Research in Applied Economics
ISSN 1948-5433
2014, Vol. 6, No. 2

An Econometric Analysis of the Impact of Macroeconomic Fundamentals on Stock Market Returns in Ghana

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Received: February 16, 2014 Accepted: March 11, 2014 Published: April 30, 2014

doi:10.5296/rae.v6i2.5146 URL: http://dx.doi.org/10.5296/rae.v6i2.5146

Abstract

Relying on more recent data spanning September, 2000 to September, 2010, this paper investigates the effects of macroeconomic variables on stock market returns by employing the Johansen multivariate cointegration approach and vector error correction model (VECM). We present evidence of a long-run relationship between macroeconomic variables and stock returns. Our Granger causality test however could not establish causality from any direction between macroeconomic variables and stock prices and that earlier literature that found causality between the series may be misleading. Results from both the impulse response functions and variance decomposition show that among the macroeconomic variables, shocks to inflation, money supply and exchange rate do not only explain a significant proportion of the variance error of stock returns but their effects persist over a long period.

Keywords: stock returns, cointegration, macroeconomic variables, causality, equilibrium, Ghana

1. Introduction

Undoubtedly, stock markets have been a major preoccupation of the financial sector of many countries given its role of realigning and channelling idle resources into productive sectors (Muhammad et. al., 2009). A well-functioning stock market is thus a viable tool that mobilizes large pool of savings for economic development. On the other hand, investors largely respond to the intricacies of macroeconomic fundamentals thus affecting movements of stock market performance. This has generated much attention in the literature on the relationship between macroeconomic variables and stock market returns.

For instance, by using the efficient market theory and rational expectations intertemporal asset pricing theory, Chen et. al., (1986) assert that asset prices depend on their exposures to the macroeconomic variables that typically describe the economy. Following this, Chen et. al., (1986) used the multi-factor arbitrage pricing theory (APT) to examine the relationship between economic forces and stock market returns using the New York Stock Exchange (NYSE) index as a proxy to the latter. Their findings reveal that industrial production, changes in risk premium, slope of the structure of interest rates, unanticipated inflation as well as changes in expected inflation were found to significantly influence asset prices. They however found no impact of oil price shocks on asset pricing. Their evidence generally shows that macroeconomic indicators significantly influence expected stock returns than a stock market index. Hamao (1988) applied the same technique to the Japanese stock market and results from his empirical study were not different from Chen et. al.,'s (1986) findings.

Using monthly data covering January, 1999 to January, 2009, Hosseini et. al., (2011) investigated the relationship between macroeconomic variables and stock market indices for China and India. Results from the multivariate cointegration and vector error correction model (VECM) show both short- and long-run relationship between stock returns and macroeconomic variables for the two countries and that the impact of the latter on the former varies from country to country. While the long-run effect of crude oil price and money supply on China's stock returns is positive, the impact of these macroeconomic indicators on India's stock prices is however negative. Their results also reveal opposing impacts of industrial production on stock returns. They found that changes in industrial production positively affect stock returns in India while exerting a negative effect on China's stock returns. Their findings however show the positive impact of inflation on stock returns for both countries.

Sbeiti and Hadadd (2011) examined the relationship between macroeconomic variables and stock prices in four Golf Cooperation Council (GCC) countries. Results from their multivariate cointegration test presents evidence of long-run relationship between stock prices and the selected macroeconomic variables. Their findings however show varying impacts on stock returns. They argue that oil prices do not significantly affect stock prices in Kuwait but has positive and significant impact on Saudi Arabia's stock prices while exerting negative and significant effect on Bahrain's and Oman's stock prices. This is however inconsistent with Chen et. al.,'s (1986) earlier evidence. Further assessments reveal the significance of oil prices in accounting for a greater proportion of variations in stock returns in Kuwait, Saudi Arabia and Oman. Sbeiti and Hadadd's (2011) findings also show that short-term interest rate has negative and significant effect on stock prices in Kuwait while positively impacting on stock returns in Saudi Arabia, Bahrain and Oman. However, its impact is insignificant in Saudi Arabia owing to the Islamic Sharia which abhors charging interest rate.

Sbeiti and Hadadd (2011) further found that domestic credit has positive and significant long-run impact in Kuwait, Saudi Arabia and Bahrain while negatively influencing stock prices in Oman. Results from their causality test show unidirectional causality from oil prices to stock prices in Kuwait, Saudi Arabia and Oman.

By using the Nigeria stock exchange (NSE) All-share index as a proxy to stock market performance, Maku and Atanda (2010) investigated the determinants of stock market performance for the period 1984–2007 by employing the Engle–Granger cointegration test. Their study revealed long-run relationship between the series. In particular, they argue that inflation, exchange rate, broad money supply and real output consistently determine stock market performance and that in the long-run, investors should pay attention to these indicators instead of interest rate.

By invoking the error correction modelling approach to cointegration on quarterly data spanning 1991–2005, Kyereboah–Coleman and Agyire–Tettey (2008) found that while inflation negatively impact on Ghana’s stock market performance, its effects take longer time to occur due to the presence of lag period. Further evidence shows that lending rates adversely affect stock market performance thus serving as a drag on business growth.

Few systematic empirical studies have been done on investigating the effects of macroeconomic variables on a developing country’s stock returns. Using more recent data, this paper presents new and comprehensive evidence on the impact of some selected macroeconomic fundamentals on Ghana’s stock market movement. The analysis showed both short- and long-run relationship between macroeconomic variables and stock returns. In particular, we found that in the short-run, only exchange rate and interest rate significantly affect stock prices. However, in the long-run, money supply, exchange rate, inflation and index of industrial production (IIP) significantly influence stock returns and that effects on stock returns resulting from shocks to inflation, money supply and exchange rate persist over a long period. Contrary to earlier studies, we found no causality from any direction between stock market index and macroeconomic variables.

The rest of the paper is organized as follow; Section 2 presents theoretical underpinnings and review of existing literature. Section 3 outlines the methodology while Section 4 presents the results and discussions. Section 5 concludes the study with some policy implications.

2. Theoretical Perspective and Review of Literature

It is often argued that behaviour of economic variables have theoretical underpinnings as such, among others the catastrophe theory provides the theoretical justification for examining the relationships and impacts of macroeconomic variables on stock markets. This theory deals with the interactions between the short- and long-run dynamics and thus investigates events involving systematic changing factors which produce sudden effects on other forces (Birău, 2013).

