Macroeconomic Factors and Stock Market Movement: Evidence from Ghana

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October 2008

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Abstract

This study examines the effects of macroeconomic variables on the movement stock prices in Ghana. We analyze both long-run and short-run dynamic relationships between the stock market index and macroeconomic variables including inward foreign direct investments, Treasury bill rate, consumer price index, and exchange rate from 1991:1 to 2006:4 using Johansen's multivariate cointegration test and innovation accounting techniques. We established that there is cointegration between macroeconomic variables and stock prices in Ghana indicating long-run relationship. Further tests indicate that, in the short-run, inflation and exchange rates matter for share price movements in Ghana, however, interest rate and inflation prove very significant in the long-run.

1. Introduction

The relationship between macroeconomic factors and stock market development has dominated in the academic and practitioners' literature over the past decades. Some fundamental macroeconomic variables such as exchange rate, interest rate, industrial production and inflation have been argued to be the determinants of stock prices. It is believed that government financial policies and macroeconomic events have large influence on general economic activities including the stock market. This has motivated many researchers to investigate the dynamic relationship between stock 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. They show that industrial production, changes in risk premiums, and changes in the term structure are positively related to the expected stock returns, while both the anticipated and unanticipated inflation rates negatively relate to the expected stock returns. Other researchers who studied the relationship between stock returns and macroeconomic variables in developed countries such as Japan, US, Australia, Canada and European countries (see, *inter alia*, Cheung and Ng, 1998; McMillan and Humpe, 1997; Mukherjee and Naka, 1995; Kwon and Shin, 1999; and Maysami and Koh, 2000) employ cointegration.

In spite of the increasing migration of capital from developed to emerging economies and its associated high returns (see Ushad *et al*, 2008; Osinubi, 2004), emerging stock markets have not been well explored. In 2006 for example, foreign equity accounted for 75.3% of the equity finance recorded in Ghana compared to 29.9% in 2001 according to the December, 2007 Quarterly Report of the Ghana Investment Promotion

Centre (GIPC).

Over the past years, macroeconomic activity in Ghana has seen a tremendous improvement as the Bank of Ghana continues its mandate of maintaining price stability, a strong and stable exchange rate, a low inflation rate, and low interest rates. The interest rates dropped from 40.95% by the end of 2001 to 9.95% in 2006, the cedi/dollar depreciation decreased from 104.4% in 1999 to 2.0% in 2006 as well as inflation rate from 59.56% in 1995 to 32.91% in 2001 and then to 10.96% in 2006.

In spite of the increase in overall government fiscal deficit from 8.0% of the GDP in 2002 to 12.4% of GDP in 2006, real GDP growth increased from 5.9% in 2005 to 6.2% in 2006. At the same time, the net foreign direct investment increased from 1.6% of GDP in 2001 to 3.37% of GDP in 2006. Comparatively, this performance was only surpassed by the 4.28% record in 1994 when Ashanti Goldfield Company Limited (AGC) now AngloGold Ashanti (AGA) was listed on GSE. The AGC effect saw the market capitalization accounting for 34.37% of GDP in 1994 as compared to 1.98% in 1993.

The growing interest in the performance of emerging markets has been attributed to the conduct of sound macroeconomic policies, privatisation, stock market reform and financial liberalization in recent years.

The objective of the present study is to contribute to the existing literature by examining the effects of macroeconomic variables on the movement of Ghana stock market proxy by Databank Stock Index (DSI). Our results indicate that stock prices in Ghana is consistently influenced by changes in macroeconomic variables consistent with the findings of studies in developed and emerging markets like the US, Japan, UK, Malaysia, New Zealand and Korea.

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The next section is a review of the relevant literature on the relationship between macroeconmic variables and stock market movement. Section 4 presents a brief history of the Ghana Stock Exchange (GSE). In Section 5 we describe the data and the cointegration methodology employed in the study. Section 6 covers the empirical results and the last section concludes.

2. Stock Returns and Macroeconomic Variables: Literature Review

Probably the relationship between stock prices and macroeconomic variables is well illustrated by the Dividend Discount Model (DDM) proposed by Miller and Modigliani (1961) than any other theoretical stock valuation model. According to the model the current price of an equity share equals the present value of all future cash flows to the share. Thus, the determinants of share prices are the required rate of return and expected cash flows (see Oyama, 1997; Gan *et al* 2006; Humpe and Mcmillan, 2007; Leibowitz, Sorensen, Arnott and Hansen, 1989; and Tessaromatis, 2003) suggesting that economic factors that influence the expected future cash flow and required rate of return affect the share price. Fama and Gibbon (1982) find that expected real returns on bills and expected inflation rates are inversely related. This is due to the positive correlation between expected real returns on financial assets and real activity.

