



MACROECONOMIC VARIABLES AND STOCK MARKET RETURNS IN GHANA: ANY CAUSAL LINK?

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ABSTRACT

The purpose of the study is to examine the existence of causality between macroeconomic variables and stock returns in Ghana. The study employs monthly time series data spanning the period January 1995 to December 2010. Unit root test is performed using ADF, PP and KPSS tests. Then, Vector Error Correction (VECM) model is used to establish long-run and short-run relationship between stock performance and macroeconomic variables. In order to determine the existence or otherwise of causality, the Granger Causality tests is performed. Impulse response functions and forecast error variance decomposition are used to assess the stability of the relationship between stock returns and macroeconomic variables over time. The study reveals that a significant long run relationship exists between stock returns and inflation, money supply and Foreign Direct Investment (FDI). In the short-run, a significant relationship exists between stock returns and macroeconomic variables such as interest rate, inflation and money supply. In the short-run the relationship between stock returns and FDI is only imaginary. Our VECM coefficient shows that it takes approximately 20 months for the stock market to fully adjust to equilibrium position in case a macroeconomic shock occurs. Lastly, a causal relationship running from inflation and exchange rate to stock returns has been established. Then also, a causal relationship running from stock returns to money supply, interest rate and FDI has also been revealed. The findings imply that arbitrage profit opportunities exist in the Ghana stock market contrary to the dictates of the Efficient Market Hypothesis (EMH). In terms of original value, among the studies



done on the topic in Ghana so far, this is the only study that incorporates dividend in the computation of returns on the Ghana Stock Exchange.

Keywords: Ghana stock exchange, Macroeconomic variables, Granger causality test, Vector error correction, Ghana, Stock returns, Time series analysis

JEL Classification: F23, R12, R30

INTRODUCTION

Long-term capital plays an important role in the economic development of all nations. It has come to the attention of most economic managers that a well-organized capital market is crucial for mobilizing both domestic and international capital. However, in many developing countries, capital has been a major constraint to economic development (Osei, 1998). To mitigate this capital constraint, nations both developed and developing have set up stock exchanges to serve as platforms for raising long term capital for firms. In the modern economy, the role of the stock exchange is even more crucial. It can be a very helpful channel for diversifying domestic funds and channelling them into productive investment (Mohammad *et al.*, 2009). Okoli (2012) similarly, asserts that the stock market plays a vital role in mobilizing individual resources and channelling same to investors. Sohail and Hussain (2009) also observe that a well-organized stock market mobilizes savings and activates investment in projects, which promote economic activities in a country. The key function of a stock market is to act as a mediator between savers and borrowers. It mobilizes savings from a large pool of small savers and channels these funds into fruitful investments. The preferences of the lenders and borrowers are harmonized through stock market operations. The stock market also supports reallocation of funds among corporations and sectors. It also provides liquidity for domestic expansion and credit growth. Financial integration in the late 1980s and 1990s increased the flow of capital into developing economies. The pace of capital inflow even experienced a more accelerated pace after the 1990s. Ghana in particular has become a huge recipient of Foreign Direct Investment (FDI). For instance, the World Investment Report 2012, ranked Ghana 4th among top destinations for investment in sub-Saharan Africa and 3rd among top five recipients of Foreign Direct Investment (FDI) into Africa for 2011. As argued by Adam and Tweneboah (2008), notwithstanding the massive inflow of capital into emerging capital markets and associated high returns, the capital market in the developing world remains less explored. This present study wishes to add to the effort of researchers such as Adam and Tweneboah (2008), Osei (1998), Osei (2006), Kyereboah-Coleman and Agyire-Tettey (2008), and Frimpong (2011) who have contributed their bit by exploring the capital market in Ghana.

The co-movement between stock returns and macroeconomic factors has become very important over the past few decades. Several studies have been conducted in order to determine the impact of macroeconomic variables on the stock price. A number of studies have been published in many



advanced countries like U.S, Japan and Europe and now in emerging countries positing the nature of the relationship that exists between stock returns and macroeconomic variables. Many studies (eg. [Kuwornu \(2012\)](#), [\(Kyereboah-Coleman and Agyire-Tettey, 2008\)](#)) argue that stock prices are dependent on macroeconomic factors such as oil price, inflation, industrial production, exchange rate, market capitalization, price earnings ratio, money supply, employment rate, risk premium, consumer price index and the market rate of interest, etc. Many investors believe that fluctuation in these factors either has positive or negative impact on the stock price and they (investors) make decisions on investment on the basis of these factors. These factors strongly affect the investors and also influence researchers to examine the relationship between stock price and macroeconomic factors ([Khalid, 2012](#)).