Closely linked to the catastrophe theory is the basic portfolio theory which identifies the expected returns from stocks as the risk-free return plus risk premium where risk could be minimized by carefully investing in portfolios with negative correlations. The capital asset pricing model (CAPM) which is considered to be an extension to the portfolio theory shows the relationship between the ex-ante expected returns on individual assets or stocks and the market portfolio (Sharpe, 1964; Lintner, 1965; Black et. al., 1972). Among others, the model assumes that investors care only about the mean and variance of one-period portfolio returns. With the help of the rather simplifying assumptions, CAPM explicitly show the risk associated with stock as well as the future expected returns (See Hill, 2010; Sharpe, 1964; Lintner, 1965). The myriad of evidence on the empirical weaknesses of the CAPM provided by Fama and French (1994) provides the yardstick that marks the point when it is generally acknowledged that the CAPM has potential problems. It is reasonable that investors also care about how their portfolio return relates to future investment opportunities, exchange rates, interest rates and other macroeconomic indicators. Thus a portfolio's return variance misses important dimensions of risk. Closely linked in ideology but fundamentally different in form is the APT which was borne out of Ross's attempt to overcome the weaknesses of the CAPM. The basic thrust of the APT is that it relates the expected returns on assets to their factor sensitivities as well as capturing the influences of non-market factors on securities (Ross, 1976). The key empirical strength of the APT lies on its flexibility in allowing researchers to select multiple sources of systemic risks and thus aids in providing best results for a particular sample (Groenewold and Fraser, 1997; Cagnetti, 2002).

Intuitively, portfolio theory typically relies on correlation between financial assets where low correlation results in diversification. However, Kasa (1992) reveals that low correlations could suggest overestimated gains especially when equity markets share a common stochastic trend in the long-term. Thus following Kasa (1992), researchers, academicians, financial analysts and investors have shifted attention from correlation analysis to cointegration, which has now been used extensively in the literature in analyzing long-term portfolio diversification and impacts of macroeconomic variables on stock market returns.

Extant studies (Cheung et. al., 2007; Bessler and Yang, 2003; Masih et. al., 2004; Mokerjee and Yu, 1997; Masih et. al., 2002, Pagan and Soydemir, 2000; Tabak and Lima, 2003) have investigated the cointegration and causality between or among countries. Results from these studies have been mixed. While some studies reveal some level of interdependence and causality between stock market performances of different countries, others show otherwise. While recognizing the effect or impact of movements in one stock market on the other (via contagion), it is worth mentioning that performance of individual stock markets among others well depends on the behaviour of macroeconomic variables of each respective country.

Mukherjee and Naka (1995) employed the Johansen cointegration and VECM to examine the long-run relationship between six (6) macroeconomic indicators and Japanese stock returns for the period 1971–1990. Consistent with their hypotheses, Mukherjee and Naka (1995) found a positive long-run relationship between short-term interest rate, money supply and stock prices. Their evidence also shows a negative relationship between inflation, long-term interest rate and stock prices.

On their part, Boyd et. al., (2001) examined the impact of inflation on financial market performance using cross-country data over a 36-year period for 48 countries. They found that the effect of inflation on stock market performance varies according to a given threshold. In particular, they argue that stock performance flattens during high inflation rates (above 15%) so that subsequent rises in inflation are not associated with any significant deterioration of stock market performance. Although their findings reveal non-linearities between inflation and financial market performance, further evidence shows a negative relationship between the two variables. This finding is consistent with Erdem et. al., (2005). By investigating the effects of macroeconomic variables on Istanbul Stock Exchange (ISE) index, results from Erdem et. al.,'s (2005) E-GARCH model reveal a unidirectional volatility spillover from interest rates and inflation to the index at least from 1991 to 2004. In particular, while positive spillover is observed from interest rates, inflation exerts negative spillover to the ISE index.

Using monthly data spanning January, 1989 to December, 2001, Maysami et. al., (2004) investigated the long-run relationship between macroeconomic indicators and stock indices in Singapore by employing the Johansen cointegration approach and VECM. Their results show cointegration between the series hence the existence of long-run relationship between the Singapore stock market and the macroeconomic indicators. Specifically, their results suggest that changes in exchange rates positively affect stock market returns. Naik and Padhi (2012) replicated and applied the same approach to the Indian stock market index. They examined the relationship between the Indian stock market index and five macroeconomic indicators over the period April, 1994 to June, 2011. Naik and Padhi's (2012) results show cointegration between the stock market, Treasury bill rates, exchange rates, money supply, wholesale price index and index of industrial production which were used as macroeconomic indicators. Further evidence reveals that while exchange rate and short-term interest rate insignificantly influence stock prices, money supply and index of industrial production were positively related to stock prices while inflation negatively affects asset prices. Results from their causality test show that while macroeconomic indicators cause movements in stock prices in the long-run, same cannot be observed in the short-run.

Gan et. al., (2006) examined the relationship between New Zealand's stock market index and its macroeconomic indicators for the period January, 1990 to January, 2003. They found cointegration between the stock market index and macroeconomic indicators. In particular, Gan et. al., (2006) show that interest rates, real GDP and money supply consistently and significantly affect movements in the stock market.

By invoking the Granger causality test, Muradoglu et. al., (2000) examined the causality between macroeconomic variables and Brazil stock market returns. Their results show that exchange rate, inflation and interest rates Granger cause stock market returns in Brazil.

Following the financial globalization, Muradoglu et. al., (2000) attributed the causality to the high level of integration of the Brazilian stock market with the rest of the world.

By examining the relationship between macroeconomic factors and Pakistani equity market, results from Nishat and Shaheen's (2004) study show that among others, industrial production has the largest positive relationship with stock prices.

Ratanapokorn and Sharma (2007) investigated the short- and long-run relationship between US stock price index and macroeconomic indicators from 1975–1999 by using Johansen's cointegration approach and VECM. Their results suggest that money supply, industrial production, inflation and exchange rate positively affect stock prices. Interestingly, while short-term interest rates positively influence stock prices, long-term interest rates however exert negative influence on US stock prices. Results from their causality test show a causation running from all the macroeconomic indicators to stock prices in the long-run but not in the short-run.

By investigating the effects of macroeconomic indicators on the average share price of Nigeria for the period spanning 1986–2007, Asaolu and Ogunmuyiwa (2011) found a long-run relationship between the average share price and macroeconomic variables. Further evidence shows that only exchange rate Granger causes movements in the share price. However, average stock price does not have the predictive power over any of the macroeconomic indicators. This finding therefore negates the existence of causality running from stock markets to the real sector via macroeconomic indicators.

The majority of studies examining the impact of the real sector via macroeconomic indicators on stock markets relate to the developed countries with relatively efficient capital markets. Few studies exist for developing and emerging economies and studies on Ghana are also non-existent. Studies by Kuwornu and Owusu-Nantwi (2011), Owusu-Nantwi and Kuwornu (2011) and Frimpong (2009) are notable. Kuwornu (2012) examined the effect of macroeconomic variables on the Ghanaian stock market returns using monthly data spanning January, 1992 to December, 2008. Results from his Johansen multivariate cointegration test reveal cointegration between the four macroeconomic indicators and stock returns. Kuwornu (2012) further show that about 79% of the deviation of stock returns is corrected in the short-run. Further evidence reveals that with the exception of exchange rate and crude oil prices, interest rates and inflation significantly influence stock returns in the short-run. However, in the long-run all the four macroeconomic indicators significantly affect stock returns. In particular, while inflation and crude oil prices negatively affect stock returns, interest rates and exchange rates both positively influence stock returns.