Using the multi-factor APT framework, Hamao (1988) shows that inflation significantly influenced Japanese stock returns. An investigation of the relationships between stock prices and real activity, inflation, and money conducted by Fama in 1981 shows a strong positive correlation between common stock returns and real variables. Kaneko and Lee (1995) and Lee (1992) find similar results. By examining the

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relationship between inflation and stock prices in 16 industrialized countries, Rapach (2002) agues that increase in inflation does not result in persistent depreciation of share real value.

The exchange rate which indicates the movement of currency affects stock prices in a way similar to the inflation variable. Depreciation of the local currency makes import expensive compared to export, leading to increased production cost of import companies. Since all the cost cannot be passed on to the consumer due to the competitiveness of the market, corporate earnings, which are a determinant of stock prices according to the DDM, fall. Although Solnik (1987) proved that exchange rate is a non-significant factor in explaining development of stock prices, Jorion (1990) finds some relationship between stock returns of US multinational companies and the effective US dollar exchange rate for the period 1971-87. Aggarwal (1981) also finds a positive relationship between revaluation of the US dollar and stock prices. Mukherjee and Naka (1995) also find that exchange rate positively relates to stock prices in Japan and Indonesia. On the contrary, Soenen and Hennigar (1988) reported that US dollar effective exchange rate negatively affect US stock market index during 1980-86.

Adler and Dumas (1984) argue that even firms whose entire operations are domestic may be affected by exchange rates, if their input and output prices are influenced by currency movements. Other studies have argued that depreciation of the local currency increases export, and hence stock prices. Lueherman (1991) finds that although exchange rate movements affect stock prices depreciation of the local currency does not constitute competitive advantage for home companies as argued.

According to the DDM, required rate of return and the share price are inversely

related. Gan *et al* (2006) ague that opportunity costs of holding cash rises with increase in interest rate, and the trade-off to holding other interest bearing securities would lead to a decrease in share price. Theoretically, French *et al.* (1987) find negative relationship between stock returns and both the long term and short term interest rates. Furthermore, positive correlation among previous month's US stock price, money supply, federal debt, tax-exempt government debt, long-term unemployment, the broad money supply and the federal were documented by Bulmash and Trivoli (1991). On the other hand, the same study established a negative relationship between stock prices and the Treasury bill rate.

As claimed by Alagidede (2008), the risk perceptions remains an obstacle to increased access to capital markets in Africa, and have set apart stock markets from other regions due to their small size and highly illiquid nature. These negative effects that marred emerging stock market are likely to reduce if open to foreign investors. For example, large investment inflows to South East Europe (SEE) supported the economic growth rates and pushed up stock prices at the major equity markets in the region (SEE Investment Guide, 2006). Oyama (1997) pointed out that the risk premium for Venezuela stock market, Jordan and Pakistan declined sharply between 1990 and 1992 following liberalization of stock investment by foreigners in 1990, and increase of the amount of home currency and foreign exchange that could be taken abroad by residents and non-residents.

3. Ghana Stock Exchange

The idea of establishing a stock exchange in Ghana, which led to the promulgation of the Stock Market Act of 1971 to lay the foundation for the establishment of the Accra Stock

Market Limited (ASML) in the same year, dates back to 1968. Unfavourable macroeconomic environment, political instability and lack of government support undermined the take off of the market.

Under the surveillance of the International Monetary Fund and the World Bank, Ghana underwent structural reforms in 1983 to deal with distortions in the economy together with other financial reforms. This led to the deregulation of interest rates, removal of credit controls, floating of exchange rates and many others. After the financial liberalization and the divestiture of a host of state-owned enterprise the need for stock market in Ghana became unavoidable.

The Ghana Stock Exchange was incorporated in July 1989 as a private company under the Ghana companies' code 1963 (Act 179). The exchange was given recognition as an authorized stock exchange under the Stock Exchange Act of 1971. Trading on the floor of the exchange commenced on November 12, 1990. In spite of the early set backs, two stock brokerage firms-the National Trust Holding Company Ltd (NTHC) and National Stockbrokers Ltd now Merban Stockbrokers-did over-the-counter (OTC) trading in shares of some foreign-owned companies prior to the establishment in 1990. However, the status of the company was changed to a public company under the Company's Code in April 1994. With regards to the number of listed companies, it increased to 13 in 1991, 19 in 1995 and currently stands at 34 (GSE, June 2007). The increase in the number of listings has also reflected on market capitalization. The GSE capital appreciated by 116% in 1993 and gained 124.3% in its index level in 1994 (GSE, March 1995). As a result, the Ghana stock market was voted the sixth market in 1993 as well as the best performing emerging market in 1994. Surprisingly, however, the market performed disappointingly

between 1995 and 2000 when interest rate and inflation were both soaring. This abysmally performance was partly attributed to the high inflation and interest rates at that time. At the end of 2004, market capitalization stood at US$2,644 million while annual turnover ratio just remained at about 3.2% in 2004, from an all-time high of 6.5% in 1998. As of October 2006 the market capitalization of the GSE stood at about US$11,500 million.

