Time series analysis of interest rates volatility and stock returns in Ghana

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Abstract

The study utilized time series analysis models and employed the Johansen's cointegration procedure and the vector error correction model to examine the short run and long run dynamics of the relationship between interest rates and stock market returns. The results of this study show that contrary to popular evidence from extant research, interest rate changes positively and significantly affect stock market returns in the long run and the deviation from the long run equilibrium is corrected each period following a shock to the stock market in the short run. The positive linkages between interest rate changes and stock market outturns may be explained by the relative strength of banking stocks on the Ghana Stock Exchange. The analysis shows that as the long run equilibrium is approached, the deviations in the short term decrease significantly.

Keywords: Interest rate, stock returns, cointegration, time series analysis, VECM

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Introduction

Knowledge of the interest rate changes and stock market returns is of immense essence to central bankers and managers of the economy, investors, portfolio managers, and corporate managers. The interest rate and stock market outturn linkages are quite central to finance and economic themes including asset pricing, asset allocation, risk management, portfolio management, and monetary policy transmission (Moya-Martinez *et al.*, 2015). Interest rates represent the cost of capital and provide indications regarding the alternative use of capital. As such, the rate of interest is a primary determinant of investors' expected returns on any asset and security of interest. Interest rate is undoubtedly an important consideration in the valuation of most financial and economic assets, including common stocks (Joseph and Vezos, 2006). Indeed, one of the foremost risks to any economic venture is the risk of interest rate changes. In a survey of US firms, Graham and Harvey (2001) report that captains of US firms perceived interest rate risk as the second most important risk factor only behind market risk.

Interest rates changes have potential impacts on financial assets prices and returns to ultimately affect economic decisions. Also, changes in the rate of interest have potential implications for the production process and consequently affecting economic growth. Bernanke and Reinhart (2004) point out that current rates of interest and future low interest rates expectations can have positive effects on asset prices. The impact of interest rates on financial assets becomes profound as interest rates are maintained at low levels by central banks. Extant research shows mixed outcomes in the investigation of changes in interest rates and stock market outturns. For example, Kurihara (2006) finds no direct effects of decreases in interest rates on the stock market during the periods of quantitative easing in Japanese. In another study of Japan, Kimura and Small (2006) find that the Japanese quantitative easing series failed to increase stock prices as it resulted in increased risk premiums for low-grade corporate bonds and equities. In contrast, Krishnamurthy and Vissing-Jorgensen (2011) find that the decrease in the corporate risk premium from the series of post-financial crisis quantitative easing events in the U.S. resulted in a lower cost of capital. Also, Aït-Sahalia, *et al.* (2012) find that in developed economies (the UK, the US, Japan and the Euro area), reduced risk premium in the financial sector was associated with quantitative easing programs as financial institutions exhibited a lower risk of failure.

Financial theory (for example Gordon's Dividend Valuation Theory) emphasizes that changes in interest rate affect the value of the firm through effects on both the firm's future cash flows expectations and the discount rate applied to the valuation of these cash flows. The analysis of the responsiveness of the market value of firms to interest rate fluctuations has received enormous attention in the literature. However, most of the empirical research (for instance, Flannery and James, 1984; Staikouras, 2003 and 2006; Hahm, 2004) have had as a primary focus, the effects of interest changes on the value of financial institutions for the obvious reason that the nature of the banking business has made financial institutions quite susceptible to volatilities in interest rates. Nevertheless, there are shreds of evidence that interest rate variations affect the value of non-financial stocks as well. Bartram (2002) argues that interest rate changes affect significantly, the value of non-financial stocks principally through their effect on the cost of capital. Also, any effect by volatilities in interest rates on the value of financial assets and liabilities held by non-financial firms will necessarily affect the values of these firms. Thus, this current study investigates the effects of interest rates changes on the returns of both financial and non-financial stocks.

In recent studies on developed economies, Huang *et al.* (2016) find negative interaction between US stock market and the real interest rates; Moya-Martinez *et al.* (2015) indicate that there is a general significant interest rate sensitivity among Spanish industries; Ferrer *et al.* (2016) find a significant link between bond yields and stock markets for a group of core Eurozone countries including the UK, France, Germany, Spain, Netherlands, and Finland. Largely, extant research shows that interest rates have significant linkages with stock market outturns in developed economies, whereas, recent studies on developing and emerging economies have uncovered limited linkages between stock returns and interest rate changes. Asseffa *et al.* (2017) suggest that in developing markets, macro determinants are not "priced in" stock returns while Papadamou *et al.* (2017) find a non-linear impact of interest rate differences on stock returns. Noteworthy is the fact that both studies utilised panel data framework. The degree of connection between interest rate changes and stock returns within the context of emerging and developing economies might differ among countries. Against this background, this paper examines the interest rate and stock returns nexus within the context of an emerging economy.