By using inward foreign direct investment (FDI), interest rate, inflation and exchange rate as candidates for macroeconomic indicators, Adam and Tweneboah (2008) examined the short- and long-run effects of these variables on the stock market movement in Ghana by using Johansen multivariate cointegration approach. Their test results suggest cointegration between macroeconomic indicators and stock prices where the Databank stock index (DSI) was used as a proxy for performance of the stock market. Their variables significantly account for variations in the performance of the DSI. At least for the first quarter, inflation and net FDI inflow explain a greater percentage of the variations in the share price than interest rate and exchange rate. Contrary to their hypothesis, their results reveal a positive relationship between inflation and DSI. Results from their VECM show that, deviation from long-run equilibrium is corrected by 60.9% and takes less than two quarters to revert to long-run equilibrium. Adam and Tweneboah (2008) however could not show which individual variable predicts or triggers changes in stock market performance.

By using monthly data spanning April, 1991 to August, 2010, Mireku et. al., (2013) investigated the effect of macroeconomic indicators on stock prices in Ghana. Results from their cointegration and VECM showed that in the long-term, interest rate and exchange rate negatively affects stock prices while inflation positively influences it. Findings from their innovation accounting analysis however show a weak ability of the macroeconomic variables in explaining variations in stock returns. Issahaku et. al., (2013) applied the same approach and found sharp contrasts to Mireku et. al.,'s (2013) earlier finding. For instance, Issahaku et. al., (2013) established a positive long-run relationship between exchange rate and stock returns and that interest rate insignificantly affect stock prices. Both studies however found a positive and significant relationship between inflation and stock performance. Further findings from Issahaku et. al.,'s (2013) study reveal that while interest rate, inflation and money supply significantly affect stock returns in the short-run, effects of FDI is only imaginary. The insignificance of FDI is however inconsistent with Adam and Tweneboah's (2008) study. Evidence from Issahaku et. al.,'s (2013) causal relationship shows a unidirectional causality from inflation and exchange rate to stock returns and from stock returns to money supply, interest rate and FDI.

By controlling for oil price shocks and employing nonparametric kernel regressions techniques to examining the impact of macroeconomic indicators on Ghana's stock market performance, Adu et. al.,'s (2013) findings suggest a negative relationship between exchange rate and GSE index. This is however inconsistent with earlier findings by Adam and Tweneboah (2008) and Kuwornu (2012). The negative relationship between exchange rate and stock market index implies that a depreciation of the Ghanaian cedi has negative effects on the performance of the stock market. Further results show that money supply, inflation and interest rate are all positively related to the stock market index (a proxy for stock market performance). This positive relationship between inflation and stock market index is in sharp contrast with Kuwornu (2012) and consistent with Adam and Tweneboah (2008), and Issahaku et. al., (2013). Adu et. al.,'s (2013) main finding suggests that stock prices are significantly affected by macroeconomic indicators and oil price shocks albeit weakly. They therefore conclude that macroeconomic variables significantly affect the performance and growth of GSE. Their study however found no causality between stock market returns and any of the macroeconomic variables.

While recognizing a relationship between macroeconomic variables and stock prices, it is worth noting that majority of the results presented have been mixed and inconclusive. This paper adds to the few studies using relatively more recent data to analyze the causal and long-run relationship between stock market returns and macroeconomic indicators. The novelty of this study is its introduction of the index of industrial production which measures the growth rate of the real sector in the economy. This paper thus makes use of the most important macroeconomic indicators.

3. Data and Methodology

3.1 Data Sources

Monthly data series on inflation (INFL), exchange rate (EXR), broad money supply (M2), interest rate (INTR), index of industrial production (IIP) and Ghana Stock Exchange index (GSEI) were all taken from the Bank of Ghana data set spanning September, 2000 to September, 2010. INTR is proxied by the 91-day Treasury bill rate while stock price/return is proxied by the official measure of the Ghana stock exchange (GSE) performance – GSEI.

3.2 Brief Description of Variables

3.2.1 Ghana Stock Exchange All-share Index (GSEI)

This serves as the dependent variable and measures the performance or returns of the stock market. This index is computed from the values of all the market's listings and thus tracks changes in the market value of the GSE.

3.2.2 Exchange Rate (EXR)

This is the price of a currency in terms of other currency. In this study, we use the Ghana cedi expressed in terms of the US dollar (that is, cedi-dollar exchange rate). Since Ghana is not in autarky, changes in the exchange rate affect the import demand, competitiveness and profitability of companies via changes in cost of production as well as changes in expected cash flow. Where the economy is import-driven, a depreciation of the Ghana cedi increases cost of production which depresses future cash flows and profits. We therefore expect a negative relationship between exchange rate and stock market performance.

3.2.3 Interest Rate (INTR)

The 91-day Treasury bill rate which is used as a proxy for the interest rate is seen as the opportunity cost of holding money. Similarly, investing in Treasury bill reflects the opportunity cost for holding shares. High interest rate makes cost of borrowing high hence negatively impacting on economic activity. Increases in the cost of loans of listed companies resulting from high lending rates undoubtedly put a depressing effect on corporate profit and dividends. Thus, increases in interest rates have indirect impact on stock prices. We therefore hypothesize a negative relationship between interest rate and stock market returns.

3.2.4 Inflation (INFL)

Increases in inflation increase the cost of living thus channelling scarce resources meant for investment to consumption. This decreases the demand for investment and stocks. We therefore hypothesize a negative relationship between inflation and equity prices.

3.2.5 Broad Money Supply (M2)

M2 is used to proxy money supply including foreign currency deposits. Thus M2 is the broad stock of money in the country. A rise in money supply increases liquidity in the economy thus making money available for consumption and investments. We therefore hypothesize a positive relationship between money supply and stock prices.

3.2.6 Index of Industrial Production (IIP)

The IIP is regarded as one of the important determinants of stock market performance. Gross domestic product (GDP) has often been used to measure the growth of real economic activity. However, data unavailability for monthly basis and the problem of interpolation have restricted the use of GDP hence the use of composite index of economic activities as a proxy for IIP. The index measures the total value of economic activity in the economy and thus influences equity prices by impacting on expected future cash flows. It is therefore expected to positively impact on stock prices.