There are a number of studies in Ghana establishing a relationship between macroeconomic variables and stock performance. [Adam and Tweneboah \(2008\)](#) using monthly data from 1991:1 to 2006:4 examine both long-run and short-run dynamic relationships between the stock market index and macroeconomic variables. They employ the Johansen's multivariate cointegration test and innovation accounting techniques, and find that stock prices in Ghana respond to interest rate, inflation and exchange rate. [Osei \(2006\)](#) also establishes the presence of cointegration between macro-economic variables and stock returns using the Ghana Stock Exchange (GSE) All-share Index as a proxy for stock performance. Other studies on the Ghanaian market include [Kyereboah-Coleman and Agyire-Tettey \(2008\)](#), [Frimpong \(2011\)](#), [Kuwornu \(2012\)](#) and [Antwi *et al.* \(2012\)](#).

These studies used the GSE All-Share Index as a proxy for measuring stock performance which is seriously limited as it ignores dividend. [Brooks \(2008\)](#) observes that ignoring dividend will have a severe impact on cumulative returns over investment horizons of several years. Ignoring dividends will also have a distortionary effect on the cross-section of stock returns. The result of these studies and their policy recommendations are seriously limited and their implementation may be misleading. This is because investors in a developing economy like Ghana buy stock not just for its capital gain, but also for the future dividend yield associated with it. Thus, using the GSE All-share Index as a proxy for stock performance leads to a gross underestimation of returns. The current study however addresses this inadequacy by incorporating dividend into the return. The previous studies have also focused on establishing the relationship between macroeconomic variables and stock returns. But the existence of a relationship does not necessarily mean the existence of bi-causality. Even those studies that have established causality (eg. [\(Antwi *et al.*, 2012\)](#)) fail to pinpoint the exact variables involved. The findings and policy prescriptions emanating from these studies could be misleading. For the purpose of policy formulation, it is important to know whether it is the macroeconomic variables that are causing returns to change or vice versa or both. It is even more crucial to know the specific macroeconomic variables that have causal relationship with GSE returns for proper policy targeting. The current study fulfils this requirement by not just

investigating the existence of a relationship but also examining the existence or otherwise of bi-causality between macroeconomic variables and GSE returns. The study aims mainly at assessing the effects of macroeconomic variables on stock performance in Ghana. The specific objectives of the study are:

1. To establish the existence of long-run relationship between macroeconomic factors and the performance of listed companies on the Ghana Stock Exchange
2. To establish the existence of short-run relationship between macroeconomic factors and the performance of listed companies on the Ghana Stock Exchange
3. To establish the existence of causality between macroeconomic factors and the performance of listed companies on the Ghana Stock Exchange

LITERATURE REVIEW

The theories in the literature are the most important means of explaining the relationship between stock returns and economic forces at the macro level. The empirical evidence in the literature provides mechanism for explaining the validity of the relationship between macroeconomic forces and stock returns. Therefore, the review of both theoretical and empirical literature is essential in investigating the relationship between macroeconomic forces and stock returns. The theoretical and empirical literature review is essential as it enables the researcher to know the work done in the subject area by other researchers. Moreover, it also enables the researcher to identify the macroeconomic factors that can potentially influence the returns of stock ([Saeed and Akhter, 2012](#)). Over the past few decades, determining the effects of macroeconomic variables on stock prices and investment decisions has preoccupied the minds of economists. In the literature, there are many empirical studies that disclose the relationship between macroeconomic variables such as interest rate, inflation, exchange rates, money supply, etc., and stock prices. However, the direction of causality still remains unresolved in both theory and empirics ([Aydemir and Demirhan, 2009](#)). [Fisher \(1930\)](#) hypothesises a positive relationship between inflation and stock return. He argues that as the rate of inflation rises, the nominal rate of interest also goes up. Consequently, real rate of interest remains the same in the long- run. [Priyanka and Kumar \(2012\)](#) also observe that external sector indicators like exchange rate, foreign exchange reserves and value of trade balance can have an impact on stock prices.

[Sohail and Hussain \(2009\)](#) examine long-run and short-run relationships between Lahore Stock Exchange and macroeconomic variables in Pakistan. Using monthly data from December 2002 to June 2008, they observe a negative impact of consumer price index on stock returns, while, industrial production index, real effective exchange rate, money supply were seen to have a significant positive effect on stock returns in the long-run. Using monthly data between 1994 to