Currently, the main indices are the GSE All-Share Index and the Databank Stock Index (DSI). Three new indices comprising the SAS Index (SAS-I), SAS Manufacturing Index (SAS-MI) and the SAS Financial Index (SAS-FI) have also been published by the Strategic African Securities Limited. Daily trading of the exchange take place on the floor of the exchange, except Ashanti Gold shares which can be traded both through the GSE and over-the-counter after GSE trading hours. Those traded over-the-counter are subsequently reported at the next trading session.

4.0 Data and Methodology

4.1 Data Selection Justification and Hypothesis

In this section we justify the selection of the variables used for the analysis in this study.

Databank Stock Index: This variable which serves as the dependent variable in our analysis captures the performance of the market and it is the dependent variable in our regression analysis. It is the first ever index computed by Databank Group. Its selection is motivated by data availability.

Inflation: High rates of inflation increase the cost of living and a shift of resources from investments to consumption. This leads to a fall in the demand for market instruments

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and subsequently leads to a reduction in the volume of stock traded. Also the monetary policy responds to the increase in the rate of inflation with economic tightening policies, which in turn increases the nominal risk-free rate and hence raises the discount rate in the valuation model. DeFina (1991) argues that nominal contracts that disallow the immediate adjustment of the firm's revenues and costs prevent cash flow to grow at the same rate as inflation. We therefore expect negative relationship between inflation and stock market.

Exchange rate: Ghana's import sector dominates the export sector; therefore depreciation of the Ghana cedi will lead to an increase in prices of production and thereby reducing cash flows to the import dominated companies. Repatriation of earning will also be relatively unattractive to foreign portfolio investors who play a major role on the GSE. We hypothesize negative impact on the performance of DSI.

Interest rate: The relationship between interest rates and stock prices is well established. An increase in interest rate will increase the opportunity cost of holding money and investors substitute holding interest bearing securities for share hence falling stock prices. The Treasury bill rate is used as a measure of interest rate in this study because investing in Treasury bill is seen as opportunity cost for holding shares. High-treasury bill rates encourage investors to purchase more government instruments. Treasury bills thus tend to compete with stocks and bonds for the resources of investors. The expected relationship between stock prices and Treasury bill rates is thus negative.

Net Foreign Direct Investment: Foreign capital inflows can make significant contributions to the host country's economic growth and development by lessening and cushioning shocks resulting from low domestic saving and investment. Increase in net

FDI therefore has positive effect on the liquidity and size of the GSE. Foreign equity finance account for over 70% of total equity investments in 2006. It is believed that the increase in market capitalization of GSE from 1.98% of GDP in 1993 to 34.37% of GDP in 1994 followed the exchange to foreigners and non-resident Ghanaian in 1993. Over the same period, an increase in net FDI from 2.10% of GDP to 4.28% of GDP was recorded. We therefore hypothesize a positive relationship between Net FDI and the exchange.

As mentioned earlier, when AGC was first listed on GSE in 1994 it accounted for about 90% of the total market capitalization. This changed the face of the exchange and attracted many foreign investors; therefore it is reasonable to discuss its expected influence on fundamental market attributes such as liquidity, volatility and turnover. Following this, we include a dummy to account for the structural effect of the listing, and assign 0 and 1 respectively to the period before and after the listing of AGC on the exchange.

4.2 Data Sources

We make use of quarterly data for DSI, CPI, EX, TB and FDI from 1991:1 to 2006:4 for the study. The data on DSI were obtained from Databank Group Research. All the other data except Inward FDI were extracted from the June 2008 edition of the International Monetary Fund's International Financial Statistics database. The Inward FDI data were extracted from the United Nations Conference on Trade and Development (UNCTAD). The FDI data were obtained in annual form and interpolated by the method proposed by Goldstein and Khan (1976) to quarterly. A brief description of the variables is presented in Table 1 below.

Table 1: Description and source of data

Variable	Concept	Description	Units	Source
LDSI	Log of Databank Stock Index	Databank Stock Index	30 Nov. 1990= 79.83	Databank Group Research and Information Limited
LFDI	Log of net Foreign Direct Investment Inflow	Volume of foreign capital invested in the economy	Millions of US Dollar	UNCTAD Database
LXR	Log of exchange rate (as a measure of macroeconomic stability)	Principal rate (National Currency per USD)	Index number	IFS Database
LCPI	Log of consumer price index (as a measure of inflation)	Consumer Price Index	Percentage per annum (200=100)	IFS Database
LTB	Log of Interest rate (as a measure of interest rates)	91-day Treasury bill rate	Percentage per annum	IFS Database

4.3 Methodology

The principal method employed to analyse the time series behaviour of the data involves cointegration and the estimation of a Vector Error Correction Model (VECM). Specifically, we employ the Johansen maximum likelihood procedure. This technique has been well popularized for testing the long-run relationships among variables so we briefly explain the methodological aspects directly relevant to this study and refer interested readers to the relevant literature[1] for detailed discussion and advantages of this method.

