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Effect of Macroeconomic Factors on Stock Prices in Ghana: A Vector Error Correction Model Approach

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Abstract
This study examines the effect of macroeconomic variables on stock prices in Ghana. Analysis was done using monthly data from 1991.4 to 2010.8. This study employed cointegration test and vector error correction models (VECM) to examine both long-run and short-run dynamic relationships between the stock market index and the macroeconomic variables. Generalized impulse function (IRF) and forecast error variance decomposition (FEVD) were used to detect the effect of shocks in the macroeconomic factors on complete time path of stock prices and vice versa. The time series properties of the data were, first, analyzed using the Augmented Dickey-Fuller (ADF) and Phillips-Perron tests. The empirical results derived indicate that all the variables were stationary after their first differencing. The paper established that there is cointegration between macroeconomic variables and Stock prices in Ghana indicating long run relationship. The above long term relation indicates that Interest Rate (TB) and Exchange Rate (XR) have a negative effect on Stock Prices whiles Inflation (CPI) showed a positive effect on Stock Prices (DSI). Results of Impulse Response Function (IRF) and Forecast Error Variance Decomposition (FEVD) indicate that the macroeconomic variables identified a low significant influence on share price movements in Ghana.
Keywords: Vector Autoregressive Model (VAR), Cointegration, Macroeconomic Variables, Stock Prices

Introduction

Over the past few decades, the interaction of share returns and the macroeconomic variables has been a subject of interest among academicians and practitioners. It is often argued that stock prices are determined by some fundamental macroeconomic variables such as the interest rate, the exchange rate and inflation. Evidence from Maghayereh (2002) indicates that investors generally believe that macroeconomic events have a large influence on stock price. This motivates many researchers to investigate the relationships between share returns and macroeconomic variables. For example, using the Arbitrage Pricing Theory (APT), developed by Ross (1976); Chen et al (1986) used some macroeconomic variables to explain stock returns in the US stock markets. The authors' findings revealed that industrial production, changes in risk premiums, and changes in the term structure to be positively related to the expected stock returns, while both the anticipated and unanticipated inflation rates were negatively related to the expected stock returns.

The development of cointegration analysis provided another approach to examine the relationships between the macroeconomic variables and stock returns. For example, Mukherjee and Naka (1995) employed the Johansen cointegration test in the Vector Error Correction Model (VECM) and found that the Japanese stock market is cointegrated with six macroeconomic variables namely, exchange rate, money supply, inflation rate, industrial production, long term government bond rate and the short term call money rate. The results of the long-term coefficients of the macroeconomic variables are consistent with the hypothesized equilibrium relationships. Cointegration is a statistical property of time series variables. Two or more time series are cointegrated if they share a common type of stochastic drift: that is, to a limited degree they share a certain type of behaviour in terms of their long-term fluctuations.

In Africa, Jefferis, Okeahalam and Matome (2001) reported that, the real stock market index of the Johannesburg Stock Exchange (JSE) has a positive long-term relationship with real GDP and real exchange rate, and a negative relationship with real long-term interest rate over the period 1985 to 1995. Establishing such relationship would not only be very useful to policy makers and investors' alike but will also test the efficiency of the stock market because establishing a lead-lag relationship between stock prices and macroeconomic variables exposes the existence of arbitrage profit hence the inefficiency of the market.

With this important implication on stock prices, there have been limited studies on the dynamic linkage between the macro economy and stock prices in Ghana. Recognizing the importance of these studies, the authors have widened the study to capture most of the key macroeconomic indicators for robust analyses. The main focus of this research was to examine the impact of macroeconomic variables, specifically, exchange rate, interest rate and inflation rate on stock prices in Ghana. The empirical methods include cointegration analysis and Vector Error Correction Model (henceforth VECM).

Literature Review

Theoretical Review

Macroeconomics is the study of the behavior of an economy at the aggregate level, as opposed to the level of specific subgroups or individuals which is called microeconomics (Chen, Roll and Ross, 1986). Macroeconomic factors include inflation, Interest Rate, Exchange Rate, unemployment, and industrial production. Stock prices are set by a combination of factors that no analyst can consistently understand or predict (Poon and Taylor, 1991). In general, economists say, they reflect the long-term earnings potential of companies. Investors are attracted to stocks of companies they expect will earn substantial profits in the future; because many people wish to buy stocks of such companies, prices of these stocks tend to rise. On the other hand, investors are reluctant to purchase stocks of companies that face bleak earnings prospects; because fewer people wish to buy and more wish to sell these stocks, prices fall.