2011, [Priyanka and Kumar \(2012\)](#) also observe among other factors that exchange rate, gold price and inflation have significant effects on the Indian Capital Market. [Aydemir and Demirhan \(2009\)](#) use three different indices as stock price indices including national 100, services, financials, industrials, and technology indices to investigate the relationship between mentioned variables and macroeconomic indicators in Turkey using daily data from 23 February 2001 to 11 January 2008. They establish a bidirectional causal relationship between exchange rate and all stock market indices. While the negative causality exists from national 100, services, financials and industrials indices to exchange rate, there is a positive causal relationship from technology indices to exchange rate. On the other hand, negative causal relationship from exchange rate to all stock market indices is determined. Using quarterly data from the period 1986-2008, [Mohammad *et al.* \(2009\)](#) establish the association between share prices of KSE (Karachi Stock Exchange) and foreign exchange reserve, foreign exchange rate, industrial production index, wholesale price index, gross fixed capital formation and broad money in the context of Pakistan. The result shows that after the reforms in 1991 the influence of foreign exchange rate and foreign exchange reserve significantly affected the stock prices. Other variables like whole sale price index, and gross fixed capital formation insignificantly affected stock prices while external factors like money supply and foreign exchange affected prices positively.

[Yusof *et al.* \(2006\)](#) employ the autoregressive distributed lag model (ARDL) to examine the long run relationship between macroeconomic variables and stock returns in Malaysia. The macroeconomic variables tested in the study are the money supply, industrial production index, real effective exchange rate, and treasury bill rates. As hypothesized, money supply is found to be positively related to the changes in stock prices while exchange rate has negative effect on stock prices in the Malaysian market. [Khalid \(2012\)](#) using Granger causality test establishes unidirectional causality running from exchange rate to stock performance on the Karachi Stock Exchange return.

[Dasgupta \(2012\)](#) using the Johansen and Juselius's co-integration test find the Indian stock markets to be cointegrated with macroeconomic variables. In the long-run, the stock prices are found to be positively related to interest rate and industrial production while the wholesale price index used as a proxy for inflation and the exchange rate are negatively related to Indian stock market return. The findings however fail to establish short-run relationships between the Indian stock market and the macroeconomic variables. Returning to studies on Ghana, [Adam and Tweneboah \(2008\)](#) establish the existence of a long-run relationship between macroeconomic variables and stock prices. They conclude that in the short-run, inflation and exchange rates are significant determinants of share prices in Ghana; interest rate and inflation matter more in the long-run. Using maximum likelihood procedure, [Kuwornu and Owusu - Nantwi \(2011\)](#) find a significant relationship between stock returns and macroeconomic variables such as inflation, exchange rate and treasury bill rate. Their

findings show that inflation has a positive relationship with stock returns while exchange rate and treasury bill rate have a negative impact on stock returns. They however find no significant relationship between stock returns and crude oil prices. Again, [Kuwornu \(2012\)](#) using the Vector Error Correction approach did find that in the long-run stock returns are positively affected by inflation, exchange rate and treasury bill rate and negatively by crude oil prices. But in the short-run, they attribute variations in stock returns to inflation (negative effect), and treasury bill rate (positive effect). Similarly, [Kyereboah-Coleman and Agyire-Tettey \(2008\)](#) show that lending rates from deposit money banks have a negative impact on stock returns and tend to smother the growth of businesses in Ghana. They also find a negative relationship between inflation rate and the performance of the stock market. These studies have two main defects. First, they use the GSE-All Share Index as a measure of returns ignoring dividend payments. Second, they are unable to identify which specific macroeconomic variables have a uni or bi-causal causal relationship with stock returns in Ghana. This lacuna is filled by this study. We construct a return index that incorporates both capital gains and dividends and also establish the existence or otherwise of uni and bi-causality between stock performance and macroeconomic indicators in Ghana.

METHODOLOGY

Data and Data Sources

Secondary data used for the study were sourced from different sources. Monthly data on stock prices and dividend yield were obtained from the Ghana Stock Exchange, whereas monthly data on macro-economic variables made up of Exchange rate (cedi/United State dollar rate), the Consumer Price Index (to represent inflation), treasury-bill rate, money supply were obtained from the Bank of Ghana. Data on FDI were obtained from the World Bank database. The data spans from January 1995 to December 2010.

Model Specification

Following the literature reviewed, the study postulates the relationship between stock prices and selected macro-economic variables as:

$$LGSER = \phi_0 + \phi_1 LMS_t + \phi_2 LEXR_t + \phi_3 LCPI_t + \phi_4 LTBILL_t + \phi_5 LFDI_t + \varepsilon_t \dots\dots(1)$$

Where

$\phi_1 - \phi_4$ are the sensitivity of each of the macroeconomic variables to stock returns, and ε_t is the disturbance term. L means the logarithm of the variable.

