corrected in the current period. The study proceeded by estimating an over parameterized error correction model. The study further estimated a specific or parsimonious Error Correction Model by including only the first differenced variables without their lags from the over- parameterized model. The choice of a zero lag length is just for convenience. In the statistical test for normality using the Jarque-Bera statistic, Breusch-Godgrey test for serial correlation, ARCH test for Autoregressive conditional heteroscedasticity, the white heteroscedasticity test, and the Ramsey Reset test for specification errors. The diagnostic test result in table 9 shows that the regression residuals are normally distributed with no serial correlation with all the parameters been stable and the model is correctly specified.

## 4.6 Interpretation of the parsimonious Error Correction Model

There is no general rule on how to choose the maximum lag to start with. Researchers usually employ a rule of thumb which is the cube root of the number of observation. As a matter of simplicity, the study included a zero lag length. The result shows an adjusted $R^2$ of 0.769; implying that about 76% of variations in GDP is explained by the independent variables in the regression. The F-statistic of the regression is also shown to be statistically significant at 1% level indicating that the overall result is good. The other tests result like the Durbin-Watson statistic of 1.92 also implies no autocorrelation in the regression. The coefficients of the regression show that the growth rate of GDP is dependent positively on its previous year's growth. The coefficient of lagged GDP in table 8 indicates that a percentage increases in GDP the previous year will lead to about a 0.82% increase in GDP in the current year.

The result again shows that an increase in rate of stock market capitalization in Ghana by just a one percent will positively caused about a 7% change in GDP growth. Foreign direct investment also determines the phase of growth in Ghana. The result finds a significantly positive impact on Economic growth. A percentage increase in FDI will increase GDP growth by 4%. Inflation as estimated to have a positive but insignificant relationship with economic growth in Ghana. Since the effect of inflation is felt with time, it is the lag of inflation that turns to affect growth. The result therefore favors the general assertion that it takes time for investors to adjust their portfolio due to the lagging effect of changing inflation. The Exchange rate (movement in the cedi-Dollar rates) is also found to positively affect economic growth and indicates the fact that the Ghana economy has benefited from major depreciation of the cedi as they do receive the proceeds from their sale on the international market in foreign currency. This is however statistically significant.

Interest rate which measures the opportunity cost of borrowing fund is statistically insignificant at 5 percent level. This therefore suggests that interest rate do not exert any significant influence on the performance of the economic growth in Ghana. However, the negative coefficient is expected since increases in interest rate crowds out private investment and slows down the rate of growth in an economy

The Error Correction term (ECM) which measures the speed to which the growth rate of GDP adjusts to its long-run equilibrium is negative and significant at one percent level with an absolute value less than unity, the results indicates a stable error correction mechanism in which GDP growth eventually converges to the long-run equilibrium level after a deviation. The results indicate that the speed of adjustment to the long run equilibrium level is relative low with a coefficient of 0.207. This suggests that about 21 percent of any previous disequilibrium in the long run will be corrected in the short term. The overall results suggest that stock market capitalization, foreign direct investment, Exchange rates only significant determinants of economic growth in Ghana, while inflation rate and interest rates are insignificant in explaining the growth rate of the Ghanaian economy.

## 4. 7 Summary and Conclusion

Ghana Stock Exchange plays a vital role in determining the rate of growth of the Ghanaian economy. However, whatever yardstick one may employ to assess the performance of the Ghana Stock Market towards investment

growth as well as growth in the entire economy, the contribution of stock market to the growth of an economy cannot be undermine. Our results on one hand show that, only inflation rate and interest rate exert insignificant influence on rate of economic growth of the Ghanaian economy. This is because, the rate of growth in inflation and interest rates are far slower than the rate of growth in GDP. On the other hand, lagged LGDP, market capitalization rate and exchange rate are shown to significantly influence the growth rate of GDP.

The negativity of the error correction term (ECT) confirms that the model will return to equilibrium after a diversion from its equilibrium value in the short run and converge in the long run to its equilibrium value.

The influence of Stock Market performance, FDI and Inflation and exchange rate on economic growth cannot be overemphasized. It is perceived that if the Bank of Ghana is able to fulfill its mandate of price stability and encourage FDI then operators of the stock market will keeps expectation so high that investors will be abreast with the happenings as well as the great benefit of the stock market and consequently on economic growth. One can also maintain that the operation of the Ghana Stock Exchange depends very largely on the degree of the freedom permitted to the exchange in dealings with pricing of securities, maintenance of strict standards and many other purposeful innovations.

