RELATIONSHIP BETWEEN MACRO-ECONOMIC VARIABLES, INVESTOR HERDING BEHAVIOUR AND STOCK MARKET VOLATILITY IN KENYA

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Abstract

This study sought to examine the relationship between interest rate, inflation, gross domestic product (GDP), foreign exchange, investor herding behaviour and stock market volatility. Published time series data from January 2001 to December 2014 was obtained from the Central Bank of Kenya, Kenya National Bureau of Statistics, Capital Market Authority and the Nairobi Securities Exchange. Granger causality test was used to determine the short run causality while the Vector Error Correction Model (VECM) was used to test the long run causality between predictor variables and stock market volatility. Result from the regression model show a positive and significant relationship between inflation and stock market volatility both in the short run and long run. The study finds that an increase in inflation by 1% leads to an increase in stock market volatility by approximately 24%. Results also revealed that there is a negative and significant relationship between interest rate and stock market volatility both in the short run and long run. GDP, Foreign exchange and herding behaviour had no significant relationship with stock market volatility in Kenya.

Keywords: Stock Market Volatility, Investor Herding, Macro-Economic Variables, Herding Index

INTRODUCTION

Stock markets serve as a channel through which surplus funds are moved from savers to borrower (Mishkin, 2001). They play a critical role in the growth of the economy. Ashaolu & Ogunmuyiwa (2010)opines that the development of stock market is essential for economic growth. A well-functioning stock market contributes to economic growth through boosting savings and allowing for more efficient allocation of resources (Junkin, 2012). Demirguc-Kunt & Levine (1996) observes that economies without well-functioning stock markets suffer from limited opportunities for risk diversification, are unable to optimally structure their financing packages and lack information about the prospects of firms thereby restricting the promotion of investment and its efficiency. In the wake of the global financial crisis of 2007, and the effect it had on the global economy, policy makers and investors have increasingly sought to understand factors that affect proper functioning of securities markets.

Available literature indicates that stock market volatility significantly affects the performance of economies. According to Karolyi, (2001), excessive stock market volatility undermines the usefulness of stock prices as a measure of the true intrinsic value of firms. High volatility means that prices or stock returns have enormous swing over a specific time (Alshogeathri, 2011). Daly, (1999) opines that volatility of security markets erodes confidence and affects liquidity of the market by causing a wide bid-ask spread. Empirical finding from recent studies has confirmed that many African countries suffer from the effects of stock market volatility. Forgha (2012) investigated the efficiency and volatility of stock markets in Cameroon, Nigeria, South Africa, Egypt and Kenya and found that stock markets in all the five countries experienced a high level of inefficiency and volatility.

Background

The Kenyan sessional paper No. 10 of 2012 on Vision 2030 has cited market volatility as a major challenge facing the Nairobi Securities Exchange (NSE). According to the NSE, (2011) report, the Nairobi Securities Exchange witnessed drastic volatility in its performance such that in the last six months of 2011 the NSE 20 share index recorded a variance from a high of 4495 points to a low of 3733 points. According to Corradi *et al.* (2006), understanding the origins of stock market volatility has long been a topic of considerable interest to policy makers and financial analysts. Orabi*et al.* (2015) opines that policy makers are interested in the main determinants of volatility and its spillover effects on real activities.

The arbitrage pricing theory, the present value model and the efficient market hypothesis are theories commonly used to explain the relationship between Stock market volatility and changes in the macro-economic variables. The efficient market hypothesis holds that prices

adjust rapidly to new and relevant price sensitive information. The present value model postulates that the fundamental value of a share is equal to the present value of expected future dividends. This value depends on macro-economic variables, particularly the prevailing interest rate used as the discounting rate. Roll (1984) posits that volatility is affected by market micro-structure. Abugri (2002), Caner *et al.* (2005), and Granger *et al.* (2000) identifies inflation rate, interest rate, exchange rate, dividend yield and money supply as notable factors affecting stock market volatility. Ackert and Smith (1993) argue that volatility in stock prices is due to either a change in the discount rate or new information concerning future cash flows received by shareholders. Central to this study was the arbitraged pricing theory, which hypothesizes that there is a causal relationship between macro-economic variables and stock market performance. However, the theory is limited since; it does not specify which macroeconomic variables are most responsible for stock market volatility. The APT has left it open for researchers to investigate various macro-economic variables that can possibly predict stock market volatility. Behavioural finance links stock market volatility to the behaviour of investors in the market rather than economic fundamental. Shiller (2000) observes that a shift in investor behaviour is driven less by fundamentals and more by sociological and psychological factors. Shefrin (2000) notes that price adjustments are not only due to the arrival of new information but also due to market conditions or collective phenomena such as herding. Tan *et al.*, (2008), records that the influence of investor herds' drive prices away from their fundamental values. Christie and Huang (1995) observe that investor herds are frequently used to explain stock market volatility.