Definition and Measurement of Variables (All variables are in natural logs (L))

LGSER is Ghana Stock Exchange Return representing stock performance. The equal weighted return index is used to compute return Index following [Aga and Kocaman \(2006\)](#). The formula



used has been adopted and modified from Value Line. The Value Line is an investment institution that computes an equal weighted return index. The formula is specified below:

$$Index_t = Index_{t-1} \times \frac{1}{N} \sum_{j=1}^N \frac{P_{j,t}}{P_{j,t-1}} \dots\dots\dots (2)$$

The above formula is adjusted to incorporate dividend which is an important consideration for stock holders in a developing economy like Ghana.

$$Index_t = Index_{t-1} \times \frac{1}{N} \sum_{j=1}^N r_{jt} \dots\dots\dots (3)$$

Where

$Index_t$ is the current index and $Index_{t-1}$ is the previous index. January 1995 is set as the base month. The index is 100 for that month. N is the number of stocks and r represents the returns of the individual companies at time t and computed as:

$$r_t = \frac{P_t}{P_{t-1}} + Dividend\ yield_{t+1} \dots\dots\dots (4)$$

Where (P_t) is the current month's stock price, and (P_{t-1}) is previous month's stock price. r_t is the stock return at time t and $Dividend\ yield_{t+1}$ is the lead-lag dividend (monthly averages of the annual values). The lead-lag is based on the assumption that individual investors are forward looking. That is, whatever investment is done today is due to the expected result in the future. Intuitively, buying a stock today is in anticipation of the dividend associated with it which would be realised the following period.

Money Supply (LMS)

It represents the broad money supply in the Ghanaian economy. An increase in money supply will increase the liquidity in the economy resulting in an increase in the purchasing power of the citizenry. This means that more money will be available not just for consumption but also for investment. Hence, a positive relationship is expected.

Exchange Rate (LEXR)

It is defined as the cedi per US dollar rate. A fall in the Ghanaian currency is likely to affect the economy negatively. In an economy which is import driven, a depreciation of the local currency will drive pricing upward which will make it difficult for people to save for investment. Hence, a negative effect is hypothesised between exchange rate and stock performance.

Treasury Bill Rate (LTBILL)

The 91-day treasury-bill rate is used as a measure of interest rate since it serves as the opportunity cost of holding shares. An increase in the treasury bill rate will see movement of investment away from stocks to treasury bills. Hence, a negative relationship is expected between interest rate and stock return.



Consumer Price Index (LCPI)

The consumer price index is used as a proxy for inflation. In times of inflation, prices are always unstable and rising. Income is therefore devoted for consumption purposes. Savings and investment will therefore be negatively affected. Based on the above argument, the *a priori* sign will be negative.

Foreign Direct Investment (LFDI)

FDI can contribute significantly to the economic growth and development of the recipient country by reducing and cushioning shock arising from low domestic savings and investment [Adam and Tweneboah \(2008\)](#). It is postulated that an increase in FDI will positively affect the liquidity and capitalisation of the GSE. Annual net FDI data was obtained from the World Bank database. The data was then converted to monthly data through interpolation.

Data Analysis

Unit Root Test

The stationarity of a data series is a prerequisite for drawing meaningful inferences in a time series analysis and to enhance the accuracy and reliability of the models constructed. Generally, a data series is called a stationary series if its mean and variance are constant over a given period of time and the covariance between the two extreme time periods does not depend on the actual time at which it is computed, but it depends only on lag amidst the two extreme time periods([Dasgupta, 2012](#)). The Augmented Dickey-Fuller (ADF)([Dickey and Fuller, 1979](#)), [Phillips and Perron \(1988\)](#) and [Kwiatkowski et al. \(1992\)](#) tests are used to determine the integrated level of each series.

Testing for Cointegration

The cointegration approach has been used by many researchers to analyse pricing factors and to observe the relationships between economic variables and stock markets. Despite the fact that the cointegration approach is still evolving within the realm of time series analysis, it has become popular in empirical work in both economics and finance since its introduction in the 1980s by [Granger \(1969\)](#) and [Engle and Granger \(1987\)](#). When researchers are aiming to investigate both the long-run and dynamic relationships between *a priori* variables and stock market prices, the trend is towards the cointegration technique. Empirical frameworks are being developed in line with the cointegration techniques of [Engle and Granger \(1987\)](#), [Granger \(1969\)](#) and ([Johansen, 1988](#); [Johansen, 1991](#); [Johansen, 1995](#); [Johansen, 2000](#)),([Kazi, 2008](#)).

[Mukharjee and Naka \(1995\)](#) and [Chen et al. \(1986\)](#) recognize that although the [Engle and Granger \(1987\)](#) two-step Error Correction Model (ECM) is suitable for use in the multivariate context, VECM yields efficient estimators of cointegrating vectors. This is because VECM is a full



information maximum likelihood estimation method. It allows cointegration to be tested in a whole system of equations in only one step without requiring a specific normalized variable. VECM avoids carrying over the errors from the first step into the second, and it does not require prior assumptions about the variables (endogenous or exogenous) (Kazi, 2008).