### 4.8 Recommendation

For the stock market to achieve objective of growth acceleration, the findings of the study have important policy implications for emerging market countries and economies;

➢ First, stock market performance plays an important role in economic growth process. It is therefore important to initiate policies to foster growth and development as countries liberalize their financial systems.

➢ Foreign direct investment flow into the country lessons shocks in the economy resulting from low saving and investment. Therefore, foreign direct investment serves as a stimulus to the growth of the Ghanaian economy by mobilizing additional funds to for investment and growth.

➢ Interest rates that have the tendency to raise investment demand and increase growth should be maintained at a low and optimal level in the Ghanaian economy. The prime rate (Base rate) set by the Bank of Ghana is expected to influence the lending rate. Hence, the bank should consider the growth effects of changes in interest rates when setting the prime rate.

➢ The prime objective of the Bank of the Bank of Ghana should be maintaining price stability in the economy as macroeconomic stability is a key factor for enabling the growth process of every economy.

➢ With macroeconomic stability, Exchange rates should be left to be determine freely be the market forces of demand and supply of foreign currency so as to stimulate growth.

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**NOTES**

**Figure 1: Trends in value of corporate bonds in million of US dollars traded in GSE**
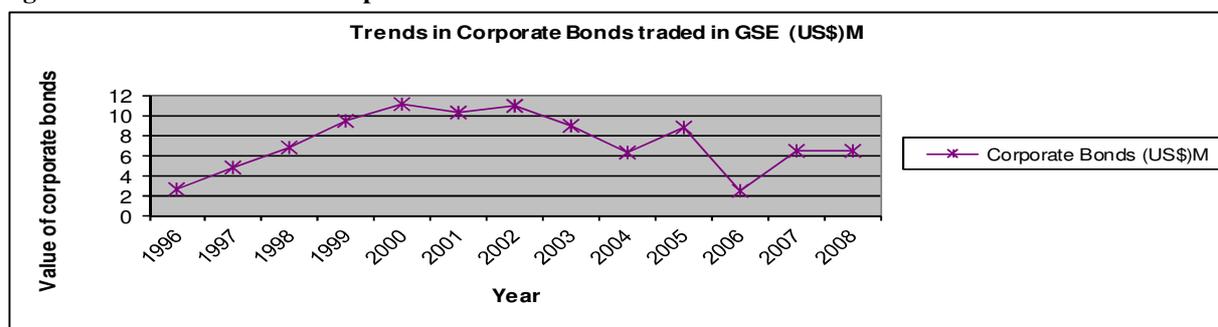


**Figure 2: Trends in Government traded bonds in GSE**
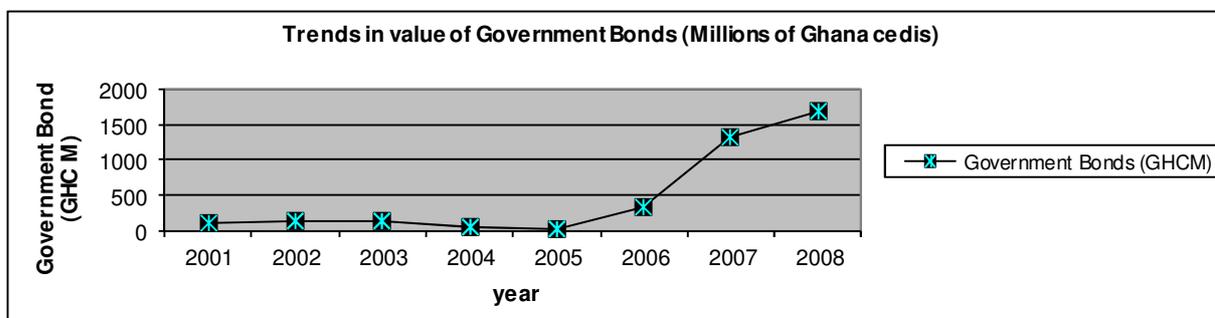
**Figure 3: Trends in Volume of stock traded in the GSE**