In estimating the cointegration we first consider whether each of the series is integrated of the same order. To do this we consider the standard Augmented Dickey-Fuller test and Phillips-Perrons unit root tests. The number of cointegration ranks (r) is tested with the maximum eigenvalue and trace test. The maximum eigenvalue statistics test the null

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[1] See, for example, Johansen (1991, 1995), Johansen and Juselius (1990) and Cheung and Ng (1998).

hypothesis that there are r cointegrating vectors against the alternative of r+1 cointegrating vectors. The trace statistics tests the null hypothesis of no cointegrating vector against the alternative of at least one cointegrating vector. The asymptotic critical values are given in Johansen (1991) and MacKinnon-Haug-Michelis (1999).

From the above theoretical, intuitive, and empirical discussion, we postulate the relationship between stock prices and selected macroeconomic variables as described above as follows:

$$LDSI_t = \beta_0 + \beta_1 LCPI_t + \beta_2 LXR_t + \beta_3 LTB_t + \beta_4 LFDI_t + \xi_t \tag{1}$$

β_0 is a constant, β_1,.. , β_4 are the sensitivity of each of the macroeconomic variables to stock prices and ξ_t is a stationary error correction term.

5.0 Empirical Analysis

5.1 Descriptive Statistics

Table 2 presents a summary of descriptive statistics of the variable. Sample mean, standard deviation, skewness and kurtosis, and the Jacque-Bera statistic and p-value have been reported. The high standard deviation of LDSI with respect to the mean is an indication of high volatility in the stock market. From the p-values, the null hypothesis that LCPI, LTB, LXR and LFDI are normally distributed at 10% level of significance can not be rejected.
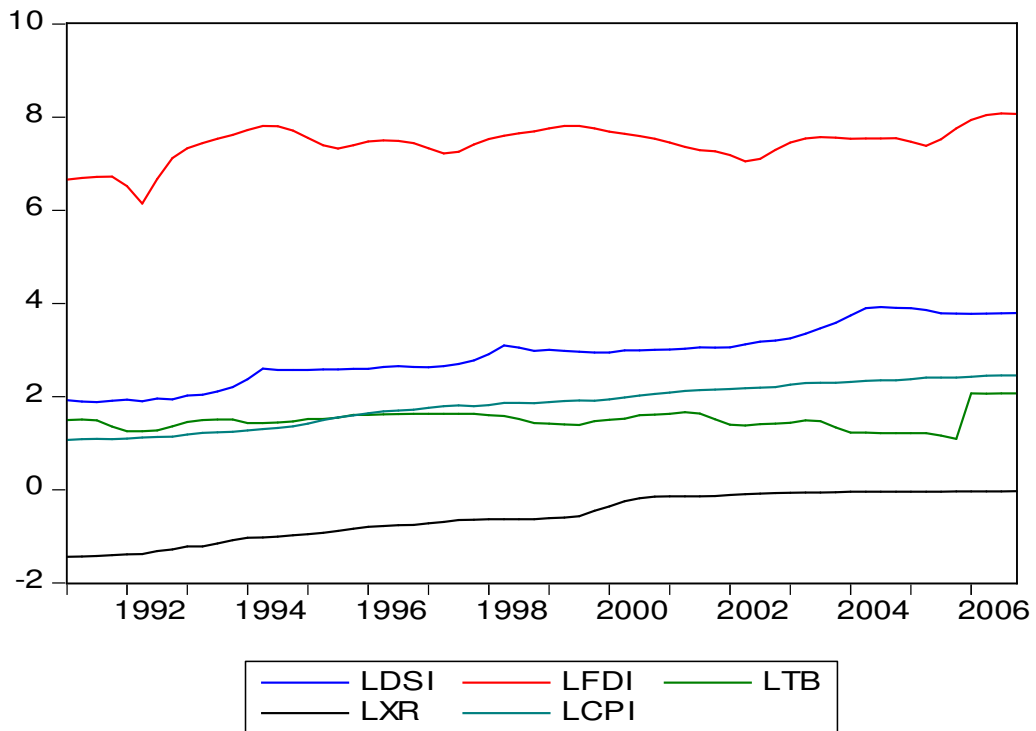
Figure 1: Logarithms of Variables

Table 2: Summary Statistics of variables

	LDSI	LFDI	LCPI	LXR	LTB
Mean	2.898272	7.431932	1.828133	-1.316873	1.492419
Std. Dev.	0.613817	0.374028	0.453579	1.116258	0.203617
Skewness	0.011984	-1.147513	-0.302435	-0.351034	0.960284
Kurtosis	2.154169	4.691274	1.778526	1.750799	4.855756
Jarque-Bera	1.909346	21.67348	4.954311	5.475736	19.01977
Probability	0.384938	0.000020	0.083982	0.064708	0.000074
Sum	185.4894	475.6437	117.0005	-84.27985	95.51480
Sum Sq. Dev.	23.73658	8.813512	12.96126	78.49999	2.611972

5.2 Unit Root Test

Table 3 shows unit root test to determine the order of integration and stationarity of the variables. Augmented Dickey-Fuller (ADF) and Phillips-Perron tests were used. Both results indicate that all the data are non-stationary at levels but first differences are

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stationary at 5% significant level. Consistent with Figure 1, we conclude that all the variables are I (1).