The functioning of the stock market is not particularly indifferent to the economic environment and researchers and the investor community have been keen on ascertaining the influences of economic factors on stock prices and stock returns. In the wake of the not-to-distant financial crises, there has been a deluge of interest rate actions by central bankers across the globe and this has resuscitated the issue of the link between the stock market and interest rate changes. Notwithstanding the emergence of frameworks to manage interest rate risk, the rate of interest lingers conspicuously in the investors' decision tools and the exposure to the interest rate risk may not be declining after all. This study deviates from the multiple factor models mainly employed in extant research (for instance, Asseffa *et al.*, 2017; Papadamou *et al.*, 2017)), and tests the effects of interest volatilities on the short run and long run variations in stock market value. This study investigates the relationship between stock market index and interest rate volatility in Ghana using monthly time series data for the period 1995 to 2015. The study took into considerations the findings of Addo and Sunzuoye (2013) and Ibrahim and Musah (2014), who utilized the multi-factor model (APT theory) to analyse the influence of macroeconomic indicators on the stock market performance in Ghana. In terms of approach, this study employed a cointegration test and VECM technique to investigate the predictive power of interest rates on the stock market index. Also, this research used expanded time series data. The expanded time series should allow for a weighty insight into the dynamic relationship between interest rate and stock market returns. This study builds on prior literature and follows a validity and robustness procedure to examine the time-varying effects using monthly, quarterly, biannual and annual time series.

The rest of the paper is organized as follows: Section 2 surveys the literature and provides an overview of theoretical and empirical research on the interaction between macroeconomic indicators and the stock market. In Section 3, the study discusses the methodology employed and specifies the estimation processes. Section 4 presents and discusses the results. Summary of the study and some concluding remarks are made in the last section.

Section 2: Related Literature

Andros *et.al.* (2007) posit that the Capital Asset Pricing Models (CAPM) have been used to understand stock returns and to measure the risk of security by relative sensitivity of the security to the stock market return. The main challenge to the CAPM has been the

revelation that returns can be predicted from other financial factors (Fama and French 1995). This sole critique of the CAPM has motivated the development and testing of some other asset pricing specifications. One of such models is the Arbitrage Pricing Theory (APT). In developing the Arbitrage Pricing Theory (APT), Ross (1976) provides for multifactor dependencies in the determination of asset returns. Ross (1976) posits that returns are influenced by several macroeconomic factors that include interest rates.

Ross' (1976) APT multi-factor models have been widely used in a multivariate setting in the asset pricing literature. Research (for example Hahm, 2004; Czaja *et al.*, 2009 and 2010) provides an abundance of evidence to show that changes in macroeconomic variables affect stock returns. Chen (1991) emphasizes the need for macroeconomic information to be fully factored into the investor's estimation of the expected dividends flow and the appropriate discount rate which ultimately affects stock returns. Existing studies (Fama, 1981; Chen *et al.*, 1986; and Harvey, 1993) have modelled and found a significant relationship between stock returns and economic indicators such as interest rates, production rates, productivity, consumption, growth rate of money supply, unemployment, exchange rates, yield spread etc.

Gordon's (1962) Dividend Valuation Theory suggests that interest rates have negative effects on returns. In the Dividend Evaluation Model, Gordon (1962) reflects the rate of interest in the cost of capital and suggests a formal relationship whereby the value of the firm today is a function of dividend payments in the following period, the growth rate of income and cost of capital. Modigliani (1971) contends that low interest rates have the tendency to motivate the flow of capital to the stock market in expectation for a higher rate of return while increases in interest rates encourage more savings in banks and flow of capital into the money market, which consequently reduces the provision of capital to the stock markets. Also, Mishkin (1977) argues that a reduction in interest rates provides the option of cheaper credits, with investors acquiring funds at a lower cost and possibly investing these funds in the stock market. Thus, decreases in interest rates lead to a flow of funds from the money market into the stock market as bonds and other money market securities become less attractive. Also, the reduction in interest rates provides cheaper credits which are likely invested in the stock market. Both actions provide demand for stocks thus boosting stock prices. Ultimately, increases in interest rates cause stock prices to decline while the opposite is also true.