Empirical Evidence

The relationship between the stock market returns and the macroeconomic variables are mostly documented for developed countries. One seminal paper analyzing the determinants of the stock market returns is presented by Chen, Roll and Ross (1986). Their paper examines the relationship between the market returns and macroeconomic factors with a different methodology that is based on pricing the systematic macroeconomic risks. They found a strong relationship between the market returns and the macro variables like industrial production, changes in the risk premium and the expected and unexpected inflation in United States. There are also some papers that found no empirical evidence that the macroeconomic factors affect the stock returns. Poon and Taylor (1991) in United Kingdom and Gjerde and Saettem (1999) in Norway found that macroeconomic variables do not appear to affect share returns. Binswanger (2000), who used monthly data during the period 1953 to1995, also states that the price movements since early 1980's cannot be explained by fundamental factors implying that the link between stock prices and real economic activity has broken down in U.S. and G-7 countries.

Interest rates are expected to be negatively related to market returns either through the inflationary or discount factor effect. Choi and Jen (1991) report that the expected returns on common stocks are systematically related to the market risk and the interest-rate risk. The findings of the study indicate that the interest-rate risk for small firms is a significant source of investors' portfolio risk and the interest-rate risk for large firms is "negative". The effect of interest rate on stock returns has been studied over emerging markets as well. Al-Sharkas (2004) for Jordan and Adam and Tweneboah (2008) for Ghana indicate that the relationship between stock prices and interest rates is negative and statistically significant.

Gultekin (1983) testing the generalized Fisher hypothesis for 26 countries for the period of 1947 to 1979, could not find a significant positive relationship between nominal stock returns and inflation rates. Moreover, the findings of the study revealed that regression coefficients are predominantly negative. A negative relationship between inflation and stock prices is contended in literature because an increase in the rate of inflation is accompanied by both lower expected earnings growth and higher required real returns. In the US, there is substantial empirical evidence that high inflation is associated with a high equity risk premium and declining stock prices (Hoguet, 2008). Rising inflation is apt to restrictive economic policies, which in turn increases the nominal risk-free rate and hence raises the required rate of return in valuation models.

There is no theoretical consensus neither on the existence of relationship between stock prices and exchange rates or on the direction of the relationship. However, in the literature, two approaches have been asserted to establish a relationship between exchange rate and stock prices: the goods market model and the portfolio balance model. The first approach according to Flannery and Protopapadakis (2001) focused on the association between the current account and the exchange rate. They developed a model of exchange rate determination that integrates the roles of relative prices, expectations, and the assets markets, and emphasized the relationship between the behaviour of the exchange rate and the current account. They also argue that there is an association between the current account and the behaviour of the exchange rate. It is assumed that the exchange rate is determined largely by a country’s current account or trade balance performance. These models posit that changes in exchange rates affect international competitiveness and trade balance, thereby influencing real economic variables such as real income and output. Thus, the goods market model suggests that changes in exchange rates affect the competitiveness of a firm, which in turn influences the firm's earnings or its cost of funds and hence its stock price. On a macro level then, the impact of exchange rate fluctuations on stock market would depend on both the degree of openness of the domestic economy and the degree of the trade imbalance. Thus, goods market models represent a positive relationship between stock prices and exchanges rates with direction of causation running from exchange rates to stock prices. The conclusion of a positive relationship stems from the assumption of using direct exchange rate quotation (Foresti, 2006).

Methodology of Research

Databank Stock Index (DSI) was used to represent the Ghana stock market. The Treasury bill rate (as a measure of interest rates), the consumer price index (as a measure of inflation), and the exchange rate were used as the macroeconomic variables. The data set covers nineteen year period from 1991.4 to 2010.8 on monthly basis. The more frequent the data the more accurate results can be obtained from model and tests. This was the motivation for taking monthly data. All data are secondary data that were extracted from IMF-World Bank World Development Indictors, September 2010 online edition. The analysis was done using E-views, 2006 version. Table 1 presents a brief description of the variables and their source.

