EFFECTS OF FOREIGN EXCHANGE RATE FLUCTUATION ON STOCK RETURNS VOLATILITY: A CASE STUDY OF NAIROBI SECURITIES EXCHANGE (NSE)

1996-2012

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DECLARATION STATEMENT

This research paper is my original work and has not been presented for a degree award in any other university.

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DEDICATION

I dedicate this project to my loving husband Johnbosco M. Muthama, and my two lovely sons Joseph Muthama and Brian Kioko.

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I wish to state that the views expressed in this study are my own and thus do not represent the views of the University of Nairobi or any other institution. I am however responsible for any errors and shortcomings of this study.

ABSTRACT

This study sought to examine the effect of foreign exchange rate fluctuations on the stock return volatility on the Nairobi Securities Exchange, Kenya. It used monthly time series data covering the period 1996 to 2012. The study employed Exponential Generalized Autoregressive Conditional Heteroscedasticity (EGARCH) in the empirical analysis. Study findings reveal that Foreign exchange rate affect stock return volatility. The magnitude of volatility, as measured by β is relatively low though significant. The result of the study offers investors and policy makers a basis upon which to make strategic investment decisions. The study therefore recommends a policy that creates favourable foreign exchange market to ensure stability in the stock market.

Keywords: ***stock returns, foreign exchange rate, stock market volatility.***

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LIST OF ACRONYMS

NSE -Nairobi Securities Exchange.

IFC -International Finance Corporation.

ATS -Automated Trading Systems.

USD - United States Dollar

KSH - Kenya Shillings.

GARCH - Generalized Autoregressive Conditional Heteroscedasticity

EGARCH -Exponential Generalized Autoregressive Conditional Heteroscedasticity

SPSS -Statistical Package for Social Studies

ADF -Augmented Dickey-Fuller.

JB - Jarque-Bera

ERT -Foreign Exchange rate.

Rt -Returns

VAR -Variance

CBK -Central Bank of Kenya

CHAPTER ONE

1.1 Introduction

Stock markets especially in small economies plays a vital role in mobilizing economic resources within and from outside the economy. It serves as an important conduit through which funds flow from individuals and corporate entities across the globe to investors in a particular economy. High stock returns imply higher firm and thus overall growth of an economy and vice versa. Stock return volatility[1] leads to uncertainty which hinders effective performance of the financial sector as well as the entire economy at large, (Olweny and Omondi, 2011).

A developing stock market like the Nairobi Securities exchange (NSE) brings about other benefits to the economy through lower cost of equity for firms, existence of mechanism for appropriate pricing and hedging risk and through increased capital flows to the domestic economy as international capital responds to the thriving stock market, Muriu,(2003). Accordingly, emerging stock markets have captured the attention of investors and researchers in recent years.

Volatility analysis in any stock market including NSE is useful in capital cost determination as well as in the evaluation of asset allocation decision. As a result, policy makers rely on volatility estimates to predict how vulnerable the financial markets are. This is because

[1] **volatility refers to the amount of uncertainty or risk about the size of changes in a security's value**

volatility may prejudice the even performance of the financial system, negatively affecting economic performance, (Gabriel and Ugochukwu, 2012).

An inconsistent stock prices change is perceived as a measure of risk by rational investors, financial analysts, brokers, and regulators. In addition this makes them worry about "excessive" volatility in which observed fluctuations in stock prices do not appear to be accompanied by any important news about the firm or market as a whole. In such situation, excessive volatility in stock returns, or "noise," destabilizes the usefulness of stock prices as an "indicator" of the true fundamental value of a firm**, (**Karolyi, 2001).

Policy makers are therefore concerned about macroeconomic factors that may influence stock returns volatility. Many firms devote substantial resources to control and manage foreign exchange rate risk that need to be actively hedged against by investors. Foreign exchange rate has been found to play an important role in the investment and the international trade systems as the appreciation of real exchange rate can lead to growth of foreign direct inflow, hence affecting the overall economy, (Jamil and Ullah, 2013).

Exchange rate volatility has implications on a country's stock market. Exchange rate movement affects output levels of firms including the trade balance of an economy. Price movements in the stock market also affect aggregate demand through wealth, liquidity effects and indirectly the exchange rate, (Subair and Salihu, 2004).

1.2 Nairobi Securities Market: Stylized facts.

Dealing in shares and stocks in Kenya started in the 1920's when the country was still a British colony. The market was informal since there were no rules and regulations to administer stock broking activities. Nairobi securities market was established in 1954 as an extension of the activities at the London stock exchange. Asians and Africans were not allowed to trade in securities, until after the attainment of independence in 1963.

Documented literature shows that NSE is the center of financial markets in East and Central Africa and also one of the best performing securities exchanges in Africa. It contains three segments; Main investors markets segment(MIMS) which deals with the main quotation, the alternative investment market segment (AIMS) which deals with alternative methods of raising capital for small , medium and young companies that find it difficult to meet the MIMS listing requirement and finally the fixed income securities segment (FISMS) which provide independent market for fixed income securities like Treasury bonds, corporate bonds, preference shares and debenture stock and short term securities like the treasury bills and commercial papers.