In the event that series are integrated of order one, Johansen's procedure should be used to determine whether any cointegrating vector among variables exists or not. The Johansen and Juselius cointegration test was developed by Johansen (1988) and Johansen and Juselius (1990) and it is based upon the Vector Auto Regressive approach. In this procedure, trace (λ trace) and maximum eigenvalue (λ max) statistics as proposed by Johansen (1988) and Johansen and Juselius (1990) are computed. When performing λ trace and λ max test, the null hypothesis that there are r or fewer cointegrating vectors is tested against at least $r + 1$ cointegration vectors and $r + 1$ cointegrating vectors respectively (Aydemir and Demirhan, 2009).

The Johansen's methodology takes its starting point in the Vector Autoregressive (VAR) of order p given by:

$$y_t = \mu + A_1 y_{t-1} + \dots + A_p y_{t-p} + \varepsilon_t \dots (5)$$

where y_t is an $n \times 1$ vector of variables that are integrated of order one – commonly denoted $I(1)$ and ε_t is an $n \times 1$ vector of innovations. If y_t is cointegrated, it can be generated by a vector error correction model and the VAR can be re-written in the first difference as:

$$\Delta y_t = \mu + \Pi y_{t-1} + \sum_{i=1}^p \Gamma_i \Delta y_{t-i} + \varepsilon_t \dots (6)$$

Where

$$\Pi = \sum_{i=1}^p A_i - I \text{ and } \Gamma_i = \sum_{j=1}^p A_j \dots (7)$$

If the coefficient matrix Π has reduced rank $< n$, then there exist $n \times r$ matrices α and β each with rank r such that $\Pi = \alpha\beta'$ and $\beta'y_t$ is stationary. r is the number of cointegrating relationships, the elements of α are known as the adjustment parameters in the vector error correction model and each column of β is a cointegrating vector. It can be shown that for a given r , the maximum likelihood estimator of β defines the combination of y_{t-1} that yields the r largest canonical correlations of Δy_t with y_{t-1} after correcting for lagged differences and deterministic variables when present. Johansen proposes two different likelihood ratio tests of the significance of these canonical correlations and thereby the reduced rank of the Π matrix: the trace test and maximum eigenvalue test, shown in equations (8) and (9) respectively.

$$J_{trace} = -T \sum_{i=r+1}^n \ln(1 - \hat{\lambda}_i) \dots (8)$$

$$J_{max} = -T \ln(1 - \hat{\lambda}_{r+1}) \dots (9)$$



Here T is the sample size and $\hat{\lambda}_i$ is the i :th largest canonical correlation. The trace test tests the null hypothesis of r cointegrating vectors against the alternative hypothesis of n cointegrating vectors. The maximum eigenvalue test, on the other hand, tests the null hypothesis of r cointegrating vectors against the alternative hypothesis of $r + 1$ cointegrating vectors (Hjalmarsson and Osterholm, 2007).

Granger Causality Test

The Granger causality test as proposed by C. J. Granger in 1969 is used to establish the existence and direction of causality between macroeconomic variables and stock performance. Under the Granger causality test, the null hypotheses are:

$$\sum_{i=1}^m b_i \neq 0 \dots (10) \quad \text{and} \quad \sum_{i=1}^m d_i \neq 0 \dots (11)$$

To implement the Granger causality test, F-statistics values are calculated under the null hypothesis that in equation (10) and equation (11) all the coefficients of b_i and d_i equal 0. The F-statistic is computed as shown below:

$$F = \frac{(RSS_R - RSS_{UR})/m}{RSS_{UR}/(n-k)} \dots (12)$$

If the computed F -value exceeds the critical F -value at the chosen level of significance, the null hypothesis is rejected. This would imply the existence of causality (Harjito and McGowan, 2007).

DATA ANALYSIS AND DISCUSSION OF RESULTS

Unit Root Tests

The first process in time series analysis is determining the stationarity or otherwise of the data. A key requirement for determining the presence of cointegration is that the variables must be integrated in order $I(1)$. To achieve this, the ADF, the PP and the KPSS tests are used. From the table above, all variables are non-stationary ($I(1)$) at levels, and become stationary at first difference. Hence, it is possible for cointegration to be established (see Table 1).

Cointegration

Having established that the variables are $I(1)$ at levels, the Johansen cointegration technique is used to determine the presence and number of cointegrating vector(s). To do this, the trace and maximum tests as required by Johansen and Juselius are employed and the result presented in Table 2.



From Table 2, both the trace and maximum tests identify one cointegration equation at 0.05 level. That is, their values are higher than their critical values at the null hypothesis of no cointegration. Hence, the null hypothesis of no cointegration is rejected in favour of the alternative hypothesis of one cointegration equation.