4. The Model, Unit Root and Cointegration

Since we anticipate that movements of stock prices among others depend on the above variables, we posit the following function where ε_t represents variables outside the model.

$$\mathrm{GSEI_t} = f(\mathrm{INFL_t}, \mathrm{INTR_t}, \mathrm{EXR_t}, \mathrm{M2_t}, \mathrm{IIP_t}) + \varepsilon_t \tag{1}$$

To linearize equation (1), we assume a Cobb-Douglas log-linear model of the following form which is multiplicative in nature;

$$\mathrm{GSEI_t} = \alpha_0(\mathrm{INFL_t})^{\alpha_1}(\mathrm{INTR_t})^{\alpha_2}(\mathrm{EXR_t})^{\alpha_3}(\mathrm{M2_t})^{\alpha_4}(\mathrm{IIP_t})^{\alpha_5}\,\varepsilon_t^{u_t} \tag{2}$$

To reduce multicollinearity and to make our equation linear, we take the natural log of equation (2) which gives;

$$\mathrm{LGSEI_t} = \alpha_0 + \alpha_1\mathrm{LINFL_t} + \alpha_2\mathrm{LINTR_t} + \alpha_3\mathrm{LEXR_t} + \alpha_4\mathrm{LM2_t} + \alpha_5\mathrm{LIIP_t} + u_t \tag{3}$$

where u_t is the stochastic error term. Since all the variables in equation (3) are in log form, their coefficients could be interpreted as their long-run elasticities. Therefore α_1 which is the coefficient of LINFL is the elasticity of GSEI with respect to INFL. In particular, it measures the degree of responsiveness of GSEI to changes in the level of inflation *ceteris paribus.* α_2 through to α_5 also represent their respective coefficients and elasticities and thus postulate similar behaviour as α_1. From the above theoretical and empirical literature, we hypothesize the following signs for our coefficients;

$$\alpha_1 < 0,\ \alpha_2 < 0,\ \alpha_3 < 0,\ \alpha_4 > 0 \text{ and } \alpha_5 > 0$$

Having estimated the ordinary least squares (OLS), we proceed to test for stationarity or unit roots of our variables. This is necessary in determining the order of integration of each series as well determine the number of times a series must be differenced to attain stationarity. In this quest, we use two formal unit root tests - the augmented Dickey-Fuller (ADF) and the Phillip-Perron (PP) unit root tests. The distribution of the ADF test assumes homoskedastic error terms. To overcome the potential problems of the rather restrictive assumption, we employ the PP test which has relatively less restrictive assumption regarding the distribution of the error terms as well correct any possible serial correlation and heteroskedasticity in the errors. A precondition to cointegration is the series to be integrated of the same order. This is verified with both the ADF and PP tests as the tests are done on both the levels and first differences where the appropriate number of lags is chosen according to Akaike information criterion (AIC).

The ADF test estimated takes the following equation;

$$\Delta Y_t = \beta_1 + \delta Y_{t-1} + \sum_{i=1}^{m} \alpha_i \Delta Y_{t-i} + \varepsilon_t \tag{4}$$

We test the null hypothesis, H_0: $\delta = 0$ (that is, the series is non-stationary) against the alternative hypothesis H_1: $\delta < 0$ (that is, the series is stationary).

After establishing the unit root or stationarity of our series, we invoke the Johansen (1988, 1991) cointegration test and the VECM. The Johansen cointegration test is a maximum livelihood approach for testing cointegration in multivariate vector autoregressive (VAR) models with the sole motive of finding a linear combination which is most stationary by relying on the relationship between the rank of a matrix and its eigenvalues.

Starting with VAR (k), for easier exposition, we let Y_t to be a vector integrated of order one ($I(1)$) variables given by equation (5) below;

$$Y_t = A_t Y_{t-1} + A_t Y_{t-2} + \ldots\ldots\ldots\ldots + A_k Y_{t-k} + \varepsilon_t \tag{5}$$

where Y_t and ε_t are $n \times 1$ vectors.

Remodelling equation (5) gives;

$$\Delta Y_t = \sum_{i=1}^{k-1} \Gamma_i Y_{t-i} + \prod Y_{t-1} + \mu_0 + \varepsilon_t \tag{6}$$

where $\prod = \sum_{i=1}^{k} A_i - I$ and $\Gamma_i = -\sum_{j=i+1}^{k} A_j$

There exist $n \times r$ matrices and α and β each with a rank r such that matrix $\prod = \alpha\beta'$ and $\beta' Y_t$ is stationary. This is possible if the reduced rank $r < n$ where r is the number of cointegrating relationships, α and each column of β are the adjustment parameters in the VECM and cointegrating vector respectively.

Hjalmarsson and Osterholm (2007) note that after correcting for possible lagged differences and deterministic variables, it can be shown that for a given r, the maximum livelihood estimator of β given the combination of Y_{t-1} yields the *r* largest canonical correlations of ΔY_t with Y_{t-1}.

Johansen (1991) suggests the trace and the maximum eigenvalue tests in testing the statistical significance and the reduced rank of matrix ∏. These test statistics are respectively given as;

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

$$J_{max} = -T\text{In}(1 - \hat{\lambda}_{r+1})$$

where T is the number of observations and $\hat{\lambda}_i$ is the *i*th largest canonical correlation.

Johansen and Julieus (1990) argue that the trace statistic tests the H_0 of *r* cointegrating relation as opposed to the H_1 of *n* cointegrating vectors where *n* denotes the number of variables in the system. Conversely, the maximum eigenvalue tests the H_0 of *r* cointegrating vectors against the H_1 of *r* + 1 cointegrating vectors. The critical values which are given by Johansen and Julieus (1990), and Osterwald-Lenum (1992) are reported by most econometric software packages like the EViews 7 which is used in estimating all equations in this study.

After establishing the cointegration, the study proceeds to estimating the following VECM which captures both the long-run dynamics as well as the short-run error correction model (ECM).

$$\text{LGSEI}_t = \alpha_0 + \sum_{i=1}^{n} \Phi\text{LGSEI}_{t-i} + \sum_{1=0}^{n} \partial\text{LINFL}_{t-i} + \sum_{i=0}^{n} \Omega\text{LINTR}_{t-i} + \sum_{i=0}^{n} \varphi\text{LEXR}_{t-i}$$

$$+ \sum_{i=0}^{n} \psi\text{LM2}_{t-i} + \sum_{i=0}^{n} \lambda\text{LIIP}_{t-i} + \varepsilon_t \qquad (7)$$

$$\Delta\text{InGSEI}_t = \alpha_0 + \sum_{i=1}^{n} \Phi\Delta\text{LGSEI}_{t-i} + \sum_{1=0}^{n} \partial\Delta\text{LINFL}_{t-i} + \sum_{i=0}^{n} \Omega\Delta\text{LINTR}_{t-i} + \sum_{i=0}^{n} \varphi\Delta\text{LEXR}_{t-i}$$

$$+ \sum_{i=0}^{n} \psi\Delta\text{LM2}_{t-i} + \sum_{i=0}^{n} \lambda\Delta\text{LIIP}_{t-i} + \delta\text{ECT}_{t-1} + \varepsilon_t \qquad (8)$$

where δ is the coefficient of the error correction term (ECT_{t-1}) which is obtained from the cointegrating vector and measures the feedback effect or the speed of adjustment to long-run equilibrium resulting from a shock to the stock market, ε_t is the error term while the other variables still maintain their usual definitions.

We also employ the impulse response functions and variance decomposition in examining the effects on stock returns to shocks in the macroeconomic variables. The study proceeds to examine the causal relations of the variables using Granger causality test. Granger (1969) propounded this test such that Y_t Granger cause X_t if Y_t can be predicted with greater certainty by using past values of X_t *ceteris paribus*. As such, we estimate the following VAR models;

$$Y_t = \alpha_1 + \sum_{i=1}^{n} \gamma_1 X_{t-i} + \sum_{j=1}^{m} \gamma_2 Y_{t-j} + \varepsilon_1 \tag{9}$$

$$X_t = \alpha_2 + \sum_{i=1}^{n} \Phi_1 Y_{t-i} + \sum_{j=1}^{m} \Phi_2 X_{t-j} + \varepsilon_2 \tag{10}$$

where X_t and Y_t denote the macroeconomic variable and GSEI respectively.