LITERATURE REVIEW

The arbitraged pricing theory has been used by various scholars to analyse the association between stock return and macroeconomic variables. According to the theory, expected returns of a financial asset can be modelled as a linear function of various macroeconomic variables or theoretical market indices, where the sensitivity to change in each factor is represented by a factor specific beta coefficient (Gay, 2008).As a single-factor model, uncertainty in asset returns comes from a common or macroeconomic factor and a firm-specific cause, where the common factor has zero expected value (McMenamin, 2005).The one-factor model can be extended to a multifactor model by allowing for other factors that might affect stock returns. The other factors that may be allowed include: interest rates, inflation, gross domestic product and foreign exchange rate. The APT fails not specify the type or the number of macro-economic factors that researchers can include in their study (Fabozzi, 2015). Ross *et al.* (1987) examined the effect of

four factors including inflation, gross domestic product, investor confidence, and the shift in the yield curve; they endorsed that the APT should not be limited to these factors.

Interest Rate

Interest rate is one of the important macroeconomic variables directly related to economic growth. Generally, interest rate is considered as a measure of the cost of capital. Alam (2009) opines that the influence of long-term interest rate on stock prices and by extension stock market volatility stems directly from the present value model. In this model, interest rate is used as a discount rate for future income streams of an asset in determining the value of the asset. Jawad and Ulhaq (2012) opine that interest rate has a more direct effect on financial market. An increase in interest rate causes investors to make a change in the structure of their investment generally from capital market to fixed income securities. In theory, interest rates and stock price have a negative correlation (Hamrita and Abdelkader, 2011).

Inflation Rate

Finance theory suggests that inflation negatively impacts the value of shares in a market. According to Hatemi (2009), one of the reasons why inflation negatively impacts share prices is the negative association between inflation and expected real economic growth so that investors shift their portfolios towards real assets if the expected inflation rate becomes remarkably high. The fisher effect theory observes that equities serve as a hedge against inflation because they represent claims to real assets (Dimand, 2003).

Exchange Rate

The causal relationship between exchange rate and stock market volatility is explained by the goods market theory and the stock oriented model. The goods market theory postulates that the appreciation of a local currency will have the tendency to hurt exporters and, cause shares of such firms to be less attractive eventually dropping in value (Barnor, 2014).Joseph, (2002) opines that international competitiveness of firms is influenced directly by change in exchange rate whether they import inputs or exports output.

Gross Domestic Product

Gross Domestic Product is a measure of the market value of all final goods and services produced within a country in a given period. According to Rahman *et al.* (2009), the level of real economic activity is a critical factor in determining stock market returns. The most popular measure of real economic activity is the gross domestic product (GDP). There is a general

consensus that an increase in GDP causes stock market returns to increase (Eita, 2012). Campbell *et al.* (2001) suggests that stock market returns have a significant predictive power for real GDP growth.

Stock Market Volatility

Stock market volatility is the fluctuation in the price of broad stock market index over a defined period. It is the dispersion and not the direction of changes in price (Ambrosio, 2007).Volatility can either be measured using standard deviation or variance between returns from that same security or market index (Debesh, 2013). According to Schwert (1990) financial economists find standard deviation to be more appropriate because it summarises the probability of seeing extreme values of return. The standard deviation of a computed Nairobi all shares index was used in this study to measure stock market volatility. Stock market volatility tends to decline as the stock market rises and increases as the stock market falls (Debesh, 2013).