Stone (1974) adapts the CAPM and shows that interest rate changes can be perceived as good or bad depending on the net effect on expected returns. An increase in interest rates may have positive effects. If it is the case that future income increases by more than the cost of securing the funds, then the increase in interest rates may produce higher net interest margins; thus, ensuring that interest rate increases result in increased returns. Lynge and Zumwalt (1980) enhance the earlier study by Stone (1974) and document that interest rate sensitivity of an asset varies according to the term structure of interest rates, namely short versus longer term interest rates. They report further that, returns of financial stocks are highly interest rate sensitive relative to non-financial stock returns. Flannery and James (1984) examine the underlying factors for the interest rate sensitivity of stock returns. They find evidence in support of the negative relationship of stock returns to interest rates for financial stocks. This negative association holds whether in the short-term or long term. Flannery and James (1984) assert that the main factor explaining the sensitivity of stock returns to changes in interest rates is the mismatch between the maturities of the sets of assets and liabilities.

Empirical research (for instance Prasad and Rajan, 1995; Dinenis and Staikouras, 1998; Reilly *et al.*, 2007, Al-Mukit, 2013) generally reports significant negative influences of interest rate changes on stock returns of financial stocks and in few instances, nonfinancial firms. However, recent works such as Ryan and Worthington, (2004); Czaja *et al.*, (2009); Subair and Salihu (2010); Kuwornu and Owusu-Nantwi (2011) and Korkeamäki, (2011) suggest a declining exposure to the interest rate risk largely due to the emergence of frameworks to manage interest rate risk. According to Moya-Martínez, *et al.* (2013), the explosive growth in the interest rate derivative markets and the expansion of corporate bond markets may account for the observed reduction in the sensitivity of stock returns to changes in interest rates.

Largely, the studies on the nexus between interest rate changes and stock returns produce mixed outturns: Shah *et al.* (2012) demonstrate a unidirectional causality from interest rate to the stock market index in Pakistan; Cifter and Ozun (2007) observe causality between interest rates and stock returns for the economy of Turkey; Joseph and Vezos (2006) find high sensitivity of stock returns to changes in interest rate; Pallegdara (2012) finds no causal relationships between interest rate changes and stock market returns in the short run while Kurihara and Nezu (2006) conclude that there is insignificant

relationship between interest rates and stock prices for the Japanese stock market; In another study of Turkey, Toraman and Başarir (2014) conclude that there is a long-run relationship between interest rate changes and stock market outturns.

Section 3: Research Methods

Data and data sources

The data for this study comprises of monthly time series data for Ghana over the period 1995 - 2015. The sources of data include statistical bulletins published by the Bank of Ghana and the Ghana Stock Exchange. The data set includes the GSE All-Share/Composite Index and the 91-Day Treasury bill rate, used as a proxy for interest rates. The study period, January 1995 to December 2015 was chosen largely due to the availability of complete data for the analysis of the relationship between interest rates and stock returns. Also, during this period, the Ghanaian financial markets have undergone substantial policy changes characterized by the revival of private foreign capital flows to emerging market economies, flexible exchange rates, strong economic growth, and increased investor interest in equities, global financial and economic instability, new capital requirement by commercial banks and significant changes in monetary policy framework.

Study variables

The variables for this study were informed by previous studies (Al-Mukit, 2013; Ibrahim and Musah, 2014; Toraman and Başarir, 2014) and data availability. The variables used are as follows:

GSE All-Share Index / Composite Index: This is the dependent variable. The GSE All-Share / Composite Index is the principal stock index of the Ghana Stock Exchange and captures the overall performance of the bourse. The index is market capitalisation based and is computed from the values of each stock listed.

Interest Rate (IR): The 91-day Treasury bill rate is used in this study as a proxy for interest rate. The Treasury bill represents an accurate opportunity cost to an investment in stocks. In Ghana, the short end of the yield curve has usually seen intense investor activities as it records the highest number of bids in the weekly Bank of Ghana treasury auctions. The

weekly auction is aimed at providing benchmark rates for the entire economy and thus, should be largely free from the central bank's regulatory actions. Treasury bills are the most actively traded money market instruments in Ghana and should presumably represent a critical influence on investment decisions. The choice of the 91-day treasury rate was also influenced by its popularity in the literature (for example Al-Mukit, 2013; Addo and Sunzuoye, 2013, Ibrahim and Musah, 2014).