Table 1. Description and source of data

Variable	Concept	Description	Source
LDSI	Log of Stock Index	Databank Stock Index	Databank
LCPI	Log of inflation	Consumer Price Index	IFS statistics
LXR	Log of exchange rate	Principal Rate (National Currency per USD)	IFS statistics
LTB	Log of Interest rate	91-day Treasury bill Rate	IFS statistics

Model Specification

The strategy for modeling the study is fashioned out in a way such that all variables entering are treated as endogenous. In order to fully address our research questions, proposed generic equations were estimated as follows:

$$\Delta Y_t = f(\Gamma(\Gamma(L)_{t-i}, U, \Delta Z_t, \beta_i) \quad (1)$$

Where Y_t is the vector of observed dependant variables, Y_{t-i} represent lagged values of Y ,Γ(*L*) is a matrix of parameters Y_{t-i} , U represent vector of unobserved variable, Z_t is a vector of stationary endogenous independent variables, β_i is a matrix of parameters of the endogenous variables. The dependant variable is the Databank Stock Index (DSI) in our regression analysis. The independent variables are the macroeconomic factors.

Method of Analysis and Interpretation

In this study, VAR technique was employed based on cointegration and error correction model to study the long run relationship between macroeconomic factors and stock prices. The study specifically uses Johansen (1991, 1995) maximum likelihood procedure of estimating cointegration vectors. Generalized impulse function (IRF) and forecast error variance decomposition (FEVD) are used to detect the effect of shocks in the macroeconomic factors on complete time path of stock prices and vice versa.

The first requirement of estimating cointegrating vector is a test for stationarity; the order of integration of the variables is required. For this purpose, Augmented Dickey-Fuller (ADF) and Phillips-Perron tests for unit roots are employed with Schwartz Bayesian Criterion (SBC) and Akaike Information Criterion (AIC) as a leading indicator for VAR lag selection. For non-cointegrating variable, we examine how the shock in the macroeconomic factors perpetuates itself into the stock prices through IRF and FEVD from first difference VAR.

3.2.1. Vector Autoregressive (VAR) model

The VAR is the expanded form of Autoregressive (AR) model and was popularized in econometrics by Granger and Newbold (1974). In general, a kth order VAR for a 2x1 vector of jointly determined (endogenous) variables X_t is written as:

$$X_t = \varphi + \sum_{i=1}^{k} \Pi_i X_{t-i} + \varepsilon_t \qquad (2)$$

Where the residual vector ε_t is interpreted innovation (shock) in X that is predicted from past values of variables in the system. Having in mind that most of financial time series are non- stationary at level we write (7) in first difference form;

$$\Delta X_t = \varphi + \sum_{i=1}^{k} \Pi_i \Delta X_{t-i} + \varepsilon_t \qquad (3)$$

The VAR system gives very little information about the dynamic interaction among the series, we therefore represent it in moving average representation (MAR) form which present equivalent information contained in the original estimation and allow s time path of the various shocks to be traced (Granger and Newbold, 1974). By polynomial lag division, MAR is derived and represent in the form:

$$\Delta X_t = \Pi^{-1}(BB)_t = \Psi(B)\varepsilon_t = \varepsilon_t + \sum_{i}^{\infty} \Psi_i \varepsilon_{t-i} \qquad (4)$$

Where $\Psi_i = \sum_{j=1}^{i} \Pi_j \Psi_{i-j}$ and $\Psi_0 = I_n$

The advantage of using this model is that it estimates the dependence among the variables identified, and also allows shocking a specific variable and analyzing how shocks carry on themselves through impulse responses.

3.2.2. Johansen Multivariate Cointegration Test

The multivariate cointegration approach is based on error correction representation of the p order Vector Autoregressive model with Gaussian error:

$$\Delta X_t = \varphi + \sum_{i=1}^{p-1} \Gamma_i \Delta X_{t-1} + \Pi X_{t-p} + \varepsilon_t$$

(5)

Where Δ is the first difference operator, $\Gamma_i = -(I - A_1 \dots - A_i)$ is coefficient matrix representing short-run dynamics, and Π defined by $\Pi = -(I - A_1 \dots - A_i)$ is $n \times n$ matrix , where I is an identity matrix, whose rank determines the number of cointegrating vectors. If rank (Π) =r, then X_t has r cointegrating relation or n-r common stochastic trends. The extent of long-run relationship is determined by the number of cointegrating vectors. Here, there are three possible cases that may arise: If n-r=0 (r=n) (full rank), X_t is stationary [I (0)] and there are no stochastic trends. Cointegration is said not to be defined in such cases. Rank (Π) =0 indicating no stationary long-run relationships among the elements of X_t . Reduced rank (i.e.