Figure 1: Stock Market Volatility Trend from January 2001 to Dec 2014
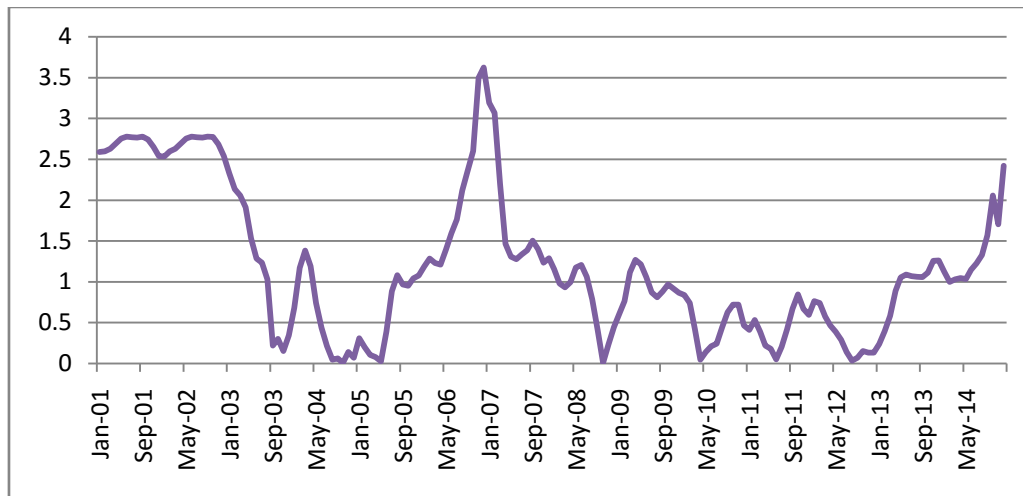
Source: Computations from Research Data Obtained from the NSE

Investor Herding Behaviour

Herding is a non-quantifiable behaviour which cannot be measured directly. It is only inferred by studying related measurable parameters. This study viewed herding behaviour as a collective buying and selling actions of the individuals in an attempt to follow the performance of the market or any other economic factors or styles. Herding is detected by exploiting the information contained in the cross-sectional stock price movements. Christie and Huang (1995), Chang, Cheng and Khorana (2000) and Hwang and Salmon (2004) are contributors of such measures.

This study measures market -wide herding by calculating an index using the Cross Sectional Standard Deviation method.

Figure 2: Monthly Herding Index Trend from January 2001 to December 2014
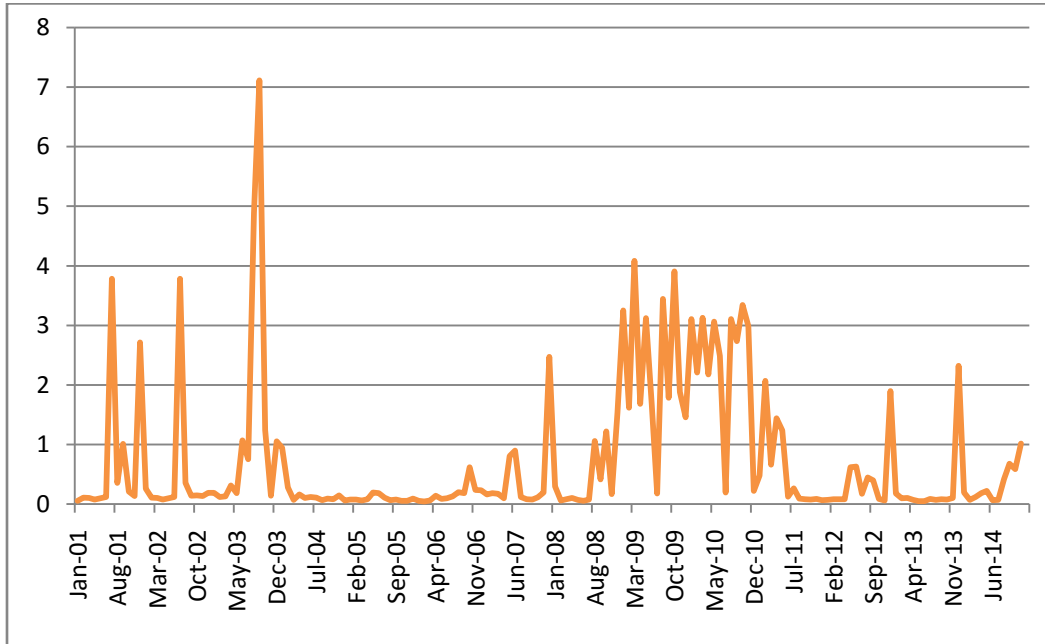
Source: Computations from research data obtained from the NSE