The stock market index and the interest rates data used in this study represent the end-of-the-month, quarter, half year and year observations.

Empirical specification

This study follows the structural model by Al-Mukit (2013) and hypothesizes the relationship between interest rates and stock market returns in a relationship between log transformed variables as stated below:

$$LY_t = \beta_0 + \beta_1 LINT_t + \epsilon_t \quad (1)$$

Where,

LY is the natural log of GSE All-Share Index and *LINT* is the natural log of interest rate. β_0 and β_1 are the parameters, ϵ is the random disturbance term and *t* is the time subscript.

For the execution of the empirical design, the time series property of each variable is investigated. If the tests confirm stationarity, equation (1) is estimated using the Ordinary Least Square method. If the tests confirm the non-stationarity of each variable, the cointegrating relationship among the variables is studied. On the evidence of cointegration among the variables, a vector error correction model (VERM) is estimated to assess the short-run dynamics and the long run causality.

The VECM is estimated as follows:

$$\Delta LY_t = \alpha + \gamma\varepsilon_{t-1} + \sum_{i=1}^{n} b_i LY_{t-i} + \sum_{i=1}^{m} c_i LINT_{t-i} + \epsilon_t \quad (2)$$

Where γ is the coefficient of the error correction term (ε_{t-1}). In this specification, the long run causality is determined by the significance of the coefficient of the error-

correction term while the short run causality is determined by the joint significance of the lagged explanatory variables using the F statistic. If the coefficient of the error correction term is negative and significant, it indicates a long run convergence and unidirectional long-run causal flows from changes in interest rate to changes in stock returns. A long run divergence and causality is however determined by a positive and statistically significant coefficient of the error correction term.

In the absence of a cointegrating relationship among the variables, the study followed Granger (1988) to estimate the vector autoregressive (VAR) model by excluding the error correction term (in equation (2)), for Granger causality with a short-term interactive feedback relationship. Equation (2) then becomes:

$$\Delta LY_t = \alpha + \sum_{i=1}^{n} b_i LY_{t-i} + \sum_{i=1}^{m} c_i LINT_{t-i} + \epsilon_t \qquad (3)$$

According to Brooks (2008), unrestricted VAR requires that the same number of lags of the variables is used in the equation; thus, the use of AIC in this study to determine the appropriate lag length. Within the framework of the VAR system, the significance of all the lags of each variable is examined jointly with the *F*-test.

The study employed a time series analysis to examine the relationship between interest rates and stock market returns. The time series property of non-stationarity was investigated using univariate analysis by subjecting the data to the Augmented Dickey-Fuller Test (ADF) and Phillips-Perrons unit root test. In a unit root test, the null hypothesis tested is that unit root exists thus not integrated of order zero against the alternative hypothesis that there is no unit root, thus integrated of order zero. If the unit root test confirms the stationarity in time series data of each variable, then equation (1) is estimated appropriately by the Ordinary Least Square (OLS) method. This is done to ensure that the presence of spurious correlation does not lead to misleading inferences (Granger and Newbold, 1974).

Further, the study employed the Johansen's Multivariate Cointegration Model, to determine whether the variables have a stable and non-spurious cointegrating relationship among themselves. The existence of a cointegrated relationship among the variables may be interpreted as a long run relationship. The cointegrating relationship among each

variable indicates the tendency for the variables to move together in the long run. A precondition to cointegration is that the series must be integrated of the same order.

To do the cointegration test, a Vector Autoregressive (VAR) approach is followed as outlined in Granger (1988) and the appropriate lag-length (p) is selected according to Akaike information criterion (AIC). The analysis starts with a statistical system of unrestricted reduced forms where Y_t is a vector integrated of order one ($I(1)$) variables as given by equation (4) below;

$$Y_t = \alpha + \prod_t Y_{t-1} + \cdots + \prod_k Y_{t-k} + \epsilon_t \quad (4)$$

Where:

Y_t is an (n x 1) vector of I (1) variables, Π_t is (n x n) matrix of parameters and ϵ_t is (n x 1) vector of white noise error.