Table 3: ADF and PP Unit Root Test

Variables	ADF Unit Root Test		PP Unit Root Test	
	Levels	*First Difference*	*Levels*	*First Difference*
LDSI	-1.124073	-4.604914**	-0.755972	-4.604914**
LXR	-1.941035	-3.618842**	-1.867166	-3.713154**
LFDI	-2.548019	-4.099517**	-1.988769	-4.259959**
LCPI	-1.877965	-2.981643**	-1.835472	-3.277407**
LTB	-1.943722	-7.682588**	-2.220418	-7.682616**

5.3 Cointegration Test and Vector Error Correction Model

The next step involves estimating the model and determining the rank, r to find the number of cointegrating relations in our model. The optimal lag length was determined by both Schwarz (SIC) and Akaike Information Criterion (AIC) using 5 maximum lags in the general VAR model. The aim is to choose the number of parameters, which minimizes the value of the information criteria. 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 of 4 for SIC.

We proceed to test for the presence of long-run relationship among the variables by using Johansen's Maximum Likelihood approach. An intercept and no trend are specified for the cointegration test. The trace statistic suggests four cointegrating vectors, and the maximum eigenvalue statistic indicates one cointegrating vector at the 5% significance level. Given evidence in favour of at least one cointegration relation, a test of

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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 likelihood ratio test rejects the null hypothesis of a zero restriction for all the five macroeconomic factors at the 95% level, except for AG ($\chi^2(1)$ = 3.443, with probability value 0.064). This suggests that AG may not be forcing the system in the long-run at 95% level but there may be still be significant in the short run dynamics. Further tests to confirm the weak exogeneity of AG gives ($\chi^2(1)$ =0.0549, with probability value 0.8147) at the 95% level, indicating that AG is weakly exogenous (i.e. not error correcting).

With the AG included as an exogenous variable, both trace test and the maximum eigenvalue test suggests two cointegrating vectors at the 5% significance level (see Table 4). This indicates co-movement between stock market index and macroeconomic variables in a long-run equilibrium path. The cointegration graph (see Figure 2 below) confirms that there are more than "one" mean reversion effect in the cointegration vector over the period and signifies a good error correction behaviour in the cointegration system. Consequently, the estimated long-run relationship via cointegration analysis and the error correction coefficients are appropriate. The long-run cointegrating relation between the macroeconomic factors and stock prices normalised on LDSI is given by:

$$\begin{matrix} Y_t \\ \beta' \end{matrix} = \begin{pmatrix} LDSI_t & LFDI_t & LTB_t & LXR_t & LCPI_t & C \\ 1.000 & -0.4031 & 0.7472 & 0.6873 & -1.9038 & 2.8675 \end{pmatrix} \tag{2}$$

This can be re-parameterized as:

$$LDSI_t = 0.4031\,LFDI_t - 0.7472\,LTB_t - 0.6873\,LXR_t + 1.9038\,LCPI_t - 2.8675 \qquad (3)$$

$$[-7.60271] \qquad\qquad [8.06367] \qquad\qquad [5.01753] \qquad\qquad [-11.3490]$$

Table 4: Multivariate Johansen Cointegration Test

	Lag	$r = 0$	$r \le 1$	$r \le 2$	$r \le 3$	$r \le 4$
λ_{trace}	4	99.68**[69.81]	59.50**[47.85]	23.14[29.79]	10.33[15.49]	3.32 [3.84]
λ_{max}	4	40.17** [33.87]	36.36**[27.58]	12.80[21.13]	7.01 [14.26]	3.32 [3.84]

Note: The null hypothesis for these two tests here is that the data generating processes under consideration are not cointegrated. Critical values in [] for both trace and maximum-eigenvalue statistics at the 5% level are given by MacKinnon-Haugh-Michelis(1999). ** denotes the rejection of the hypothesis at the 1% level