Statement of the Problem

Volatility of security markets erodes confidence in the capital market, reduces liquidity and discourages wide participation (Daly, 1999).The sessional paper No. 10 of 2012 on Kenya Vision 2030 highlights market volatility as one of the leading problems facing the Nairobi Securities Exchange. According to the financial sector stability report, (2010), the Nairobi Securities Exchange witnessed volatility in 2008 through 2010, during this time; the volatility index stood at 56.93, rose to 150.16 in March 2010 and dropped to 67.84 in June 2010.

According to the NSE report, (2011), the NSE witnessed drastic volatility in the last six months of 2011 where the NSE 20 share index recorded a variance from a high of 4495 points to a low of 3733 points. Studies on investor behaviour have reported significant levels of herd behaviour on the Nairobi securities Exchange. Wamae (2013) found that herding behaviour influences investment decision making among investment banks in Kenya. Yenkey, (2012), finds that newly recruited investors through IPOs, present significant levels of herding behavior. According to Tan *et al.,* (2008), the influence of investor herds' drives prices away from their fundamental values. Fluctuations in share prices have greatly been witnessed on the Nairobi

securities Exchange over the years causing losses to investors due to high risk caused by unpredictability of the market.

Corradi et al. (2006) suggests that forecasting stock market volatility constitutes a formidable challenge but also a fundamental instrument to manage the risks faced by investors. Studies on the effect of macro-economic variables on stock market volatility in Kenya are scanty. Results from the few studies are mixed and not conclusive. There is therefore the need for further research to investigate the relationship between macro-economic variables and stock market volatility. Such studies should also investigate the role of investor behaviour on market performance particularly the herding behaviour. This study attempts to address this knowledge gap.

Research Objectives

The general objective of this study was to investigate the relationship between macro-economic variables, investor herding behaviour and stock market volatility in Kenya.

The specific objectives were;

1. To establish the relationship between inflation rate and stock market volatility in Kenya
2. To examine the relationship between interest rate and stock market volatility in Kenya.
3. To establish the relationship between exchange rate and stock market volatility in Kenya
4. To determine the relationship between the gross domestic product and stock market volatility in Kenya
5. To explore the effect of herd behavior on stock market volatility in Kenya.

RESEARCH METHODOLOGY

The study adopted a descriptive research design Time series data was used. Regression analysis was used to express the relationship between macro-economic variables, herding and stock market volatility. The VAR models, in particular, the VECM and Granger causality test were used to estimate the relationship between stock market volatility, investor herding and macro-economic variables. The research population for this study comprised of all listed companies on the Nairobi Securities Exchange between January 2001 and December 2014. The Nairobi Securities Exchange had 60 listed companies as at December 2014.

The Data

The study used mainly quantitative data comprising time series observation on interest rate, inflation, foreign exchange rate, herding index and Gross domestic product covering a period of 14 years starting January 2001 to December 2014.

The choice of the 14 year time series data was motivated by the tremendous developments that took place in the Kenyan market between 2001 and 2014. During this period the Kenyan market was liberalised and participants in the market increased drastically following the privatisation act of 2005 and the numerous IPOs that took place. Most of the newly recruited investors were nascent investors who exhibited evident herd-like behaviour. At the same time, the market witnessed persistent volatility to the extent that, the Kenyan vision 2030 development plan highlighted volatility as a critical problem facing the securities market. The study therefore found the 14 year time series data for the period appropriate and capable of returning the best possible results.

Analytical Approach

The 14 year time series data was collected and analysed using e-views version 8 software packages.

Descriptive statistics were used to describe the relationship between macro-economic variables and stock market volatility. The study used both correlation and regression analysis to express the relationship between herding index, macro-economic variables and stock market volatility.