Section 4: Results and Discussion

Descriptive Statistic

Findings from the descriptive statistics (Table 1) show near normality in the data distribution of the variables. The coefficient of skewness of each variable is low with the GSE CI showing positively skewed distribution while the interest rate data displayed negatively skewed distribution. Approximate normality is confirmed in each variable, as the value for kurtosis is below the benchmark for normal distribution of 3.

Table 1. Summary of Descriptive Statistics

	LnGSE CI	*LnIR*
Mean	3.258	1.362
Median	3.243	1.394
Minimum	2.472	0.960
Maximum	4.038	1.681
Standard Deviation	0.452	0.219
Kurtosis	-1.154	-1.008
Skewness	0.002	-0.270

Also, in each variable, the mean-to-median ratio is approximately 1 while the range of variation between minimum and maximum is quite logical, indicating the near-normality

of the distributions. The descriptive statistics also reveal low coefficients of variation as the standard deviation is quite low relative to the mean. The stock market index (LnGSE CI) exhibited the largest standard deviation among the variables, which may suggest rather high volatility of stock market returns.

Stationarity Test

The study examined the time series property of each variable using the ADF and PP test for unit root. The results (presented in Table 2) shows that both ADF and PP statistic failed to reject the null hypothesis of the presence of a unit root for both variables at level.

Table 2. Results of ADF and PP tests

	Level		First Difference	
	ADF	PP	ADF	PP
LnGSE CI	-1.7668	-1.8125	-14.4949***	-14.5348***
LnINT	-1.7961	-1.8389	-5.9722***	-9.7036***

Note: *** indicates significance at 1%

Thus, both the ADF and PP tests are consistent in confirming the non-stationarity of each variable at level. However, the stationarity of both variables is restored on first differencing, showing the same order of integration. Both LnGSE CI and LnIR assumed stationarity at the 1% level of significance implying that all the variables are integrated of the first order, I(1).

Ordinary Least Square Estimations

The study estimated the OLS regression model and presents the results in Table 3. The results indicate that interest rate has considerable explanatory power in predicting variations in stock returns with the F-statistic showing overall statistical significance at 1% level of significance.

Table 3: OLS Regression Results

Dependent Variable	GSE CI
Variable	Coefficient
C	5.1726*** (0.1319)
INT	-1.4063*** (0.0956)
R-squared	0.4639
Adjusted R-squared	0.4617
F-statistic	216.3224
Prob (F-statistic)	0.0000

Note: Standard errors in parenthesis and *** indicates significance at 1%

As generally observed, the OLS regression results show a negative relationship between stock returns and interest rate. This result may suggest that investing in treasury securities presents an alternative to holding shares. Interest rates are measures of the cost of capital. Thus, increases in interest rates have the tendency to impact negatively on economic activity with depressing implications for the profitability of listed firms. Increases in interest rates are most likely associated with decreases in stock returns. This result is consistent with Addo and Sunzuye (2013).

Cointegration Test and VAR Model

In the first step, the appropriate lag length is determined. Table 4 presents the VAR lag order selection criteria to be used in both the Johansen cointegration test and the VAR model.

Table 4 VAR Lag Order Selection Criteria

Endogenous variables: GSE_CI, INT						
Lag	LogL	LR	FPE	AIC	SC	HQ
0	-44.2596	NA	0.0050	0.3823	0.4111	0.3939
1	861.7355	1789.527	2.91e-06	-7.0722	-6.9857	-7.0373
2	895.6838	66.4938*	2.27e-06*	-7.3197*	-7.1755*	-7.2616*
3	897.5970	3.7157	2.31e-06	-7.3025	-7.1006	-7.2211
4	900.6120	5.8058	2.33e-06	-7.2943	-7.0348	-7.1898
5	904.7264	7.8547	2.33e-06	-7.2953	-6.9781	-7.1675
6	905.5401	1.5399	2.39e-06	-7.2689	-6.8941	-7.1179
7	906.7091	2.1931	2.45e-06	-7.2455	-6.8130	-7.0713
8	910.5167	7.0804	2.45e-06	-7.2439	-6.7538	-7.0465
9	911.4462	1.7129	2.51e-06	-7.2186	-6.6707	-6.9979
10	915.3878	7.1993	2.52e-06	-7.2181	-6.6126	-6.9742

* 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

All the information criteria identified the lag length of 2; thus, the study chose a lag length of 2 for the estimation of the cointegration test and the VAR models.

Cointegration Tests

The variables are all integrated of the first order thus, the study appropriately employed the cointegration method to estimate the long-run relationship between stock returns and interest rates. The study followed the Johansen-Juselius cointegration procedure and presents the results for the unrestricted cointegration rank test in Table 5.