Long-run Relationship

Having established the number of co-integrating equations, the coefficients of the variables are estimated and presented in the Table 3.

All our explanatory variables except FDI failed to meet our a priori expectations. The results indicate that all macroeconomic variables except treasury bill (LTBILL) are statistically significant. The treasury bill (interest rate) variable's insignificance contradicts the findings of [Adam and Tweneboah \(2008\)](#), and [Kuwornu \(2012\)](#) but consistent with the results of [Frimpong \(2011\)](#). [Chen et al. \(1986\)](#) suggests that it is not interest rate that is relevant but the yield and default spread that are likely to influence stock prices. Money supply (LMS) impacts negatively on stock performance of companies listed on GSE while Consumer Price Index (LCPI), exchange rate (LEXR) and Foreign Direct Investment (LFDI) exert positive influence on stock returns. These values represent long-term elasticities at the same time due to the logarithmic transformation of the variables. The negative relationship between money supply and stock performance is in conformity with the findings of [Frimpong \(2009\)](#). The justification to this finding is that, according to [Fama \(1981\)](#), an increase in money supply leads to an increase in both inflation and the discount rate which then lead to a fall in stock prices. The positive long-run relationship between inflation and stock performance is in sync with [Choudhry \(2001\)](#), [Mohammad et al. \(2009\)](#), [Owusu-Nantvi and Kuwornu \(2012\)](#) and [Kuwornu \(2012\)](#). This positive relationship suggests that investors are compensated for inflation and that the GSE cannot be used as a hedge against inflation since investors will require higher returns to compensate for high inflation ([Kuwornu, 2012](#)). The relationship could be justified by the active role played by government in curbing inflation ([Omran and Pointon, 2001](#)). The positive long-run relationship between exchange rate and stock returns is not too surprising. This is consistent with the findings of [Mukharjee and Naka \(1995\)](#) and [Kuwornu \(2012\)](#). The explanation is that, an appreciation of the cedi leads to a decrease in price of imported inputs which constitutes a large part of factor inputs of industries in Ghana. It also leads to an increase in reserve, money supply and a fall in the interest rate. This lowers the cost of production leading to increased business activity and hence increased stock returns. The positive relationship between FDI and stock returns concurs with [Adam and Tweneboah \(2008\)](#). The explanation is that the opening of the GSE to non-resident Ghanaians and foreign investors and the exchange control permission granted to investors to invest through the GSE without prior approval facilitated the listing of highly rated foreign owned companies on the GSE ([Adam and Tweneboah, 2008](#)). LCPI has a co-efficient of about 0.1 which means that a 1% increase in CPI will result in an increase in

LGSER (stock returns) by 0.1%. With regard to LEXR, the results show that, an increase in LEXR by 1% will lead to a rise in LGSER by 1.18%. Further, LMS exerts a negative influence on the LGSER. A 1% rise in LMS results in a decrease of LGSER by about 1.8%. LFDI has a positive effect on the returns (LGSER). A 1% increase in LFDI leads to a 0.28% increase in LGSER.

Short-run Relationship

The Vector Error Correction Model (VECM) is used to estimate the short-run relationship between the selected macroeconomic variables and stock performance of GSE listed companies. This is shown in Table 4. The table shows the vector error correction model, with significant error correction term (ECM(-1)). Theoretically, the ECM(-1) should have a negative value which is exactly the case in the present study. The higher the coefficient, the more stable the long-term relationship. The estimated coefficient of the ECM(-1) is -0.049235 (significant at 1%) suggesting that in the absence of changes in the independent variables, deviation of the model from the long term path is corrected by 4.9% per cent per month, which is too slow. The implication is that, it will take the market about 20 months to fully return to long-run equilibrium if there is a shock to the macroeconomic variables. This shows that the market is not efficient and hence the existence of arbitrage activities on the stock market.

The short-run results further indicate that, the first and third lags of the first difference of LGSER exert significant and positive effect on Δ LGSER consistent with the findings of [Frimpong \(2009\)](#). This implies that it is possible to predict current and future stock returns based on past returns. Thus, financial analysts can exploit these existing arbitrage opportunities to make abnormal profit. The first, second and third lags difference of CPI show significant negative impact on Δ LGSER. This significant negative short-run relationship between inflation and stock returns is consistent with the results of [Kuwornu \(2012\)](#). Lags of LMS exert negative and significant impact on Δ LGSER while only the third lag of LTBILL first difference shows negative and significant effect on Δ LGSER which is inconsistent with the findings of [Kuwornu \(2012\)](#). These significant impacts further support the inefficiency in the market. The overall significance of the model is good as shown by the F-statistic value of 11.74423 (significant at 1%). The model fitness is also quite good with an R-squared and adjusted R-squared value of 57% and 52% respectively.