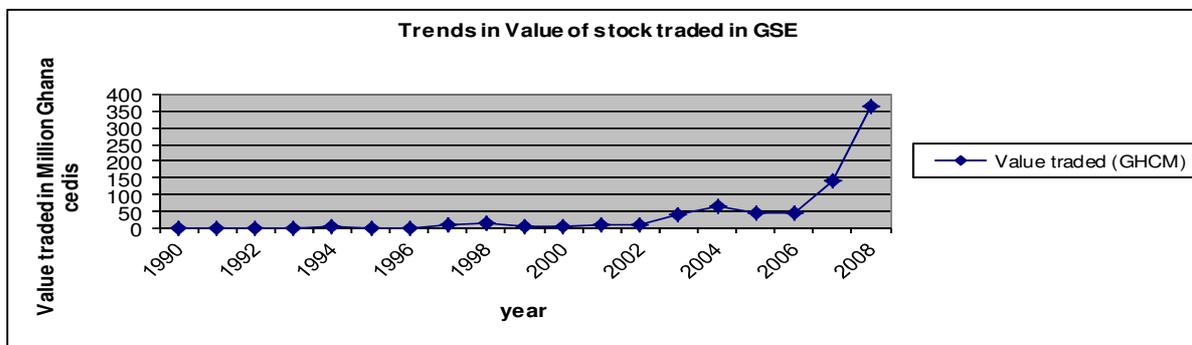**Figure 4: Trends in Value of stock traded in GSE**
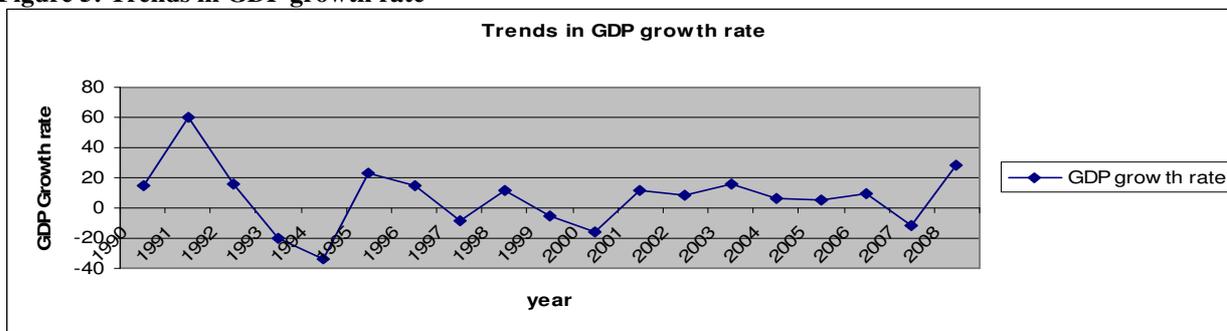


**Figure 5: Trends in GDP growth rate**



**Figure 6: Trends in Stock market capitalization in GSE**
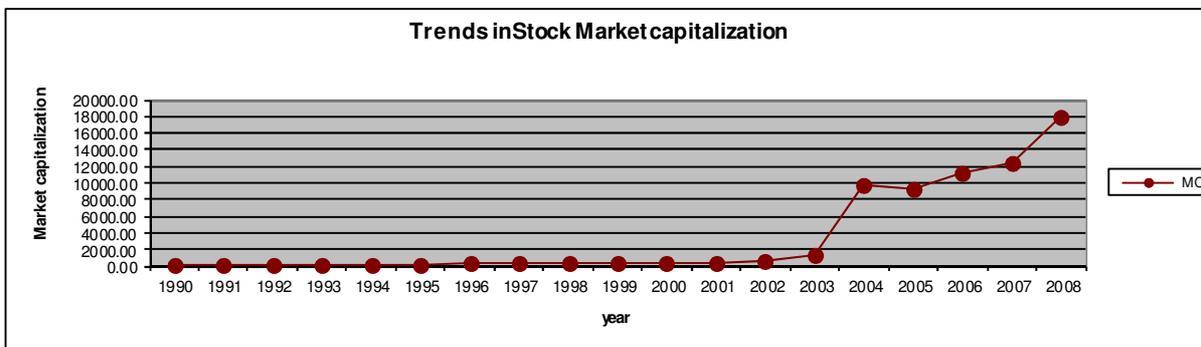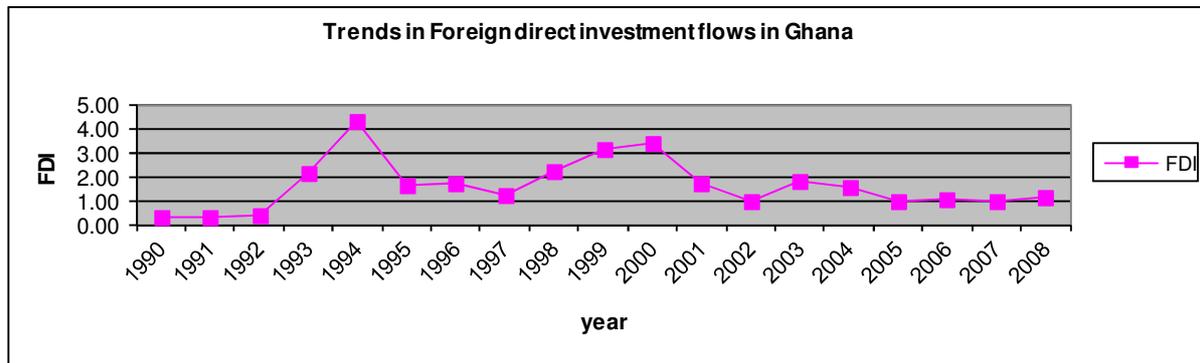
**Figure 7: Trends in Foreign direct flows in Ghana**