Rank ($\prod$) <n) implying presence of at least one common stochastic trend, and error correction representation of X_t such that $\prod$ =αβ', where α and β are n×r matrices. The rows of β matrix give the cointegrating vectors and the columns of matrix α are adjustment factors.

Two different likelihood ratio tests were developed by Johansen for testing the number of cointegration vectors (*r*): the trace test given by:

$$\lambda_{trace}(r) = -T \sum_{i=r+1}^{g} \ln(1-\lambda_i) \quad (6)$$

and

Maximum eigenvalue test statistics given by:

$$\lambda_{max}(r, r+1) = -T\ln(1 - \lambda_{i+1}. \quad (7)$$

The null hypothesis of the trace statistics tests is no cointegration $H_0 : r = 0$ against the alternative of more than 0 cointegration vector $H_1 : r > 0$ whereas the maximum Eigenvalue statistics test the null hypothesis of r cointegrating vectors against the alternative of *r* + 1 cointegrating vectors.

3.2.3. Impulse Response and Variance Decomposition Analysis

The two variables y_t and z_t standard VAR model with two types of reduced form shocks ε_y and ε_z can be represented in Vector Moving Average, $VMA(\infty)$ in terms of ε_{yt} and ε_{zt} in matrix notation of the form:

$$\begin{bmatrix} y_t \\ z_t \end{bmatrix} = \begin{bmatrix} \bar{y} \\ \bar{z} \end{bmatrix} + \sum_{i=0}^{\infty} \begin{bmatrix} \phi_{11}^{(i)} & \phi_{12}^{(i)} \\ \phi_{21}^{(i)} & \phi_{22}^{(i)} \end{bmatrix} \begin{bmatrix} \varepsilon_{y,t-1} \\ \varepsilon_{z,t-1} \end{bmatrix} \quad (8)$$

The coefficients $\phi_{jk}(i)$ can be used to trace the impact of one unit change in ε_{yt} and ε_{zt} on the path of y_t and z_t through time. The coefficient $\phi_{jk}(i)$ is interpreted as change in j^{th} variable due to a unit shock to k^{th} variable at i^{th} period.

The impulse response applies in this study is generalized impulse response function (GIRF), given by:

$$GIRF(n, \varepsilon_{t,} \omega_{t-1}) = E[y_{t+n} / \varepsilon_{j,t,} \omega_{t-1}] - E[y_{t+n} / \omega_{t-1}] \quad (9)$$

Where n is the forecast horizon, ε_{t+i} is a random shock, y_t is a random vector, and ω_{t-1} is a specific realization of the information set Ω_{t-1}.

Following Pesaran and Smith (1995) by constructing orthogonal sets of innovations that do not depend on the VAR ordering, GIRF was derived from an innovation to the jth variable by applying a variable specific Cholesky factor computed with the variable at the top of the Cholesky ordering. FEVD measures the percentage of variation in each variable that can be explained by its own shock and the shocks to all the variables in the system. Following Enders (1995), we define forecast error variance decomposition (FEVD) by:

$$\frac{\sigma_z^2[a_{12}(0)+a_{12}(1)^2+......+a_{12}(m-1)^2]}{\sigma_y(m)^2} \quad (10)$$

It can be said that as $\sigma_y(m)^2$ increases, *m* period increases. Additionally, the variance can be split into two series: y_t and z_t series. Therefore, e_{yt} and e_{zt} composes the error variance for *y*. Series y_t is independent of series z_t if e_{yt} approaches unity (indicates e_{zt} approaches zero) and therefore we can say that y_t is exogenous with respect to z_t. In contrast, we say that y_t is endogenous relative to z_t if e_{yt} approaches zero (Enders, 1995).