Figure 2: A Plot of Cointegration Vector normalised on LDSI
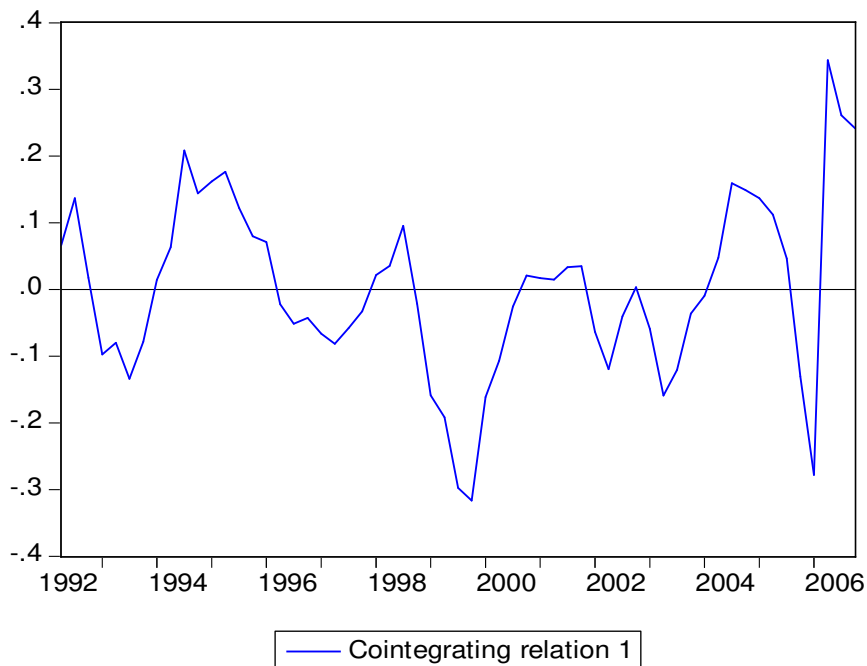
The coefficients of LTB, LXR and LFDI are correctly sign. Contrary to our expectation, LCPI has positive signs. The negative relationship between LTB and LDSI is expected because Treasury bill acts as the rate of return offered by the risk-free asset. The shifting of funds between risky equity and risk-free assets by portfolio managers is thus expected

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in such a situation. When T-bill rate is high, rational investors would tend to invest in less risky assets with high returns. This was the case in Ghana between 1995 and 1999 which affected the performance of the exchange.

With regards to the positive relationship between LFDI and LDSI, we argue that the opening of the market to non-resident Ghanaians and foreigners in June 1993 was a big boost to the development of the market. The exchange control permission given to investors to invest through the exchange without prior approval attracted a number of top-rated foreign institutional buyers.

The positive relation between LCPI and LDSI though not expected may be in support of the Fisher (1930) hypothesis which implies a positive one-to -one relationship between stock returns and inflation. It also implies that investors are compensated for inflationary increase in prices.

The negative relationship between LDSI and LXR suggests that depreciation of the Ghana Cedi (GHS) makes shares unattractive for investors to invest in the Ghana stock market. Also the long-run negative relationship is that the cost of imported goods becomes expensive to producers. As an import dominated economy the depreciation of the GHS may be regarded as a curse to the economy. The Ashanti Goldfield Company dummy (Ag) used in our study has negative and significant impact on stock price in Ghana.

Given the evidence in favour of at least one cointegrating vector, we proceed to estimate the VECM to examine the short-run causal linkages between the variables. The result of the VECM estimation is reported in Table 5.

Table 5: VECM estimation for LDSI

Variable	Coefficient	Std. Error	t-Statistic	Prob.
$\Delta LDSI_{t-1}$	0.729174	0.157590	4.627022***	0.0000
$\Delta LDSI_{t-2}$	0.558718	0.180464	3.096006***	0.0038
$\Delta LDSI_{t-3}$	0.496105	0.184872	2.683511**	0.0109
$\Delta LDSI_{t-4}$	0.324128	0.160000	2.025795*	0.0502
$\Delta LFDI_{t-1}$	-0.196295	0.080999	-2.423434**	0.0205
$\Delta LFDI_{t-2}$	-0.248719	0.092020	-2.702895**	0.0104
$\Delta LFDI_{t-3}$	-0.231987	0.084651	-2.740500***	0.0095
$\Delta LFDI_{t-4}$	-0.112185	0.078916	-1.421566	0.1638
ΔLTB_{t-1}	0.450398	0.112992	3.986099***	0.0003
ΔLTB_{t-2}	0.424169	0.103010	4.117734***	0.0002
ΔLTB_{t-3}	0.329496	0.084872	3.882286***	0.0004
ΔLTB_{t-4}	0.396377	0.177179	2.237159**	0.0316
ΔLXR_{t-1}	-0.876689	0.355169	-2.468369**	0.0185
ΔLXR_{t-2}	0.655371	0.367197	1.784793*	0.0827
ΔLXR_{t-3}	-0.030850	0.380552	-0.081067	0.9358
ΔLXR_{t-4}	-0.826456	0.345708	-2.390616**	0.0222
$\Delta LCPI_{t-1}$	0.231517	0.565233	0.409596	0.6845
$\Delta LCPI_{t-2}$	-1.622915	0.629976	-2.576154**	0.0142
$\Delta LCPI_{t-3}$	1.078012	0.692906	1.555785	0.1285
$\Delta LCPI_{t-4}$	0.185066	0.554621	0.333679	0.7406
AG	-0.121866	0.028345	-4.299323***	0.0001
C	-3.393073	0.774212	-4.382617***	0.0001
ECM(-1)	-0.609677	0.137399	-4.437284***	0.0001