**Trends in Foreign direct investment flows in Ghana**
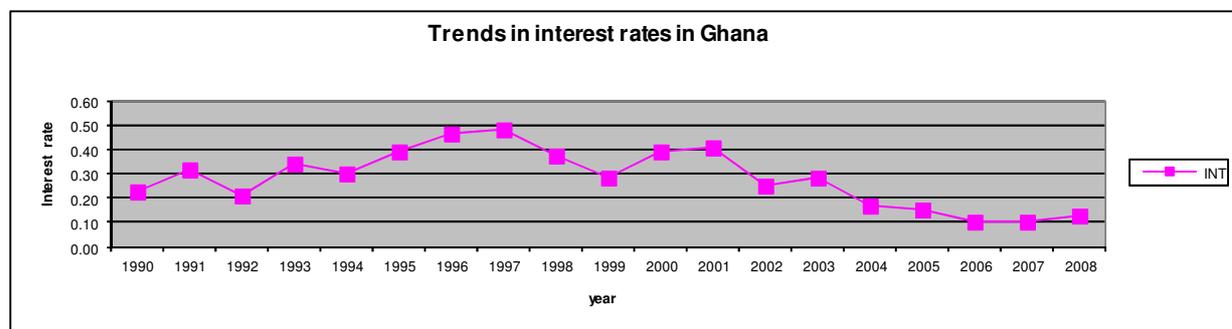
**Figure 8: Trends in Interest rates in Ghana**