The short run and long run relationships between the variables were established by carrying out a granger causality test and then specifying the vector error corrections model (VECM). The vector error correction model followed the regression model specified below.

$$SMV = \beta_0 + \beta_1 INF + \beta_2 INT + \beta_3 GDP + \beta_4 FEX + \beta_5 HI + \varepsilon .... (1)$$

Where;

SMV is the stock market volatility (standard deviation of the NASI index)

INF is the inflation rate as measured by the consumer price index

INT is the interest rate as measured by the 91 day Treasury bill rate.

GDP is the Gross Domestic Product

FEX is the Foreign Exchange Rate measured by the exchange rate between Kenya shilling and one US dollar

HI is the market-wide herding Index as measure by the Cross Sectional Standard Deviation (CSSD) method.

ε is the error term

Measurement of Variables

Stock Market Volatility

Stock market volatility was measured by the standard deviation of the NASI index. This method is suggested to be suitable in measuring historical stock market volatility. The standard deviation expresses how closely prices of stocks are grouped around the mean or moving average. When prices are closely bunched together, the standard deviation is small. When the price is spread apart, the study observes a relatively large standard deviation. Stock market volatility tends to decline as the stock market rises and increases as the stock market falls (Debesh, 2013).

Inflation

The overall Consumer Price Index (CPI) was used as a proxy for inflation rate. The Consumer Price Index (CPI) is a key macroeconomic indicator used to monitor price movements and how they affect policy decisions (KNBS, 2010). Monthly change in the CPI was obtained from the data provided by the Kenya National Bureau of Statistics.

Interest Rate

The 91 day Treasury bill rate was used as a proxy for interest rates. The 91 day Treasury bill rate was averaged to obtain monthly changes. The study used monthly changes in the 91day Treasury bill rates which were obtained from the Central Bank of Kenya reports.

Gross Domestic Product

This study used the annual percentage growth rate of GDP at market prices based on constant local currency as published by the Kenya National Bureau of Statistics (KNBS). Quarterly GDP figures were extrapolated for the entire study period.

Foreign Exchange

The foreign exchange rate was measured by the monthly changes in the buying rate of a US dollar.

Herding Index

This study views herding behaviour as a collective buying and selling actions of the individuals in an attempt to follow the performance of the market or any other economic factors or styles. Herding is detected by exploiting the information contained in the cross-sectional stock price

movements. This study measures market -wide herding by calculating an index using the Cross Sectional Standard Deviation

EMPIRICAL FINDINGS

Preliminary Tests

This study employed the variance inflation factor (VIF) to test for multicollinearity. Results in Table 1 shows that the explanatory variables are not collinear.

Table 1: Variance Inflation Factor (VIF) for the Explanatory Variables

Variables	VIF
Inflation	1.04633
Interest rate	1.20108
GDP	1.32187
Foreign Exchange rate	1.37713
Herd index	1.09987

The Lagrange Multiplier (LM) tests were used to test for autocorrelation. In this method, autocorrelation is said not to be present if the P-values are more than 0.5. Results in table 2 indicate that there is no auto correlation since the p-values are more that 0.05 at lag 2 respectively.

Table 2: VEC Residual Serial Correlation Lagrange Multiplier Test Results
Null Hypothesis: No serial correlation at lag order 2

Lags	LM-Stat	Prob.
1	52.44605	0.0376
2	41.42835	0.2458

To test whether macro-economic variables and stock returns follow the normal probability distribution Shapiro Wilk test for normality was used. The test has a null hypothesis that the data is normally distributed. The test statistics for normality of each variable are shown in table 3. From the results, the measures did not indicate extreme departure from normality assumption.

Table 3: Normality Test Results

Macro Variable	Mean	Standard deviation	Skewness	Kurtosis
Stock Market Volatility	1.192	0.899	0.735	2.541
Interest Rates	7.735	3.650	0.560	4.371
Inflation Rate	8.300	4.917	0.638	2.340
Foreign Exchange	78.530	6.765	0.026	3.500
Gross Domestic Product	335.196	58.182	0.102	1.747

Stationarity and Unit Root Test

This study employed the use of both Augmented Dickey-Fuller (ADF) test, and Phillips-Perron (PP) tests to test stationarity of the data. The two methods were used for their comparability. ADF is considered more restrictive than PP. In cases where a variable is not stationary using ADF but stationary using PP, the PP test is used to test results and make judgment as PP has higher power than ADF in the presence of structural breaks. The results (table 4) indicate that the null hypothesis of unit root cannot be rejected for all the variables in levels. However, it is rejected in first differences. Thus all variables become stationary after differencing them once i.e. each of them is integrated of order one.