Data Presentation and Analysis

Testing for Unit Root and Stationarity

A necessary but not sufficient condition for cointegration is a test for unit root for examining the stationarity of the variable used in this study. Stationarity is important for standard econometric theory. For the purpose of this study the Augmented Dickey-Fuller (ADF) and Phillips-Perron tests for unit roots are employed. The results of these tests can be seen in Tables 2 and 3.

Table 2. Augmented Dickey -Fuller Unit Root Test (1991.4 -2010.8)

Variable	Levels	First Difference	Order of Integration
	Intercept	Intercept	
CPI	-1.6337 [0.4637]	-6.9919 [0.0000]	I(1)
DSI	-1.1996 [0.6750]	-10.0281 [0.0000]	I(1)
TB	-1.4771 [0.5436]	-8.7386 [0.0000]	I(1)
XR	-2.5869 [0.0971]	-7.1821 [0.0000]	I(1)

Table 3. Philip-Perron Unit Root Test (1991.4 -2010.8)

Variable	Levels	First Difference	Order of Integration
	Intercept	Intercept	
CPI	-1.9597	-7.0561	I(1)

	[0.3046]	[0.0000]	
DSI	-1.0228	-10.1240	I(1)
	[0.7454]	[0.0000]	
TB	-1.5133	-9.1345	I(1)
	[0.5253]	[0.0000]	
XR	-2.2250	-11.0387	I(1)
	[0.1980]	[0.0000]	

Augmented Dickey-Fuller (ADF) test and Philip-Perron (PP) test were applied to all the variables in levels and in first difference and presented in Tables 2 and 3 respectively. The results indicate that all the data were non-stationary at levels but become stationary after first differencing, which provided a necessary, but not sufficient rationale for estimating cointegration and error correction model. Knowing this leads to the testing of Long Run relationship between the macroeconomic Variables and Stock Prices.

Long Run Relationship - Lag Length Selection

This step involves estimating the model and determining the rank, r to find the number of cointegrating relations in our model. The model lag length selection was determined by both Schwarz (SIC) and Akaike (AIC) Information Criterion using 8 lags in the general VAR model. The aim is to choose the number of parameters which minimizes the value of the information criteria. That lag length selection determines which year selection would have significance on the current results. The SIC has the tendency to underestimate the lag order, while adding more lags increases the penalty for the loss of degrees of freedom. To make sure that there is no remaining autocorrelation in the VAR model, AIC is selected as the leading indicator. The model lag length reported in Table 4 indicates appropriate lag length as 2.

Table 4. VAR Lag Order selection Criteria

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-426.8797	NA	0.000515	3.779647	3.839811	3.803921
1	1778.885	4314.785	2.34e-12	-15.42882	-15.12800	-15.30744
2	1897.928	228.6871	9.48e-13*	-16.33270*	-15.79122*	-16.11423*
3	1911.054	24.75670	9.73e-13	-16.30750	-15.52536	-15.99193
4	1926.044	27.74401	9.82e-13	-16.29863	-15.27585	-15.88597
5	1945.223	34.82392*	9.56e-13	-16.32651	-15.06307	-15.81675
6	1955.293	17.93193	1.01e-12	-16.27450	-14.77040	-15.66764
7	1966.583	19.70795	1.05e-12	-16.23318	-14.48843	-15.52923
8	1980.636	24.03786	1.07e-12	-16.21610	-14.23069	-15.41505

* 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-Quinn information criterion

Cointegration Test (Long Run Test)

A test for the presence of cointegrating long-run relationship among the variables using Johansen's Maximum Likelihood approach among the Databank stock Index (DSI), Treasury Bill (TB), Exchange Rate(XR) and Consumer Price Index(CPI) using lag length of 2 was done. An intercept and no trend are specified for the cointegration test. Both trace test and maximum eigenevalue test are performed on the variance using general VAR lag length of 2, which is selected from AIC and SBIC lag selection test. The results of both tests are reported in Tables 5 and 6 respectively.