**Trends in interest rates in Ghana**

**Figure 9: Trends in Inflation rates in Ghana**



**Trends in Inflation rates in Ghana**
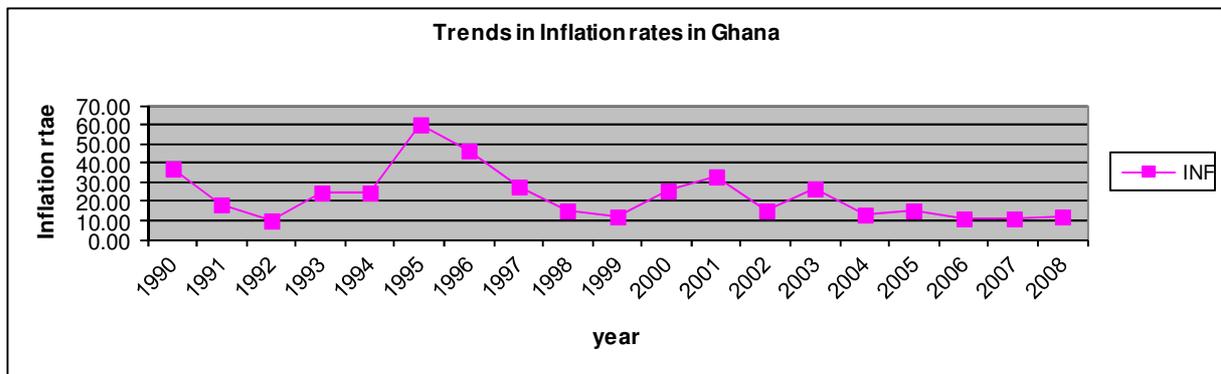
**Table 1: Summary Statistics**

|  | LGDP | LMC | LFDI | LINF | LINT | LXR |
|---|---|---|---|---|---|---|
| **Mean** | 10.16456 | 5.990134 | 0.206369 | 2.981941 | -1.377643 | 7.886125 |
| **Median** | 10.24390 | 5.801907 | 0.234087 | 2.828866 | -1.235625 | 7.923757 |
| **Maximum** | 11.88082 | 9.949021 | 1.495423 | 4.139728 | -0.711397 | 9.165694 |
| **Minimum** | 7.500132 | 1.015231 | -2.690574 | 2.192350 | -2.368874 | 5.751200 |
| **Std. Dev.** | 1.377148 | 2.713060 | 0.840521 | 0.541259 | 0.495506 | 1.182721 |
| **Skewness** | -0.357475 | -0.393955 | -0.988487 | 0.487557 | -0.582132 | -0.452415 |
| **Kurtosis** | 1.909847 | 2.376556 | 4.081694 | 2.107266 | 2.157089 | 1.848058 |
|  |  |  |  |  |  |  |
| **Jarque-Bera** | 5.169574 | 3.070521 | 15.44706 | 5.316289 | 6.284120 | 6.526459 |
| **Probability** | 0.075412 | 0.215400 | 0.000442 | 0.070078 | 0.043194 | 0.038265 |
|  |  |  |  |  |  |  |
| **Sum** | 742.0131 | 437.2798 | 15.06490 | 217.6817 | -100.5679 | 575.6872 |
| **Sum Sq. Dev.** | 136.5506 | 529.9701 | 50.86630 | 21.09324 | 17.67785 | 100.7157 |
|  |  |  |  |  |  |  |
| **Observations** | 73 | 73 | 73 | 73 | 73 | 73 |

GDP=Gross Domestic product, MC= Stock Market capitalization, INFL= Inflation Rate, EXR=Exchange Rate, INT= Interest Rate, FDI= Foreign Direct Investment.

**Table 2: Results of Unit Roots test**

|  | Level | Prob* | First Difference | Prob* | Order of integration |
|---|---|---|---|---|---|
| **GDP** | -1.013806 | 0.7375 | -1.967933 | 0.0988** | I(1) |
| **LMC** | -1.184518 | 0.6752 | -4.209124 | 0.0015** | I(1) |
| **LFDI** | -2.381922 | 0.1507 | -6.595896 | 0.0000** | I(1) |
| **LINF** | -2.304908 | 0.1737 | -2.775064 | 0.0677** | I(1) |
| **LINT** | 0.571107 | 0.9877 | -0.831090 | 0.0026** | I(1) |
| **LXR** | -1.884729 | 0.3373 | -3.353456 | 0.0166** | I(1) |

| 1% | **-3.552666** |
|---|---|
| 5% | **-2.914517** |
| 10% level | **-2.595033** |

**Table 3: Correlation Matrix**

|  | LGDP | LMC |
|---|---|---|
| **LGDP** | 1.000000 | 0.952642 |
| **LMC** | 0.952642 | 1.000000 |

**Table 4 : Pairwise Granger Causality Test Results**

Pairwise Granger Causality Tests

Date: 11/28/09   Time: 23:56

Sample: 1 76

Lags: 2

| Null Hypothesis: | Obs | F-Statistic | Probability |
|---|---|---|---|
| LMC does not Granger Cause LGDP | 67 | 0.55954 | 0.57433 |
| LGDP does not Granger Cause LMC | | 2.37094 | 0.10181 |

**Table 5: Johansen Cointegration relationships**

Unrestricted Cointegration Rank Test (Maximum Eigenvalue)

| Hypothesized No. of CE(s) | Eigenvalue | Max-Eigen Statistic | 0.05 Critical Value | Prob.** |
|---|---|---|---|---|
| None * | 0.527397 | 47.96799 | 40.07757 | 0.0053 |
| At most 1 | 0.392880 | 31.93789 | 33.87687 | 0.0837 |
| At most 2 | 0.278432 | 20.88503 | 27.58434 | 0.2832 |
| At most 3 | 0.166299 | 11.64032 | 21.13162 | 0.5834 |
| At most 4 | 0.145222 | 10.04247 | 14.26460 | 0.2092 |
| At most 5 * | 0.091894 | 6.169195 | 3.841466 | 0.0130 |

Max-eigenvalue test indicates 1 cointegrating eqn(s) at the 0.05 level

* denotes rejection of the hypothesis at the 0.05 level

**MacKinnon-Haug-Michelis (1999) p-values

**Table 5: Normalized cointegrating coefficients**

| 1 Cointegrating Equation(s): | Log likelihood | 530.3556 |
|---|---|---|

Normalized cointegrating coefficients (standard error in parentheses)

| LGDP | LMC | LFDI | LINF | LINT | LXR |
|---|---|---|---|---|---|
| 1.000000 | -0.022009 | -0.227757 | -0.062222 | 0.515621 | -0.895482 |
| | (0.04108) | (0.06097) | (0.09072) | (0.12579) | (0.05595) |