R-squared	0.704394	Prob(F-statistic)	0.000149	
F-statistic	3.899252	Durbin-Watson stat	1.851355	

Table 5 shows the VECM for LDSI with significant error correction term in the DSI equation. The sign and magnitude of the error correction coefficient indicates the direction and speed of adjustment towards the long-run equilibrium path. It should be

negative and significant, which is the case here. The negative sign implies that, in the absence of variation in the independent variables, the model's deviation from the long-run relation is corrected by increase in the dependant variable. Bannerjee *et al.* (1998) holds that a highly significant error correction term is further proof of the existence of a stable long-term relationship. The estimated coefficient of the ECM (−1) is -0.609 [p-value=0.000] suggesting that-in the absence of changes in other variables-deviation of the model from the long-term path is balanced by 60.9 per cent increase in DSI per quarter. This means that deviation from the long run relationship takes less than two quarters to be corrected. The results also show that all the variables significantly explain the variation in the performance of the DSI.

The listing of the AGC on the market has been thought to have caused major transformation of the exchange but our result is contrary to that. The AGC dummy (AG) has negative impact on the performance of DSI. It is an indication of negative effect of AGC high concentration on the market; rendering the market inactive and for that matter illiquid. Lack of liquidity on the exchange would affect ability of the listed firms on the market in raising the needed long-term capital to finance investment and production

The key regression statistics show that R^2 is high implying that overall goodness of fit of the VEC model is satisfactory. The diagnostic test statistics reported in Table 6 indicates that the model passes serial correlation, functional form misspecification, non-normal errors and heteroscedasticity test at the 5%. The cumulative sum (CUSUM) and cumulative sum of squares (CUSUMQ) plots (see Fig. 3) from a recursive estimation of the model also indicate stability in the coefficients over the sample period.

Table 6: VECM Model Diagnostic Tests

Serial Correlation F(2, 34)=0.391996[0.6782]   Functional Form F(2, 34)=2.5492[0.0930]

Heteroskedasticity F(22, 36)=0.51219[0.7571]   Normality $\chi^2(2)$=0.245425[0.884518]

Figure 3: Plots of CUSUM and CUSUM of Squares of Recursive Residuals
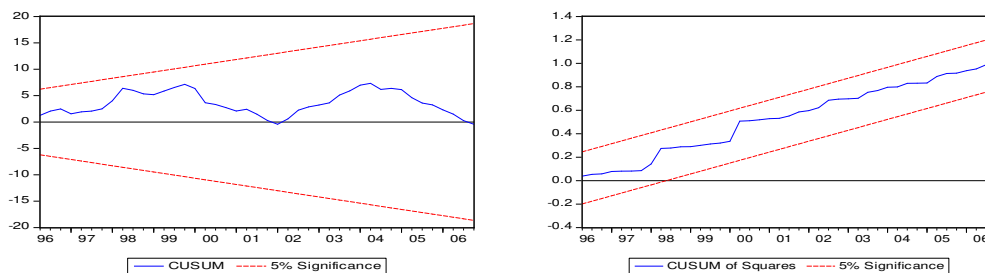
5.4 Innovation Accounting

The cointegration analysis only captures the long-run relationship among the variables. Since it does not provide information on responses of variables to shocks or innovations in other variables, we employ the Impulse Response Function and Forecast Error Variance Decomposition based on the VECM to examine how DSI responds to shocks in the other variables. Figure 4 shows the impulse response functions while the variance decomposition at the 5% significance level is presented in Table 7.

We observe an immediate response of LDSI to innovations in LCPI. The rise in LDSI implies that the market efficiently allocates resources by adjusting to general increase in prices in the long run. The response of LDSI to LXR and LTB are in line with other research findings for both advanced and emerging markets. A shock in LTB leads to a sharp reduction in LDSI after 5 quarters. This explains the strong inverse relation

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between the T-bill and stock market investment in Ghana.

Figure 4 also indicates that LDSI instantly rises after a shock in LFDI, peaks after seven quarters and begins to decline. This supports the claim by Oyama (1997) that increase in foreign investors increase the liquidity of the stock market and reduce the risk premium.

We observe from the variance decomposition in Table 7 that the variations in LDSI are mainly due to its own variations at the end of the first quarter while LFDI and LCPI account for 8.95% and 9.85% respectively. After 4 quarters LXR and LCPI become dominant factors through to 8 quarters explaining a total of 50% in the fourth quarter and about 72% of LDSI variation in 8 quarters. The variation in LDSI is significantly explained by LTB after 12 quarters by accounting for 14%. However, the fraction accounted for by LFDI dropped to less than 5% after 12 quarters. The LCPI and LTB prove to be the most significant factors for stock price movement respectively accounting for 40.7% and 52.5% at the end of 24 quarters. This means that the Ghana equity market responds well to shocks in real economic activities.