Table 5. Unrestricted Cointegration Rank Test (Trace)

Hypothesized No. of CE(s)	**Eigenvalue**	**Trace Statistic**	**0.05 Critical Value**	**Prob.****
None *	0.184852	74.76582	54.07904	0.0003
At most 1	0.053468	27.14396	35.19275	0.2817
At most 2	0.041578	14.34044	20.26184	0.2667
At most 3	0.018899	4.445620	9.164546	0.3498

Trace test indicates 1 cointegrating eqn(s) at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

Table 6. Unrestricted Cointegration Rank Test (Maximum Eigenvalue)

Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen Statistic	0.05 Critical Value	Prob.**
None *	0.184852	47.62185	28.58808	0.0001
At most 1	0.053468	12.80352	22.29962	0.5759
At most 2	0.041578	9.894820	15.89210	0.3441
At most 3	0.018899	4.445620	9.164546	0.3498

Max-eigenvalue test indicates 1 cointegrating eqn(s) at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

The trace statistics and the maximum eigenvalue statistic tests suggest one cointegrating vector at 5% significance level. Given evidence in favour of at least one cointegration relation, a test of zero coefficients on each factor in the cointegrating vector is conducted to determine whether the coefficients for all factors in the cointegrating VAR model are significantly different from zero. The tests indicate that the entire variables are significantly different from zero. We therefore reject the null hypothesis and conclude that there exist a long run relationship between stock prices and macroeconomic factors in Ghana. The long-run cointegrating relationship between the macroeconomic factors and stock prices normalized on LDSI is given by:

$$\mathbf{DSI = -1.25TB + 4.92CPI - 3.4536XR - C}$$
$$\mathbf{[-2.437] \quad [-3.6960] \quad [-2.7610]}$$

The coefficients of Interest Rate (TB) and Exchange Rate (XR) are negatively signed. Inflation (CPI) on the other hand has a positive sign.

The Short Run Relationship (Error Correction Model)

Given the evidence in favour of at least one cointegrating vector, the Vector Error correction model (VECM) was estimated to examine the short run relationship between the market index and macroeconomic variables. The result of the VECM estimation is reported in Table 7.

Table 7. Error Correction Model

	D(LNDSI)	D(LNTB)	D(LNCPI)	D(LNXR)
CointEq1	-0.001084	0.000124	-0.000367	-0.000337
	(0.00047)	(0.00040)	(9.7E-05)	(0.00020)
	[-2.29809]	[0.30829]	[-3.76868]	[-1.72117]
% Corrected per month	0.11	0.01	0.03	0.03
Time taken to revert to long run relationship in the absence of changes in independent variables				
Months	909.09	10000	3333.33	3333.33

Table 7 shows vector error correction model for DSI with significant error correction term in the Databank stock index equation, showing explicit information on the short-run dynamic interactions among those variables. The sign and magnitude of these error correction parameters give information about the short-run mechanics of the process. They indicate the direction and speed of adjustment towards the long-run equilibrium course. A quick look at Table 7 shows that, the adjustment coefficients are negative and statistically significant in the entire models irrespective of which variable is dependent variable in the model.

The negative sign indicates that with absence of any change in the independent variables, deviation from the long run relation is offset by increase in the dependent variable. For instance with the absence of changes in TB, CPI and XR, deviation of the model from long run relationship is offset by about 0.11 percent increase in DSI. This means deviation from long run equilibrium relationship takes 909 months from Table 6 for the DSI to revert it in the absence of changes in other variables.

Effect of Shock on Macroeconomic Factors to Stock Prices (Impulse Response)

In this section impulse response functions were investigated for DSI in order to see the effect of macroeconomic factors on the DSI in terms of reaction over time. Figure 1 shows the generalized impulse response functions which trace the effects of a shock to one endogenous variable on to the other variables in the system. It should be noted that a shock to one variable does affect itself and other endogenous variables in the system due to the dynamic lag structure.