From equations (9) and (10), we test $H_o: \sum_{j=1}^{n} \gamma_1 = 0$ and $H_o: \sum_{i=1}^{n} \Phi_1 = 0$ respectively.

We reject each H_o if the computed *F* statistic is greater than the critical value at a reasonable significance level otherwise we do not reject H_o. Rejecting the H_o in equation (9) implies that the selected macroeconomic variable Granger causes GSEI and that past values of former significantly predict stock prices. Similarly, rejecting H_o in equation (10) also implies that GSEI Granger causes the selected macroeconomic variable as such past values of the index could be used to predict the macroeconomic variable in question.

5. Results and Discussions

Table 1. Descriptive Statistics

	LGSEI	LEXR	LIIP	LINFL	LINTR	LM2
Mean	8.219143	-0.049146	4.999155	2.867179	2.950419	7.976604
Median	8.521125	-0.095850	4.940928	2.833213	2.890372	7.937732
Maximum	9.295674	0.395953	5.538121	3.735286	3.850148	9.321059
Minimum	6.751686	-0.428478	4.559126	2.240710	2.261763	6.440947
Std. Dev.	0.812989	0.215839	0.315670	0.409017	0.478336	0.831598
Skewness	-0.708909	0.749762	0.238198	0.523149	0.100913	-0.091675
Kurtosis	2.027323	2.754808	1.620003	2.324405	1.905158	1.918504
Jarque-Bera	14.90473	11.63965	10.74554	7.820471	6.248709	6.066386
Probability	0.000580	0.002968	0.004641	0.020036	0.043965	0.048162
Sum	994.5163	-5.946612	604.8978	346.9286	357.0007	965.1691
Sum Sq. Dev.	79.31412	5.590399	11.95771	20.07537	27.45663	82.98656

The descriptive statistics for all the six variables are presented in Table 1. A distribution is said to be normal if the value of the skewness and kurtosis are respectively 0 and 3. From Table 1, it can be seen that the distributions of the variables are far from being normal. The values of the standard deviation indicates that money supply and Ghana stock exchange index are relatively more volatile compared to exchange rate, inflation, interest rate and index of industrial production.

Table 2. Unit Roots Test for Stationary

Variables	ADF		PP	
	Levels	First Difference	Levels	First Difference
LM2	-1.31798	-1.623392*	-1.637451	-12.35261
LINTR	-2.192261	-4.67135	-1.718759	-6.822415
LINFL	-1.655446	-4.930692	-1.714366	-10.5872
LIIP	-0.031828	-3.161953*	0.375902	-20.03906
LEXR	0.159820	-5.712626	-0.457293	-5.984901
LGSEI	-1.971888	-2.963075*	-1.651423	-6.225328

* denotes significance at 1% level of significance.

From Table 2, the ADF test results present mixed results. Our data are non-stationary at levels but at first difference LGSEI and LIIP become stationary at 1% significance level while LEXR, LINFL and LINTR become stationary at any level of significance. However, LM2 still remains non-stationary even at first difference. Thus our series are individually integrated of order one ($I(1)$) expect for money supply which is $I(0)$. On the other hand, results from PP test show that at first difference, all our series become stationary at any reasonable level of significance. Thus following the PP test, all our series are individually $I(1)$ after first difference. Because the ADF suffer from low power and assumes a stringent homoskedastic error terms, we rely on the PP test results which corrects for any serial correlation and heteroskedasticity in the errors terms by directly modifying the t (= τ) test statistic.

The precondition for cointegration is established since all our variables are of the same order of integration. In practice, the first step in the estimation of any VAR model once the variables that will enter the VAR have been established, will be to determine the appropriate lag length. Table 3 below presents VAR lag order selection criteria to be used in both the Johansen cointegration test and VECM. Different lag lengths are suggested by all the information criteria. To minimize the value of the information criteria, this work chooses a lag length of 7 in the general VAR model as suggested by AIC. We thus proceed to estimate the Johansen cointegration equation using the selected lag length.

Table 3. VAR Lag Order Selection

Endogenous Variables: LGSEI, LEXR, LNIP, LINFL, LINTR, LM2

Lag	LogL	LR	FPE	AIC	SC	HQ
0	176.2156	NA	1.98e-09	-3.012666	-2.867849	-2.953901
1	1228.304	1973.829	3.07e-17	-20.99653	-19.98281*	-20.58517
2	1312.023	148.1760	1.33e-17	-21.84112	-19.95850	-21.07717*
3	1351.810	66.19395	1.26e-17*	-21.90814	-19.15662	-20.79160
4	1381.548	46.31817	1.44e-17	-21.79732	-18.17689	-20.32819
5	1424.791	62.75980	1.32e-17	-21.92551	-17.43618	-20.10379
6	1453.772	38.98248	1.59e-17	-21.80127	-16.44304	-19.62696
7	1504.450	62.78652*	1.35e-17	-22.06105*	-15.83392	-19.53415
8	1537.403	37.32792	1.61e-17	-22.00713	-14.91110	-19.12764

*indicates lag order selected by the criterion

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

FPE: Final prediction error

AIC: Akaike information criterion

SC: Schwarz information criterion

HQ: Hannan-Quinnin formation criterion

Table 4. Multivariate Johansen Cointegration Test

H_o	Eigenvalue	J_{trace}	5% Critical Value	J_{max}	5% Critical Value
r = 0	0.406930	187.3139*	117.7082	59.55845*	44.49720
r ≤ 1	0.365167	127.7555*	88.80380	51.80084*	38.33101
r ≤ 2	0.262397	75.95466*	63.87610	34.69588*	32.11832
r ≤ 3	0.160302	41.25879	42.91525	19.91726	25.82321
r ≤ 4	0.111310	21.34152	25.87211	13.45273	19.38704
r ≤ 5	0.066860	7.888791	12.51798	7.888791	12.51798

*denotes rejection of the hypothesis at the 5% level

The null hypothesis (H_o) that the variables are not cointegrated is rejected at 5% significance level and thus from Table 4 above, both test statistics indicate at most 3 cointegrating relationships. The results thus show the existence of a long-run relationship between the macroeconomic variables and the stock market. The long-run cointegrating relationship expressed in equation (3) is thus given as;

$$LGSEI = 5.6298 + 0.3499LINFL - 0.0061LINTR - 3.0922LEXR + 2.5755LM2 - 11.8778LIIP \quad (10)$$

After adjusting for degrees of freedom, about 83% of the variation in LGSEI is explained by changes in our selected macroeconomic variables. The long-run coefficients of LINTR, LEXR and LM2 are consistent with our expectation. The coefficients of LINFL and LIIP are however inconsistent with our hypothesised coefficients. Our results show that with the exception of interest rate, all the macroeconomic variables are significant. The negative long-run relationship between LGSEI and LEXR is expected. A 1% increase in LEXR (or depreciation of the cedi) reduces stock returns by 3%. The possible explanation is that since Ghana is not in autarky and thus import-driven, a depreciation of the cedi does not only make investment in the Ghana stock market unattractive but also increases the cost of production to importing firms thus reducing their expected cash flows hence profits.