Table 4: Unit Root Test Results

Variable	ADF Test		PP Test		Order of Integration of Variable
	At Levels	At First Difference	At Levels	At First Difference	
HI	− 2.460	− 5.930***	− 8.178***	-	-
SMV	− 2.50	− 6.30***	− 2.246	− 7.647***	I(1)
FOREX	− 2.071	− 6.301***	− 1.758	− 9.535***	I(1)
GDP	0.013	− 3.564***	− 0.405	− 5.132***	I(1)
INF	− 2.958	− 5.553***	− 2.956	− 7.575***	I(1)
TBILL	− 3.053	− 4.613***	− 3.042	− 8.991***	I(1)

Note**:** *** indicates the rejection of the null hypothesis of unit root at 1% level of Significance. For HI, the ADF test indicates non-stationarity, whereas the PP test shows that it is stationary, hence the test is inconclusive for it. We rely on the ADF test for this variable. I (1) indicate that the variable becomes stationary after differencing it once.

Cointegration Test

It was necessary to performing cointegration test since relying on non-stationary time series data would lead to wrong conclusion. The Johansen- Juselius (1990) cointegration test was conducted to test the order of cointegrating relationships. Table 5 shows the hypothesized number of Cointegration relationships being none is rejected at five per cent level of significance, Trace statistic 25.42; p-value 0.0358. Table 4.10 shows that the hypothesized number of Cointegration relationships being at most 1 is not rejected at five per cent level of significance. Trace statistic 11.53; p-value 0.0675. Therefore, Johansen -Juselius test indicates that there is one co integrating relationship between the log of stock market volatility, log of exchange rate and log of GDP.

Table 5: Cointegration Test results

SMV FEX GDP

Hypothesized		Trace	0.05	
No. of CE(s)	Eigenvalue	Statistic	Critical Value	P-Value
None *	0.082633	25.41906	24.27596	0.0358
At most 1	0.048227	11.53320	12.32090	0.0675
At most 2	0.021961	3.575174	4.129906	0.0696

Descriptive Statistics

Table 6: Summary of Statistical Features of Variables Used

Variable	Obs.	Mean	Std. Dev.	Min	Max
SMV	168	1.191787	.8990608	.0087774	3.624102
Herding index	167	.7135298	1.104878	.0410549	4.907421
T bill rate	166	7.73488	3.649142	.83	20.56
Inflation rate	167	8.296331	4.917111	.4612105	19.71573
Forex rate	167	78.52931	6.765172	62.03	99.83
GDP	168	335.196	58.18294	248.88	443.3578

Correlation Analysis

Correlation analysis was carried out to establish the relationship, positive or negative, weaker or stronger, between stock market volatility, interest rate, inflation, GDP, exchange rate and the investor herding behaviour index. Table 7 shows findings in form of correlation coefficients.

Table 7: Correlation Analysis Results

	SMV	TBILL	INF	FEX	GDP	HI
SMV	1					
TBILL	0.2402***					
	(0.0018)	1				
INF	-0.4535***	0.1894**				
	(0.0000)	(0.0145)	1			
FEX	-0.2737***	0.2650***	0.0943			
	(0.0004)	(0.0006)	(0.2253)	1		
GDP	-0.4837***	0.1657**	0.0817	0.4921***		
	(0.0000)	(0.0329)	(0.2941)	(0.000)	1	
HI	-0.1284	0.2790***	-0.1124	-0.0054	0.0421	
	(0.1012)	(0.0003)	(0.1481)	(0.9446)	(0.5894)	1

Key: *** Significant at 1 per cent

** Significant at 5 per cent

Results in Table 7 show that there is a positive and significant correlation between Treasury bill rate (interest rate) and stock market volatility (r = 0.2402, p-value= 0.0018). There is a negative and significant relationship between stock market volatility and foreign exchange rate (r = -0.2737 p-value= 0.0004).There is a negative and significant relationship between inflation and stock market volatility (r= -0.4535, p-value 0.0000). There was a relatively strong negative correlation between GDP and stock market volatility (r= -0.4837 p-value=0.000). The correlation between investor herding and stock market volatility was found to be insignificant (r -0.1284; p-value 0.1012).