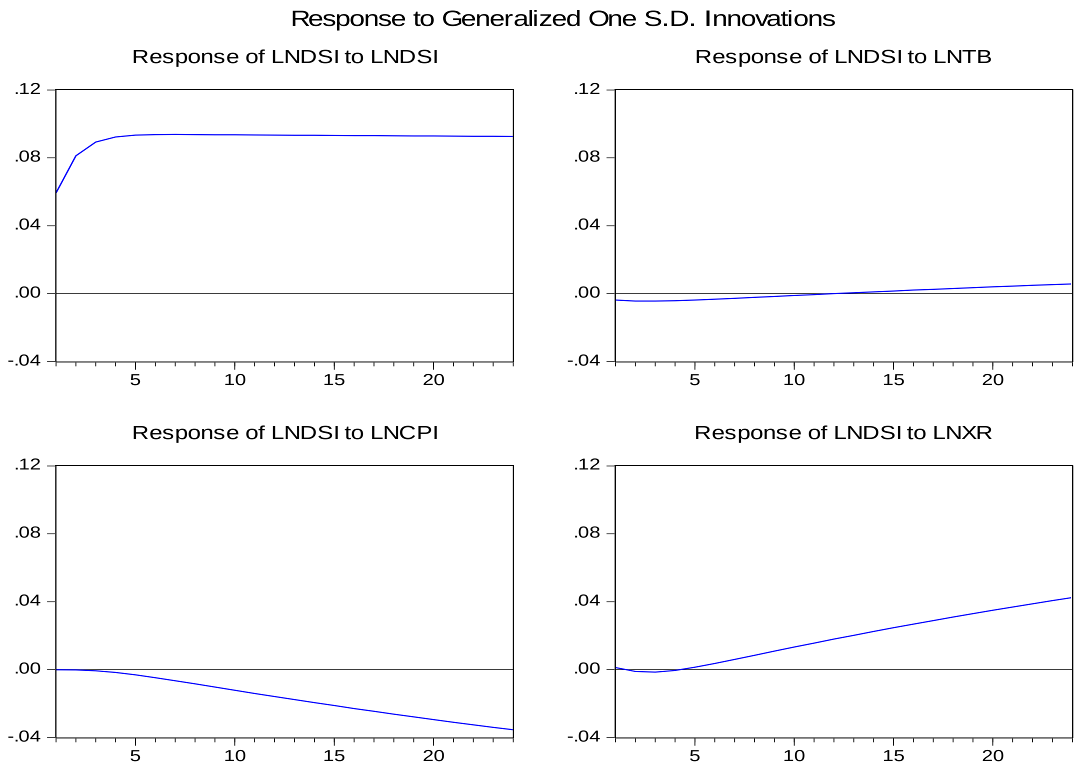

Figure 1. Impulse Response

The figure above shows that DSI index respond positively to innovations in its own lags. However, it changes in steady response after some periods. Economical explanation to this evidence can be that when the Cedi (national currency in Ghana) deflates the exports are motivated and the Ghana industry which is mainly mining and agriculture export is also motivated, consequently the expectations of future cash flows of such companies increase which in turn push up the share prices.

The story with CPI is different. There was a negative response at first periods to CPI. This is probably reasoned by the high cash flows related with price increases. Inflation is the prediction of lower real cash flows that pushes down the share prices.

Shocks to LNXR instantaneously affect the DSI positively from the figure. This is attributed to the fact that since most companies import goods with the major foreign currencies, an increase in exchange rate instantly results in an increase in share prices in order to maintain share prices. *The impact of Interest Rate on DSI is almost negligible.*

Variance Decomposition

Variance decomposition or forecast error variance decomposition indicates the amount of information each variable contributes to the other variables in a vector autoregression (VAR) models. Variance decomposition determines how much of the forecast error variance of each of the variable can be explained by endogenous shocks to the other variables. That is in determining the price of Stocks which of the macroeconomic factors is considered greatly before pricing.