Also worth commenting on is the long-run relationship between LINTR and the stock returns. Seen as the cost of borrowing, interest rate (proxied by 91–day Treasury bill) is thought to reflect information about future economic conditions and thus captures investment opportunities. In the long-run, a 1% increase in interest rate reduces stock performance by 0.6%. This is because increase in the cost of borrowing deters investors from borrowing more for possible increases in production. This puts a depressing effect on firms' corporate earnings and profits thus translating into a reduction in stock performance. That said, interest rate is however not significant in determining stock prices in the long-run. Also consistent with our expectation, money supply has a positive and significant long-run effect on stock returns. In the long-run, stock returns increases by 2.5% following a 1% increase in money supply. Thus increasing the money supply increases liquidity and economic stimulus hence stock prices will increase. These findings are consistent with Adam and Tweneboah (2008), Ratanapokorn and Sharma (2007) and Adu et. al., (2013).

However, contrary to our expectation, inflation positively affects stock prices while index of industrial production negatively affect the stock returns. Because inflation is usually accompanied by higher cost of living, increase in inflation results in channelling scarce resources to consumption and little for investment. This increases volatility and business uncertainty thus inhibiting investments. The combined effect decreases stock returns. However, in the long-run, a 1% increase in inflation increases stock returns by 0.35% suggesting that inflation leads to higher investment and production to the extent that it increases profits of businesses. This implies that stocks are better hedged against inflation hence reduces or even eliminates the likelihoods of stock returns from falling below some minimum threshold. Our results suggest that investors are compensated for inflationary pressures. This can be seen from the fact that despite the higher inflation the country is experiencing over the years, Ghana stock market continues to improve albeit some minor fluctuation. Our finding is akin to Adu et. al., (2013), Adam and Tweneboah (2008) and Issahaku et. al., (2013) whose studies on the impact of macroeconomic variables on Ghana stock market also among others found a positive relationship between inflation and stock returns.

On the stock returns-index of industrial production nexus, our results reveal a negative and significant relationship at 5% level. It is clear that a 1% increase in index of industrial production reduces stock returns by 12%. Although inconsistent with our prior expectation, this finding is unsurprising. Increase in productivity of real capital increases expected market returns via increases in future expected output. As a result, forward looking investors borrow in anticipation of the expected future output. This undoubtedly increases the demand for funds and as a consequence increases interest rates (seen as the cost of borrowing) resulting in a decrease in the present value of future expected cash flow.

Given the existence of long-run relationship/equilibrium between stock returns and macroeconomic variables, we estimate the VECM which shows short-run dynamics and an error correction term (ECT) where in the short-run, disequilibrium from long-run path resulting from a shock to the stock market is corrected according to the speed of adjustment. Thus the VECM restricts the long-run dynamics of the endogenous variables to revert to their cointegrating relationship albeit short-run dynamics. Only the cointegrating equation which normalises on the stock index is reported since the interest is on the effect that the other variables have on the stock price.

Table 5. Normalized Cointegrating Coefficients

LGSEI(-1)	LEXR(-1)	LINFL(-1)	LINTR(-1)	LM2(-1)	LIIP(-1)	C
1.000000	0.000000	0.000000	-5.572166	+2.569722	-35.97557	+61.81002
			[4.85451*]	[-0.86026]	[0.93084]	

[ ] *t*-statistics, * denotes 1% significance level.

Results from Table 5 are not remarkably different from our long-run coefficients in equation (10). With the exception of interest rate, all the other variables are insignificant. While index of industrial production and interest rate negatively affect stock returns, money supply on the other hand has a positive effect.

Table 6. VECM Estimation for D(LGSEI)

Lag (k)	$D(LGSEI)_{t-k}$	$D(LINTR)_{t-k}$	$D(LEXR)_{t-k}$	$D(LM2)_{t-k}$	$D(LIIP)_{t-k}$	$D(LINFL)_{t-k}$	ECT_{t-1}
1	0.442344**	0.216947**	-1.549419***	-0.034186	1.368931	-0.083131	-0.074936*
	[4.08052]	[1.98637]	[-1.92104]	[-0.16291]	[1.21498]	[-1.45655]	[-3.38819]
2	-0.135430	0.016492	1.280690	0.113691	2.076002	-0.062620	
	[-1.14262]	[0.15729]	[1.36301]	[0.58407]	[1.87542]	[-1.07994]	
3	0.086544	-0.120088	0.428056	0.010546	0.676218	-0.062032	
	[0.79270]	[-1.19303]	[0.49444]	[0.05080]	[0.62542]	[-1.03566]	
4	0.353073**	0.124010	-0.784025	0.301394	1.996722	0.014864	
	[3.28090]	[1.14911]	[-0.95203]	[1.47542]	[1.82156]	[0.24719]	
5	-0.100522	-0.008824	-0.765510	0.073702	1.216445	-0.025492	
	[-0.83483]	[-0.08194]	[-1.07661]	[0.35095]	[1.27598]	[-0.45434]	
6	0.058327	0.057681	1.670169**	-0.095353	0.797236	-0.000431	
	[0.56292]	[0.53257]	[2.42799]	[-0.48550]	[1.01076]	[-0.00849]	

*, ** (***) denote significance at 1%, 5% (10%) level.

Results from the VECM presented in Table 6 above show that about 50.2% of the variation in the first difference of LGSEI [D(GSEI)] is explained by variations in the macroeconomic variables after accounting for the degrees of freedom. Our results also suggest that lags difference of index of industrial production, inflation and money supply have insignificant effect on D(GSEI) in the short-run. While the first lag difference of exchange rate exerts a negative but significant impact on D(GSEI), its sixth lag difference exerts positive and significant effect on D(GSEI). On the other hand, all the lags difference of interest rate is insignificant except for its first lag difference which has a positive and significant impact on stock returns. The results reveal that in the short-run only the first and fourth lag difference of LGSEI have positive and significant impact on its first difference.

The error correction mechanism and cointegration theory suggest that the GSEI and the macroeconomic variables have long-run relationship where short-run disequilibrium is corrected. The coefficient of the ECT shows the speed of adjustment towards long-run equilibrium. As expected, the negative and significant (at 1% level) ECT suggests that following a shock to the stock market in the short-run, deviation from long-run equilibrium is corrected by 7.5% every month and takes approximately 13 months for all disequilibrium to be corrected and the series eventually returned fully to its long-run equilibrium.