VECM Causality Test Results and Discussions

Having established the correlation between various variables of the study, a causality test was done to understand the causal effect of macro-economic variables and herding on stock market volatility.

This study employed the VAR models in particular the Vector Error Correction Model (VECM) and Granger causality test to determine the causality effect of variables considering the problem of non-stationarity in time series data. The analysis is guided by regression equations specified below.

$$SMV = \beta_0 + \beta_1 INF + \beta_2 INT + \beta_3 LGDP + \beta_4 LFEX + \beta_5 HI + \varepsilon .... (2)$$

Where;

SMV is the stock market volatility (standard deviation of the NASI Index.)

INF is the inflation rate as measured by the consumer price index

INT is the interest rate as measured by the 91 day Treasury bill rate.

LGDP is the Logarithm of Gross Domestic Product

LFEX is the Logarithm of Foreign Exchange Rate measured by the exchange rate between Kenya shilling and one US dollar

HI is the market-wide herding Index as measure by the Cross Sectional Standard Deviation (CSSD) method.

ε is the error term

Vector Error Correction Model results are shown in Table 8 below.

Table 8: Vector Error Correction Model

Coefficient	Model
INF (-1)	0.239745
	(0.04017)
	[5.96881]**
TBILL(-1)	-0.18562
	(0.06231)
	[-1.90268]**
LFEX (-1)	2.678194
	(2.27881)
	[1.17526]***
HI(-1)	-0.515755
	(0.22791)
	[-2.26294]
LGDP(-1)	1.056665
	(1.07291)
	[0.98486]***
Constant	-18.21055
Coint.Eq. (ECT)	-0.204123
	[-4.02863]
R-squared	0.234657
Log likelihood	209.4944
Akaike information criterion	-1.030795
Schwarz criterion	1.370669

Note: The VECM results include 162 observations. Figures not in parenthesis or brackets represents regression coefficient, figures in brackets ( ) represents standard errors, while figures in parenthesis [ ] represents t-statistics. A coefficient is significant if the t-statistic is greater than the critical value at 5% which is 1.96.

Key: ** Significant at 5 per cent, *** Not significant

Granger Causality Tests

Granger Causality tests were performed to investigate the short run causal relationship among the variables using E-Views. This test was deemed appropriate as it checks for joint significance of each variable and its lags.

Table 9: Granger Causality Test Results (Block Exogeneity Wald Tests)

Dependent variable: D(SMV)			
Excluded	Chi-sq.	Df.	P-Value.
D(INF)	13.39024	3	0.0039
D(TBILL)	7.121743	3	0.0681
D(LFEX)	4.297999	3	0.2310
D(HI)	3.349327	3	0.3408
D(LGDP)	1.529136	3	0.6756
All	30.05590	15	0.0117

SUMMARY OF FINDINGS

Relationship between Inflation and Stock Market Volatility

The long run equation (table 8) shows that the coefficient of the inflation rate is 0.24 with t-statistic of 5.96 which is greater than the critical five per cent value of 1.96. Therefore, in the long run the coefficient of inflation is positive and significant.

The short run equation as shown by the Granger causality test (table 9) indicates that the t- statistic has a chi-square value of 13.39 and a p-value of 0.0039 which is less than 0.05. Therefore in the short run, changes in inflation and its lags jointly influence stock market volatility at one per cent level of significance.

This means that in the long run, an increase in inflation by one percentage point's increases stock market volatility by approximately 24 percentage points.

Relationship between Interest Rate and Stock Market Volatility

The long run equation (table 8), shows the coefficient of T-Bill rate(interest rate) as 0.12 with t-statistic of -1.90 which is greater than the critical value of 1.645 at 10 per cent level of significance. Therefore, the coefficient is negative and weakly significant. This means that in the long run a unit increase in interest rate decreases stock market volatility by approximately 0.12 per cent.