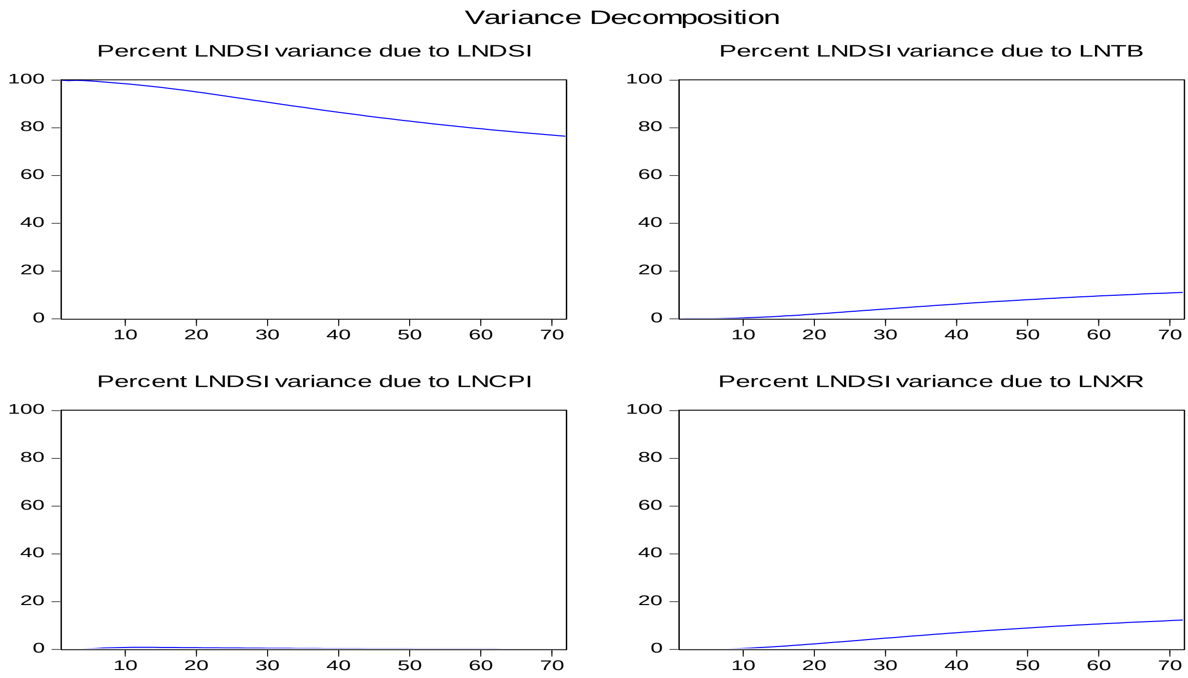

Figure 2. Variance Decomposition

The plot from Figure 2 above suggests that DSI support largely on its own previous price. This is an indication that in determining the current stock prices, the previous price is the major determining factor to be considered. Negligible amount of variances in forecasted errors of DSI can be explained by CPI from the graph in Figure 2. The relatively influential variables are considered to be XR and TB, which are not themselves significant to explain stock prices within given case.

Summary of Findings and Recommendations

The main findings are summarized as follows: share prices cannot be predicted from past macroeconomic variables; there is a long run relationship between macroeconomic factors and Stock Pricing; the impulse results from the analysis suggest that Shocks to XR instantaneously affect the DSI positively. For CPI and TB, impact of the shock is negligible; and the Variance results from the analysis also suggest that DSI support largely on its own previous price

Based on the empirical findings of the study, the following recommendations are offered to policy makers, stakeholders and management of companies in Ghana: For a better stock market performance, policy makers should put in place measures that will ensure stable macroeconomic environment, since any disturbances in the macroeconomic environment may affect the stock market's activities. So to attract investors means that we should have a stable macroeconomic environment; It is also recommended that investors should take into consideration the nature of volatility in the macroeconomic variables in the economy to make an informed decision as to where to direct their investments. For example, whenever the local currency depreciates, it is a signal that the stock market returns is likely to depreciate, especially for an import dominated economy. But this argument is based on an improvement in the international competitiveness of the local firms; and Good regulatory framework should be designed to make it attractive for more companies to be listed on the stock market.

Conclusions

This study empirically examines the relationship between macroeconomic factors and stock prices in Ghana. Databank Stock Index (DSI) was used to represent the Ghana stock market. The Treasury bill rate (as a measure of interest rates), the consumer price index (as a measure of inflation), and the exchange rate were used as the macroeconomic variables. The data set covers nineteen year period from 1991.4 to 2010.8 on monthly basis. Johansen's multivariate cointegration test was used to examine the long run relationship between share prices and the macroeconomic variables. Short run dynamics were traced using impulse response function and forecast error variance decomposition analysis. Findings of this study may help stakeholders to recognize the link between macroeconomic factors and Stock Prices and choosing appropriate measures to evaluate and analyze the companies' performance. The findings from this study suggest there are both long and short run relationship between the macroeconomic variables and stock prices. Also the impulse results from the analysis also suggest that Shocks to Exchange Rate instantaneously affect the DSI positively. For Inflation and TB, impact of the shock is negligible. Finally, the Variance results from the analysis also suggest that DSI support largely on its own previous price. Negligible amount of variances in forecasted errors of DSI can be explained by Inflation. The relatively influential variables are considered to be Exchange Rate and Interest Rate.

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