**Table 6: Results of over parameterized Error Correction Model**

Dependent Variable: DLGDP

Method: Least Squares

Date: 11/29/09   Time: 00:00

Sample (adjusted): 4 76

Included observations: 64 after adjustments

| Variable | Coefficient | Std. Error | t-Statistic | Prob. |
|---|---|---|---|---|
| C | 0.002626 | 0.003895 | 0.674102 | 0.5033 |
| DLGDP(-1) | 0.910427 | 0.067680 | 13.45189 | 0.0000 |
| DLMC | -0.002708 | 0.018896 | -0.143318 | 0.8866 |
| DLMC(-1) | 0.003759 | 0.012819 | 0.293229 | 0.7705 |
| DLFDI | 0.008968 | 0.008139 | 1.101944 | 0.2757 |
| DLFDI(-1) | -0.004378 | 0.007350 | -0.595690 | 0.5540 |
| DLINF | 0.095458 | 0.030456 | 3.134237 | 0.0029 |
| DLINF(-1) | -0.077008 | 0.025525 | -3.016934 | 0.0040 |
| DLINT | -0.173276 | 0.054299 | -3.191159 | 0.0024 |
| DLINT(-1) | 0.163300 | 0.051781 | 3.153637 | 0.0027 |
| DLXR | 0.112352 | 0.019990 | 5.620296 | 0.0000 |
| DLXR(-1) | -0.093619 | 0.020134 | -4.649692 | 0.0000 |
| ECM(-1) | -0.300098 | 0.150206 | -1.997914 | 0.0511 |

| | | | | |
|---|---|---|---|---|
| R-squared | 0.867962 | Mean dependent var | | 0.056431 |
| Adjusted R-squared | 0.836894 | S.D. dependent var | | 0.030713 |
| S.E. of regression | 0.012404 | Akaike info criterion | | -5.762427 |
| Sum squared resid | 0.007847 | Schwarz criterion | | -5.323904 |
| Log likelihood | 197.3977 | F-statistic | | 27.93771 |
| Durbin-Watson stat | 2.076957 | Prob(F-statistic) | | 0.000000 |

**Table7: Results of the Final Error Correction Model**

Dependent Variable: DLGDP

Method: Least Squares

Date: 11/29/09   Time: 00:03

Sample (adjusted): 4 76

Included observations: 64 after adjustments

| Variable | Coefficient | Std. Error | t-Statistic | Prob. |
|---|---|---|---|---|
| DLGDP(-1) | 0.823168 | 0.071480 | 11.51612 | 0.0000 |
| DLMC | 0.071190 | 0.016060 | 4.432600 | 0.6593 |
| DLFDI | 0.041631 | 0.006996 | 5.950700 | 0.5542 |
| DLINF | 0.014328 | 0.016362 | 0.875674 | 0.3849 |
| DLINT | -0.034170 | 0.030567 | -1.117864 | 0.2684 |
| DLXR | 0.066922 | 0.020870 | 3.206646 | 0.0022 |
| ECM(-1) | -0.207626 | 0.094950 | -2.186666 | 0.2404 |
| C | 0.006081 | 0.004431 | 1.372520 | 0.1754 |

| | | | | |
|---|---|---|---|---|
| R-squared | 0.794940 | Mean dependent var | | 0.056431 |
| Adjusted R-squared | 0.769308 | S.D. dependent var | | 0.030713 |
| S.E. of regression | 0.014752 | Akaike info criterion | | -5.478466 |
| Sum squared resid | 0.012186 | Schwarz criterion | | -5.208605 |
| Log likelihood | 183.3109 | F-statistic | | 31.01304 |
| Durbin-Watson stat | 1.923929 | Prob(F-statistic) | | 0.000000 |

**D and L** represents the first difference operator and the logarithm of the variables respectively. All the variables remains as previously defined.

**Table8: Results of Diagnostic Test**

| Diagnostic Test | F-Statistics | Probability |
|---|---|---|
| **Normality Test: Jarque Bera** | 121.7203 | 0.000000 |
| **Serial Correlation** (Breusch-Godfrey test) | 0.560354 | 0.574291 |
| **ARCH test for Autoregressive conditional Heteroscasticity** | 2.016168 | 0.160894 |
| **Ramsey Reset test for Specification** | 2.695399 | 0.106345 |
| **White tests for Heteroscesdasticity** | 0.953454 | 0.511911 |

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