Table 5: Unrestricted Cointegration Rank Test

Unrestricted Cointegration Rank Test (Trace)

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.5 Critical Value	Prob.
None	0.060253	18.84319	15.49471	0.0150
At most 1	0.014044	3.493375	3.841466	0.0616

Unrestricted Cointegration Rank Test (Maximum Eigenvalue)

Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen Statistic	0.5 Critical Value	Prob.
None	0.060253	15.34982	14.26460	0.0336
At most 1	0.014044	3.493375	3.841466	0.0616

Both the Trace and Maximum Eigen statistics indicate the presence of cointegrating relationships. The variables are cointegrated and exhibit a stable long-run relationship. This may suggest that in the long run, interest rates have significant influences on stock returns. This finding is consistent with Al-Mukit, (2013) and Ibrahim and Musah, (2014).

Vector Error Correction Model (VECM)

The cointegration test affirmed the presence of a long run relationship between interest rates and stock returns, consequently, the VECM was employed to examine the level of short-run adjustments towards the long-run equilibrium relationship between the variables. The results of the VECM estimations are presented in Table 6.

Estimates from the error correction model suggest that the GSE CI and interest rates have a stable long-run relationship where short-run disequilibrium is corrected. The coefficient of the error correction terms is negative and significant as expected and indicates that about 0.25 per cent deviation from long-run equilibrium is corrected each period following a shock to the stock market in the short-run, while the gaps in interest rates close by about 1.20 per cent.

Table 6: Results of the Vector Error Correction Model

Vector Error Correction Estimates		
Cointegrating Eq:	CointEq1	
GSE CI(-1)	1.0000	
INT(-1)	**2.5588**	
	(0.5916)	
C	-6.7443	
Error Correction:	D(GSE CI)	D(INT)
CointEq1	**-0.0025**	**-0.0120**
	(0.0095)	(0.0038)
D(GSE CI(-1))	**0.0827**	0.0188
	(0.0647)	(0.0260)
D(GSE CI(-2))	0.0249	0.0076
	(0.0648)	(0.0260)
D(INT(-1))	**0.0336**	**0.4211**
	(0.1563)	(0.0627)
D(INT(-2))	-0.0977	**0.1121**
	(0.1572)	(0.0631)
C	0.0029	-0.0005
	(0.0039)	(0.0016)
R-squared	0.0094	0.2578
Adj. R-squared	-0.0110	0.2425
Sum sq. resids	0.8919	0.1437
S.E. equation	0.0606	0.0243
F-statistic	0.4604	16.8820

Note: Standard errors in ( ). Statistically significant estimates are indicated in bold.

However, contrary to expectations interest rates have a positive and significant long-run relationship with the stock market index. This result is consistent with Hyde (2007) who also report significant and positive influences of interest rate on stock returns for France and Germany. This result may give credence to the relative strength of the banking stocks on the Ghana Stock Exchange. There are currently ten (10) banking stocks on the Accra bourse and they form the core of the heavily weighted stocks on the exchange and thus constitute the main driving force of the value-weighted GSE Composite Index. Rising interest rates may reflect in significant increases in net interest income.

The coefficient of the error correction term also confirms the unidirectional long-run causal flows from changes in interest rate to changes in stock returns. The results of the VECM also indicates the existence of short-run relationships. The results reveal that in the short-run only the first lag of the differenced LGSE CI have significant and positive

effects on its first difference. This may suggest that the previous period's performance of the stock market exert positive feedbacks on its current performance. Thus, a falling performance of the stock market may persist in the short run while also the momentum for an upward trajectory would be maintained in the short run. The coefficients of the lagged term of changes in interest rates indicate a short term negative effects on stock returns.

Robustness and validity checks

To ensure the validity of the results, we perform a robustness check and further estimate the baseline VECM for three different time intervals, including quarterly, biannual and annual time series. This approach allows for time-varying long-run equilibrium relationship that can capture the gradual drifting from the short run to the long run. In columns (1), (2) and (3) of Table 7, we present the estimates for quarterly, biannual and annual time series respectively.