Cointegration analysis and VECM only establishes long-run relationship where short-run deviation from a systemic shock is corrected. However, both cointegration and VECM does not distinguish between shocks from GSEI or shocks from the macroeconomic variables. To analyze and to distinguish the various shocks, we employ the impulse response functions (IRF) and variance decomposition. While the IRF establish how responsive GSEI in the VAR is to shocks to each macroeconomic variable, the variance decomposition shows the proportion of the fluctuations in GSEI resulting from its own shock as against shocks to the macroeconomic variables. The generalized impulse response is used in this study because it does not depend on the ordering of the variables. Figure 1 and Table 7 respectively show the IRF and variance decomposition of LGSEI.

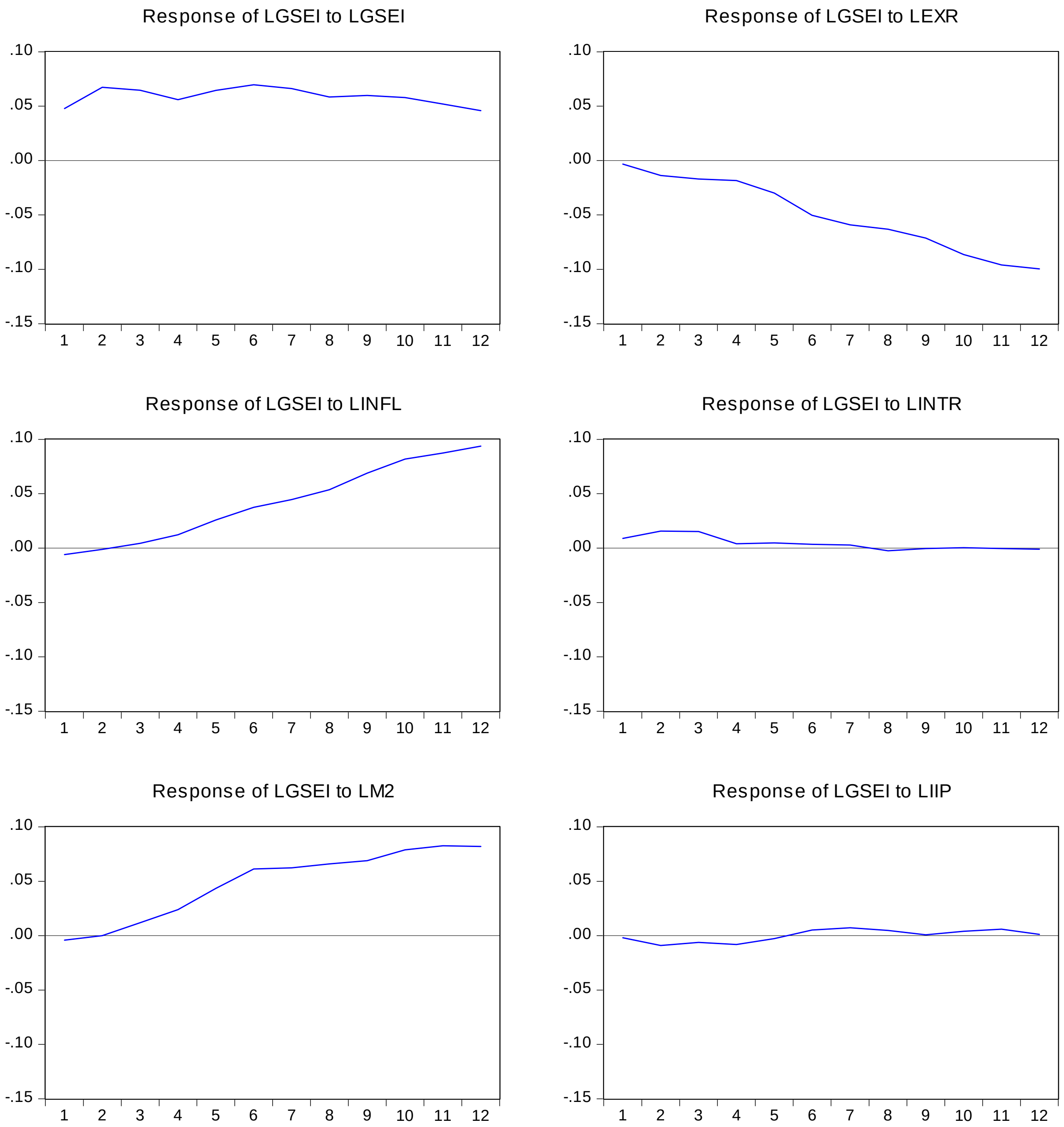

Figure 1. Response to Generalized One S.D. Innovations

From Figure 1 above, a shock to exchange rate puts an immediate downward effect on the stock returns after the 1st month and this decrease continues unabated. As a consequence, a shock to money supply sharply increases stock returns from the 2nd month until the 6th month. After this period, stock returns continue to increase but at a decreasing rate. Similarly, a shock to inflation leads to a continuous rise in stock returns. Thus the effect on stock returns following shocks to money supply, exchange rate and inflation does not die off even after 12 months. However, a shock to interest rates increase stock prices within the first quarter where it begins to slowly fall until the 8th month and stabilizes afterwards.

However, the behaviour of stock return to shocks in the index of industrial production is mixed and varies from one quarter to another. In particular, when there is a shock to IIP, stock returns fall in the 1st quarter, rises slowly with the 2nd quarter. It slowly falls again after the 7th month, stabilizes in the 9th month and begins to rise modestly until it again stabilizes in the 12th month. Notice that within the 1st quarter, the decrease in stock returns resulting from the shocks to IIP is sustained over a period relatively larger than the temporal or rather short rises in stock returns in the subsequent quarters. The implication is that industrial production depends on factors which may have opposing effects and to the extent that the generalized impulse response is independent of the ordering, changes in one factor triggers an opposite effect on industrial production by another factor thus making the effect on stock returns resulting from a shock to industrial production non-linear. A negative shock resulting from a decrease in industrial production is expected to exert an effect on the volatility of the stock returns (via expected future cash flows) which outweighs the positive shock of the same magnitude resulting from an increase in industrial production. For instance, decrease in money supply deteriorates the liquidity of the economy thus raising interest rate as the demand for money increases. The rising interest rate crowds out investments thus slowing economic activities. Therefore, the non-linearity can be attributed to the presence of different impacts. Hence the quarterly variation of stock returns following a shock to industrial production is asymmetric. In general, results from the IRF are consistent with our long-run and VECM estimates.