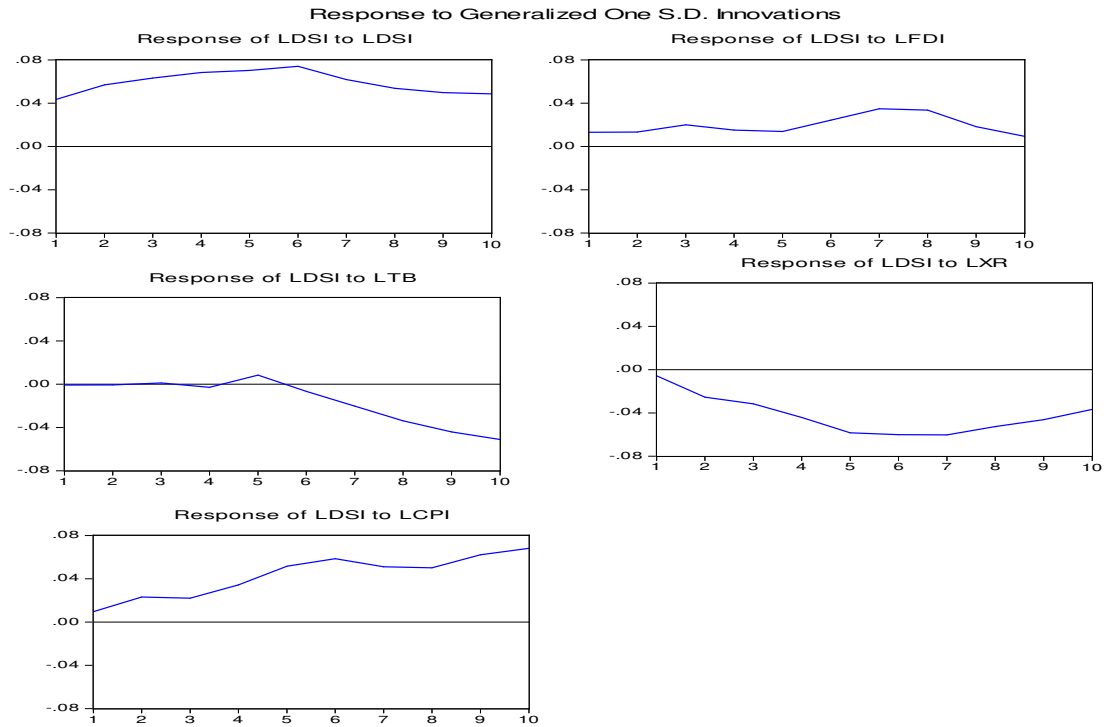**Figure 4: Response of LDSI to a 1 S. D. Shocks in System Variables**

Response to Generalized One S.D. Innovations

Response of LDSI to LDSI	Response of LDSI to LFDI
Response of LDSI to LTB	Response of LDSI to LXR
Response of LDSI to LCPI	

Table 7: Forecast Error Variance Decomposition of LDSI

Period	LDSI	LFDI	LTB	LXR	LCPI
1	77.09627	8.951709	0.392020	3.704633	9.855362
4	43.13519	5.676167	0.251513	26.15218	24.78495
8	16.84772	6.598742	3.816597	34.19638	38.54056
12	10.31674	4.254649	14.96876	25.54465	44.91520
16	6.160229	2.374609	30.86365	14.22490	46.37661
20	3.134374	1.371480	44.51238	7.017151	43.96462
24	1.582157	1.247678	52.52673	3.917016	40.72642
Cholesky Ordering: LFDI LTB LXR LCPI LDSI					

6. Conclusion

In this study we examine the role of macroeconomic variables in stock market movement

for the period 1991:1 to 2006:12. We considered the Databank Stock Index, interest rate,

inflation, net foreign direct investment and exchange rate. We explored the long run

relationship between the variables using Johansen's multivariate cointegration tests. Short-run dynamics were traced by means of impulse response function and forecast error variance decomposition analysis. The cointegration analysis provides evidence in support of a long-run relationship between variables over the time horizon. Contrary to our hypothesis, we find inflation to positively relate to DSI, which implies that- consistent with the finding of Firth (1979), Anari and Kolari (2001), Luintel and Paudyal (2006), and Gultekin (1983)-the stock market partly or fully provides a hedge against inflation.

The FEVD indicates that interest rate and exchange rates explain small proportion of the variation of the share prices in the first quarter compared to inflation rate and net FDI inflow. This means that the elimination of the 10% limit placed on non-resident foreign investors' holdings in securities listed on GSE and 74% limit on holdings of all non-resident foreign investors in any listed security under the Foreign Exchange Act of 2006 (Act 723) is a positive signal to boost investments in the stock market.

Based on the results, we recommend that potential investors pay more attention to inflation and exchange rate dynamics followed by net FDI inflow rather than interest rate. However, in the long run attention should be on interest rate and inflation rates.

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