The short run relationship as shown by Granger causality test (table 9) indicates that changes in T-Bill (interest rate) and its lags had chi-square statistic of 7.1217 with a corresponding p-value of 0.0683 and therefore significant at 10 per cent. This indicates that T-bill (interest rate) and its lags granger cause stock market volatility in the short run. Consequently, at 10 percent level of significance, the study finds a significant relationship between T-bill rate (interest rate) and stock market volatility.

Relationship between Exchange Rate and Stock Market Volatility

The short run relationship as shown by the Granger causality test (Table 9) indicates the chi-square value of the exchange rate and its lags as 4.297 with a corresponding p-value of 0.2310. The p-value is greater than 0.10 implying that it is not significant. Therefore, exchange rate does not granger-cause stock market volatility at 10 percent significance level.

The long run equation shows that the coefficient of the log of the exchange rate is 2.67 with t-statistic of 1.17 which is less than 1.645 and 1.96. Therefore, the coefficient is not significant. This suggests that changes in exchange rate do not have a long run effect on stock market volatility. The results from this study conclude that there is no significant relationship between exchange rate and stock market volatility both in the long run and short run.

Relationship between Gross Domestic Product and Stock Market Volatility

The long run equation (table 8) shows that the coefficient of GDP is 1.06 with t-statistic of 0.985 which is less than the critical t values of 1.645 at 10 percent and 1.96 at five per cent. Therefore, the coefficient is not statistically significant. This implies that gross domestic product has no long run effect on stock market volatility.

The Granger causality test in table 9 shows a chi-square test statistic of 1.529 with a corresponding p-value of 0.6756. This means that GDP does not granger-cause stock market volatility at 10 percent level of significance. Therefore, changes in GDP and its lags do not explain stock market volatility in the short run.

Effect of Herding Behaviour on Stock Market Volatility

The long run equation (table 8) shows that the coefficient of herding index is -0.515 with t-statistic of -2.26294which is less than the critical t values of 1.645 at 10 percent and 1.96 at five per cent. Therefore, the coefficient is not statistically significant. This implies that investor herding behaviour has no long run effect on stock market volatility.

Granger causality test in table 9 shows a chi-square test statistic of 3.349327 with a corresponding p-value of 0.3408. This means that herding does not granger-cause stock market volatility at 10 percent level of significance. Therefore, changes in herding index and its lags do not explain stock market volatility in the short run.

CONCLUSION & POLICY IMPLICATIONS

Based on findings discussed, the study concludes that there is a short run and long run relationship between inflation and stock market volatility in Kenya. An increase in inflation leads to an increase in stock market volatility by 24 percentage in the long run. The study also finds that there is a significant but weak short run and long run relationship between interest rate and stock market volatility in Kenya. In the long run, a unit increase in interest rate causes a decrease in stock market volatility by 0.12 percent. The study concludes that foreign exchange, gross domestic product and herding have no significant relationship with stock market volatility in Kenya.

The findings suggested that stock market volatility can be significantly reduced if the rate of inflation in the country is controlled. In light of this finding, the study recommends a strict monetary policy and control of factors contributing to fluctuations in the rate of inflation in order to reduce the volatility of the stock market. This study recommends that policies on interest rate controls be observed closely to contain rapid increase in interest rate which is found to contribute to stock market volatility.

LIMITATIONS OF THE STUDY

The limitation of this study was in the scope where two macro-economic variables out of the many macroeconomic variables suggested to be predictors of stock market volatility were studied. It would be suggested that more macro-economic variables be included in future similar studies.

Another limitation was in measuring the investor herd behaviour, where the measure in this study was based on average monthly data. More accurate results can be achieved if daily data is used. It may be recommended that future studies be done using daily data.

Finally, the study involved only one behavioural factor out of the many other factors which may possibly have more predictive power on stock market volatility especially in emerging markets. The study would suggest inclusion of more behavioural factors to understand their causal effect on stock market volatility.

AREAS OF FURTHER STUDIES

Further studies should be done using other macro-economic variables in order to understand if they contribute to stock market volatility. The study also recommends that more studies be carried out to explore the effect of other behavioural factors which may have a have a role to play in influencing stock market volatility.

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