Table 7. Variance Decomposition for LGSEI

Period	S.E.	LGSEI	LEXR	LIIP	LINFL	LINTR	LM2
1	0.047686	100.0000	0.000000	0.000000	0.000000	0.000000	0.000000
2	0.084209	95.94679	1.121131	0.567665	0.204467	0.794134	1.365810
3	0.109709	91.27281	1.935153	0.438110	0.931816	1.015595	4.406519
4	0.129160	84.61554	2.647623	0.520517	2.237247	0.764453	9.214621
5	0.157751	73.33278	4.364699	0.348938	5.641701	0.514437	15.79745
6	0.194651	60.91269	8.369261	0.404425	8.871052	0.366087	21.07648
7	0.227643	52.96288	11.86762	0.494666	11.41120	0.343494	22.92014
8	0.257576	46.50864	14.55556	0.467357	13.87425	0.283248	24.31095
9	0.290227	40.87073	16.80929	0.382186	16.94285	0.286794	24.70815
10	0.327686	35.16901	19.55082	0.340442	19.71882	0.399346	24.82157
11	0.364346	30.47441	22.25517	0.328276	21.63744	0.556664	24.74804
12	0.398859	26.75365	24.43730	0.280854	23.18501	0.716446	24.62675

From Table 7 above, results from the variance decomposition for LGSEI reveal that changes in stock returns are typically driven by its own variations especially in the 1st period where it accounts for all of its variations and by end of the 9th and 12th period, about 41% and 27% of the variation in stock returns is respectively accounted for by its own variation. By the end of the 2nd period, about 1.1% and 1.4% of variation in stock returns is respectively explained by variation in exchange rate and money supply. By the end of the 10th period, while 35% of the variation in stock prices is accounted for by variations in LGSEI itself, 44% is jointly accounted for by changes in exchange rate and money supply. Inflation has also been a major variable in explaining variations in stock returns. In particular, it respectively explains about

21% and 23% of stock returns' variation by the end of the 11^{th} and 12^{th} period.

Notice that although the proportion of the variations in stock prices explained by the macroeconomic variables continue to increase in subsequent periods, with the exception of money supply, inflation and exchange rate, all the other macroeconomic indicators account for only a very small proportion of the variation in stock returns.

Causality tests are employed to examine the direction of causal relations between the stock returns and macroeconomic variables as well as causality between the macroeconomic indicators. Our causality test results are presented in Table 8 below:

Table 8. Pairwise Granger Causality Tests

Null Hypothesis:	Obs	F-Statistic	Prob.
LEXR does not Granger Cause LGSEI	115	1.12295	0.3543
LGSEI does not Granger Cause LEXR		1.51787	0.1797
LIIP does not Granger Cause LGSEI	115	0.94416	0.4671
LGSEI does not Granger Cause LIIP		1.51372	0.1811
LINFL does not Granger Cause LGSEI	115	0.59668	0.7324
LGSEI does not Granger Cause LINFL		0.45765	0.8380
LINTR does not Granger Cause LGSEI	115	1.88708	0.0901
LGSEI does not Granger Cause LINTR		0.69388	0.6551
LM2 does not Granger Cause LGSEI	115	1.54610	0.1708
LGSEI does not Granger Cause LM2		0.62079	0.7132
LIIP does not Granger Cause LEXR	115	2.87256**	0.0126
LEXR does not Granger Cause LIIP		0.74388	0.6156
LINFL does not Granger Cause LEXR	115	0.51033	0.7993
LEXR does not Granger Cause LINFL		1.10353	0.3655
LINTR does not Granger Cause LEXR	115	0.66841	0.6753
LEXR does not Granger Cause LINTR		1.66649	0.1368
LM2 does not Granger Cause LEXR	115	1.80928	0.1046
LEXR does not Granger Cause LM2		0.47284	0.8271
LINFL does not Granger Cause LIIP	115	0.72126	0.6334
LIIP does not Granger Cause LINFL		0.63935	0.6985
LINTR does not Granger Cause LIIP	115	1.41513	0.2160
LIIP does not Granger Cause LINTR		1.04920	0.3982
LM2 does not Granger Cause LIIP	115	4.11765*	0.0010
LIIP does not Granger Cause LM2		2.00066	0.0723
LINTR does not Granger Cause LINFL	115	2.28550***	0.0413
LINFL does not Granger Cause LINTR		1.80247	0.1059
LM2 does not Granger Cause LINFL	115	0.65601	0.6852
LINFL does not Granger Cause LM2		0.21172	0.9724
LM2 does not Granger Cause LINTR	115	2.30419***	0.0397
LINTR does not Granger Cause LM2		0.48793	0.8160

*, ** (***) denote significance at 1%, 5% (10%) level.

From Table 8, results from the Granger causality tests suggest that from equation (9) and (10), the null hypothesis (H_o) of no causality in any direction between stock returns and macroeconomic variables cannot be rejected at any reasonable level of significance. Thus macroeconomic indicators cannot be used to predict the past values of stock returns and vice versa. The implication is that stock returns in Ghana and the set of macroeconomic variables are completely independent. This is consistent with Adu et. al., (2013). Our findings are however inconsistent with Issahaku et. al., (2013) who found a unidirectional causality from stock returns to interest rate, money supply and FDI as well as a unidirectional causality from inflation to stock returns and then exchange rate to stock prices.

Our study rather found a unidirectional causality from money supply to interest rate and index of industrial production. This causality is not surprising. The reason being that given a well-behaved money demand function, expansionary monetary policy lowers interest rate and since interest rate is the cost of borrowing, investors borrow more for investment in productive sectors which in turn triggers changes in industrial production. Our finding also reveals a unidirectional causality running from interest rate to inflation and index of industrial production to exchange rate. The former is in support of the Fisher effect which argues that movements in inflation is closely linked to movements in interest rate and that there is a one-for-one change in inflation in response to interest rate. The latter causal relation is also expected since increases in industrial production may lead to changes in exchange rate because importing firms will need foreign currency in order to import their inputs for more production.

By carefully studying the above causal relationships especially from money supply to interest rate and then interest rate to inflation, one can deduce a channel through which changes in monetary policy affects inflation. In other words, given its assumptions, we find support for the quantity theory of money which argues that price level changes are in response to changes in the quantity of money.

6. Conclusion

This paper examined the impact of macroeconomic variables on Ghana's stock market returns. Results from the cointegration analysis show evidence of long-run relationship between stock returns and macroeconomic fundamentals namely broad money supply, inflation, exchange rate, index of industrial production and interest rate. Contrary to our hypothesis, our findings suggest a negative impact on stock prices of industrial production. The implication is that a surge in productivity of real economic activities via real capital, increases expected market returns through increases in future expected output. This encourages investors to borrow in anticipation of the expected real future output thus increasing interest rates, which in turn leads to a decrease in the present value of future expected cash flow. Further evidence shows that stocks are better hedged against inflation hence compensating investors for inflationary pressures.

Contrary to earlier studies, we found no causality between stock market index and macroeconomic variables. However, in the short-run, exchange rate and interest rate significantly affect stock performance. It is also worthy of note that in the long-run, money supply, inflation, exchange rate and index of industrial production significantly influence stock prices. Findings from our innovation accounting analysis show that effects on stock returns resulting from shocks to inflation, money supply and exchange rate last for a very long time and do not show any sign of reversion to normalcy.

Based on our findings, we conclude that macroeconomic variables significantly drive stock returns in Ghana. Fund managers and investors should thus pay crucial attention to the exchange rate (rather than interest rate) as it appears to significantly influence stock returns in both the short- and long-run. Our evidence therefore calls for the need for policy makers to institute sound and prudent macroeconomic policies that stabilizes the economy. Care must also be taken when implementing policies affecting macroeconomic fundamentals as those policies may have indirect impact on stock market performance. It is also imperative for policy makers to use rents from the resources to shore up the economy thus improving on liquidity and stock market returns.

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