Causality

The pair-wise Granger-Causality is employed to detect the presence of causality between macroeconomic factors and returns of GSE listed companies. The results are displayed in Table 5. The results as shown in the table above indicate a uni-causality running from LCPI to LGSER at 5% significance level and from LEXR to LGSER at 10%. This means that by studying the past values of inflation and exchange rate, it is possible to predict what the current return will be which is inconsistent with the Efficient Market Hypothesis (EMH). This further lends credence to the



inefficient nature of the stock market. Also, there exists a unidirectional causality running from LGSER to interest rate, money supply (at least at 5%) and FDI (at 10%) implying that the returns of the GSE can be used to predict the rate of interest, money supply and FDI inflows. This finding appears justified since high returns on the GSE will attract FDI and foreign portfolio investment which may lead to an increase in the money supply.

System Stability

Cointegration analysis merely establishes the existence of long-run relationships among variables but does not fully establish the stability of such relationships especially in the occurrence of a shock to the system. We employ the impulse response function and variance decomposition to examine how LGSER responds to shocks in the system variables. Figure 1 contains the impulse response functions while the Forecast Error Variance Decomposition is presented in Table 6.

From figure 1, a sudden shock to the general price level (CPI) leads to a sharp dip in stock returns in the first three months, which then stabilises afterwards. Thus, when there is a shock arising from inflation, it takes the market three months to adjust back to equilibrium. A sudden shock to FDI only leads to a slight increase in LGSER from the 2nd to the 5th month and stabilises thereafter. A shock to interest rate (LTBIL) results in a continuous fall in LGSER after the third month. This confirms the results of the cointegration where it is only after the third lag that LTBIL affects stock returns significantly. A shock to money supply leads to an immediate and continuous rise in stock returns. A shock to exchange rate results in a fall in stock returns after the 3rd month. The returns stabilise after the 6th month. Generally, the market adjusts quite slowly to shocks to macroeconomic variables. The variance decomposition values in Table 6 show that in the immediate period (one month into a shock) changes in the LGSER are due to its own variation at the end of the month. By the end of the 6th month, variations in the LGSER are mostly accounted for by 46.6% of variation in LGSER, 41.3% of variation in inflation, and 11.0% of variation in money supply. By the end of the 10th month, inflation becomes the major factor (39.3%) causing variation in LGSER, followed by LGSER itself (37.7%), and then money supply (21%). Thus, inflation and money supply are the most important determinants of stock returns on the Ghana stock exchange in the short-run.

CONCLUSIONS AND RECOMMENDATIONS

The study examines the existence of a causal relationship between stock returns and macroeconomic variables in Ghana. First, a long term relationship between stock variables and macroeconomic variables is established. The study shows that a significant long term relationship exists between stock returns and inflation, money supply, and FDI. In the short-run, a significant relationship exists between stock returns and macroeconomic variables such as interest rate, inflation and money supply. In the short-run the relationship between stock returns and FDI is



insignificant. Further, a causal relationship running from inflation and exchange rate to stock returns has been established. Then also, a causal relationship running from stock returns to money supply, interest rate and FDI has also been found.

These findings suggest the existence of arbitrage profit opportunities on the Ghana stock market lending credence to the non-portability of the EMH. Based on past values of exchange rate, inflation and money supply, financial analysts can predict stock returns to make abnormal profit. We advise both current and potential investors to pay close attention to the movements of macroeconomic variables such as inflation, money supply and FDI since they impact on the performance of their investments in the long-run. In the short-run, investors should closely monitor changes in interest rate, inflation and money supply. We further recommend to the managers of the economy to implement inflation and exchange rate policies that are conducive to the development of the capital market since our study provides evidence to show that changes in inflation and exchange rate elicit movements in the stock market.

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APPENDIX

Table.1.Results of Unit Root Tests

Variable	ADF UNIT-ROOT TEST		PP UNIT-ROOT TEST		KPSS	
	Levels	First Difference	Levels	First Difference	Levels	First Difference
LGSER	-0.999029	-8.783092***	-0.950890	-8.985273***	1.643571	0.128929***
LMS	-1.304330	-10.49892***	-1.334996	109.0746***	1.696562	0.308996***
LTBILL	-1.252375	-7.913119***	-1.226641	-8.004720***	1.177180	0.064795***
LCPI	-2.030553	-13.82292***	-2.030553	-13.82292***	0.769345	0.144026***
LEXR	-1.921469	-10.42260***	-1.959736	-37.15482***	1.527960	0.270013***
LFDI	-0.809924	-19.81991***	-0.852572	-19.94182***	1.533420	0.074450***