The results show that the coefficients of the error correction terms are negative and significant as expected and indicate that the estimations are consistent and robust to the different time intervals. The findings from the varying time series analysis revealed that as the time interval increases, the proportion of the deviation from the long-run equilibrium which is corrected in each period following a shock to the stock market in the short-run, increases. About 0.25 per cent of the short run deviation is corrected in the analysis of the monthly time series. The proportion corrected increases as the time interval increases, rising to about 2.57 per cent (quarterly time series), 15.15 per cent (biannual time series) and finally to 62.55 per cent (annual time series). This indicates that as the period drifts towards the long run, the deviation from the long run equilibrium declines substantially. The validity and robustness procedure reveals the time-varying effects and confirms the validity of our results.

Table 7: Quarterly, Biannual and Annual Analysis

Vector Error Correction Estimates			
	(1)	**(2)**	**(3)**
Cointegrating Eq:	CointEq1	CointEq1	CointEq1
GSE CI(-1)	1.0000	1.0000	1.0000
INT(-1)	**2.6044**	**2.2869**	**2.2806**
	(0.4186)	(0.3625)	(0.2093)
C	-6.8168	-6.3984	-6.3628
Error Correction	D(GSE_CI)	D(GSE_CI)	D(GSE_CI)
CointEq1	**-0.0257**	**-0.1515**	**-0.6255**
	(0.0346)	(0.0966)	(0.3410)
D(GSE CI(-1))	**0.0946**	**0.3744**	**0.3730**
	(0.1187)	(0.1724)	(0.3500)
D(GSE CI(-2))	0.1426	-0.0295	0.4055
	(0.1212)	(0.1755)	(0.3214)
D(INT(-1))	-0.1723	-0.1545	**1.0809**
	(0.2131)	(0.2455)	(0.5877)
D(INT(-2))	**0.1371**	**0.7216**	**0.5081**
	(0.2212)	(0.2519)	(0.5202)
C	0.0074	0.0129	0.0245
	(0.0129)	(0.0260)	(0.0713)
R-squared	0.0319	0.2541	0.2556
Adj. R-squared	-0.0326	0.1411	-0.0546
Sum sq. resids	0.9827	0.8302	0.9936
S.E. equation	0.1145	0.1586	0.2878
F-statistic	0.4945	2.2486	0.8240

Note: Standard errors in ( ). Statistically significant estimates are indicated in bold.

The analysis of the different time intervals shows that as the time approaches the long run, the short run findings become coterminous with the long run relationship. The results also show short term relationships and indicate that both the monthly and quarterly time series analysis produce a negative net feedback effect from changes in interest rates to

the stock market while the biannual and annual time series analysis reveal a short term positive net effects from changes in interest rates to the stock market. This implies that as the time interval increases, we approach the long run equilibrium and the short run findings converge into the long run results. Again, this confirms the validity of the results from the monthly time series analysis.

The findings of this study may imply that investors with long term horizon pay little attention to macroeconomic considerations in their investment decisions relative to their counterparts with short term horizons. It is crucial to note that most of the top-weighted stocks on the GSE are banking stocks and interest rate hikes may boost their fundamentals and consequently attract investor interests. The findings may suggest the behaviour of active investors who direct their attention to the money market in the short term to take advantage of attractive rates but shift their focus towards the stock market for their long-term investment needs.

Conclusion

Modigliani and Chon (1979) identify interest rate as one of the most significant factors affecting stock prices. The analysis of the responsiveness of the market value of firms to interest rate fluctuations has received enormous attention in the literature. Contrary to the general conclusion in extant research, this study finds a positive and significant association between interest rate and the stock market returns in the long run. The positive relationship may be underlined by the relative strength of banking stocks on the Ghana Stock Exchange. The banking stocks form the chunk of the top-weighted stocks on the exchange and are the key drivers of the value-weighted GSE Composite Index.

The results of this study show that in the short run, the performance of the stock market in the previous period would positively influence its performance in the current period. The analysis of the short run relationship also indicates the inverse relationship between returns on the Ghana Stock Exchange and interest rates. The findings of this study indicate that in the long run, interest rate has a positive relationship with the stock market value where short-run shocks to the stock market are corrected. The analysis for the different time series proved the validity of the results. As the time interval increases, we approach the long run equilibrium and the short run findings converge with the long run results.

The results of this study suggest that significant linkages between interest rates and stock returns both in the short run and long run; hence, interest represent a major indicator for equity investments decisions. A review of the macroeconomic environment should be combined with the analysis of the fundamentals of listed firms in equity investments decisions. Future research should investigate whether the interest rate and stock market return relationships vary according to industry identity.

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