***significant at 1%.

Table-2.Results of Cointegration

No. CE(S)	Of	Trace Statistic	0.05 Critical Value(Trace)	Max-Statistic	0.05 Critical Value(Max)
None *		98.92660	95.75366	47.53432	40.07757
At Most 1		51.39228	69.81889	19.46632	33.87687
At Most 2		31.92596	47.85613	16.16964	27.58434
At Most 3		15.75632	29.79707	8.833614	21.13162
At Most 4		6.922704	15.49471	5.195198	14.26460
At Most 5		1.727505	3.841466	1.727505	3.841466

* denotes rejection of the hypothesis at the 0.05 level

Table-3.Long-run Relationship Coefficients

Regressor	Coefficient	Std Error	t-statistic
LCPI	0.101123	0.03231	3.129774064***
LEXR	1.181879	0.23410	5.048607433***



LMS	-1.804015	0.19354	-9.321148083***
LTBILL	0.174311	0.18004	.9968179293
LFDI	0.288768	0.08734	3.306251431***

*** denotes significant at 1%

Table-4.VECM Estimation for Δ LGSER

Regressor	Coefficient	Std. error	t-statistic
Constant	0.013487	0.00333	4.05053***
D(LGSER(-1))	0.132136	0.06138	2.15278**
D(LGSER(-2))	0.010665	0.06120	0.17427
D(LGSER(-3))	0.133950	0.05791	2.31296**
D(LCPI(-1))	-0.018472	0.00578	-3.19396***
D(LCPI(-2))	-0.035403	0.00588	-6.02108***
D(LCPI(-3))	-0.048057	0.00614	-7.83124***
D(LEXR(-1))	0.026952	0.03039	0.88696
D(LEXR(-2))	0.009376	0.03183	0.29460
D(LEXR(-3))	-0.023636	0.03104	-0.76144
D(LMS(-1))	-0.052156	0.01260	-4.14039***
D(LMS(-2))	-0.038000	0.01170	-3.24720***
D(LMS(-3))	-0.015759	0.00913	-1.72536*
D(LTBILL(-1))	0.042846	0.05672	0.75536
D(LTBILL(-2))	0.049811	0.06117	0.81436
D(LTBILL(-3))	-0.131412	0.05557	-2.36485**
D(LFDI(-1))	-0.006033	0.02734	-0.22066
D(LFDI(-2))	0.026068	0.02786	0.93561
D(LFDI(-3))	0.057175	0.02811	2.03404**
ECM(-1)	-0.049235	0.00983	-5.00715***
R-squared	0.570487	Akaike AIC	-3.579953
Adj. R-squared	0.521911	Schwarz SC	-3.235650
F-statistic	11.74423***	Sum sq. resids	0.248043
Mean dependent	0.021739	Log likelihood	356.5155
S.E. equation	0.038425		
S.D. dependent	0.055572		

***, **, *, indicates significant level at 1%, 5% and 10% respectively

Table-5.Pairwise Granger Causality Tests

Null Hypothesis:	Obs	F-Statistic	Prob.
LCPI does not Granger Cause LGSER	190	3.19087	0.0434
LGSER does not Granger Cause LCPI		0.12721	0.8806
LEXR does not Granger Cause LGSER	190	2.93260	0.0557
LGSER does not Granger Cause LEXR		1.96838	0.1426
LFDI does not Granger Cause LGSER	190	0.10312	0.9021
LGSER does not Granger Cause LFDI		2.51090	0.0840
LMS does not Granger Cause LGSER	190	1.95224	0.1449
LGSER does not Granger Cause LMS		8.52446	0.0003
LTBILL does not Granger Cause LGSER	190	0.56217	0.5709
LGSER does not Granger Cause LTBILL		3.53757	0.0311

Table-6.Forecast Error Variance Decomposition of LGSER

Period	S.E.	LGSER	LCPI	LEXR	LFDI	LMS	LTBILL
1	0.038425	100.0000	0.000000	0.000000	0.000000	0.000000	0.000000
2	0.058239	96.99697	2.557736	0.001899	0.108848	0.291815	0.042735
3	0.078535	83.21360	14.76602	0.202377	0.071802	1.482861	0.263337
4	0.109735	61.30658	34.05949	0.254722	0.288646	3.931044	0.159521
5	0.137350	51.44168	39.88502	0.178146	0.451071	7.817753	0.226327
6	0.162656	46.55562	41.28392	0.156022	0.671013	11.01739	0.316033
7	0.187012	43.62774	41.16340	0.145923	0.839386	13.77024	0.453321
8	0.209904	41.39556	40.51754	0.157128	0.913971	16.42646	0.589334
9	0.232270	39.39049	39.92075	0.176911	0.960668	18.82579	0.725400
10	0.253858	37.66322	39.30573	0.202449	0.979980	20.97339	0.875225

Figure-1.Response of LGSER to 1 S. D. Shocks in Macroeconomic Variables