The NSE market has passed through a number of changes and developments up to date; there are currently 60 companies that are publicly quoted in this market. Live trading on the automated trading systems of the Nairobi Stock Exchange was implemented in September 2006 where it trades in equities, immobilized corporate bonds and treasury bonds. In July 2007 NSE reviewed the Index and announced the companies that would constitute the NSE Share Index that

would become the true gauge of the market. In 2007, A Wide Area Network (WAN) platform was implemented .This eradicated the need for dealers to conduct business presently at the trading floor. Equity settlement cycle moved from the previous T+4 settlement cycles to the T+3 settlement cycle allowing, investors who sell their shares, to get their money three (3) days after the sale of their shares.

NSE is licensed and regulated by Capital Market Authority (established in 1989) to provide a trading platform for listed securities and overseeing its Member. Several policy changes have also been made which include removal of the role of the capital market committee in regulating shares, elimination of double taxation of dividends by conversion of the withholding tax into the final tax ,elimination of the corporate tax on dividend income of the unit trusts, exemption of withholding tax on dividends of corporate tax exempt bodies ,abolition of the stamp duties on retail share transactions and deductibility of all costs incurred in the issue of shares debentures and bonds.

Demutualization was a collaborative initiative by NSE, Capital Markets Authority (CMA) and Kenya Association of Stock Brokers (KASIB), a process supported by the Kenyan government and managed by the Demutualization Steering Committee (DSC) which was established in 2009. Demutualization in NSE was implemented with the objective to improve the governance system by separating the ownership structure and the trading participation rights of the exchange, from a ownership currently limited by guarantee into a company limited by shares. Draft demutualization bill is in place awaiting the Cabinet for approval to become a Act through Cabinet Memorandum.

1.3 Objectives of the study.

The Main objective of this study is to investigate the effects of foreign exchange rate fluctuations on stock market return volatility at the Nairobi Securities Exchange.

Specifically the study shall.

i) Determine the effects of foreign exchange rate fluctuation on stock return volatility in the NSE market.

ii) Draw appropriate policy measures to enhance and promote development of the NSE market.

1.4 Statement of the problem.

The stock market activity is important because the market sets up prices that affect the cost of capital and also because excess market volatility may distort the economy's allocation of capital and lead to financial strains through liquidity crises and macroeconomic instability. Economies characterized stock return volatility usually attracts little or no funds because they are regarded as risky. Developing economies are perceived to have high level of risk that international investors shy away from especially the potentially profitable emerging markets. This perception is more prone when we consider foreign exchange fluctuations, (Muriu, 2003).

Foreign Exchange rate volatility spillover is bad for firms because it affects the real output of a country. The share prices of companies are eventually influenced due to the changes in the current and future cash flows of the firm. The exchange rate fluctuations therefore bear the

effects on stock return, through economic exposure due to changes in foreign exchange rates where operating costs rise. This renders the firms uncompetitive in the world market, which further erodes profitability. This is through the systematic risk that cannot be diversified, which every enterprise must endure with. Foreign exchange rates fluctuations reduce a company's earnings and weaken its balance sheet through translation exposure, (Giddy and Dufey, (1991).

Consistent with other emerging markets worldwide, NSE faces stock return volatility. This volatility adds another layer of risks, not only making the prices of financial assets more difficult but also by generating portfolio flows that are potentially more unstable, Muriu, (2003). Though there have been several studies carried out in Kenya on stock market volatility which include; Equity risk and returns factors (Malamba, 2002), Volatility of stock returns (Muriu, 2003), the effect of macro-economic factors on stock return volatility (Olweny and Omondi, 2010) and the impact of inflation on stock market return and volatility (Murungi, 2012), the evidence on effects of foreign exchange rate fluctuations on stock returns volatility is however missing.

This study aims at filling this gap. In addition the recent global financial crisis has attracted the attention on the financial assets behaviour in the context of foreign exchange rate volatility. The study will set precedence for future research in NSE.

1.5 Significance of the study

This study will be of great interest to academics, investors and policy makers. First, most of the existing evidence is on the developed stock markets, for example, on the response of

Australian stocks, foreign exchange and bond markets to foreign asset returns and volatilities (McNelis, 1993), on the causal relationship between stock returns and exchange rates changes for seven developed and six emerging markets, (Tudor, 2012), and on foreign exchange risk and risk exposure in the Japanese stock market, (Tai, 2010). The scant literature in the Kenya's stock market (NSE) does not address the exchange rate volatility spillover. This study will therefore make a contribution to existing literature.

Second, this study is important to the policy makers in that it will enable them determine the foreign exchange rate levels that would be consistent with the performance of the equity market. It will also enable the government to make sound economic policy decisions for managing exchange rate fluctuations and which regime to adopt.

Finally the study will enable investors to understand how vulnerable the stock market is to exchange rate volatility in order to make the right decisions for minimizing risks and maximizing on the stock returns, through diversification for better risk and portfolio management strategies.

1.6 Organization of the research paper.

This paper is structured into five chapters. Chapter two presents the literature review both theoretical and empirical, chapter three discusses the methodology, chapter four presents the empirical findings and discussions. Chapter five concludes the study.

CHAPTER TWO

LITERATURE REVIEW.

2.1 Introduction

This chapter reviews both theoretical and empirical literature on the effects of foreign exchange rate fluctuations on stock returns volatility. It gives us an overview of the literature which is important in laying the foundation for the analytical framework discussed in the next chapter.

2.2 Theoretical Literature

Classical economic theory considers that stock prices and exchange rates can interact in two ways, the first way is through the 'flow oriented' model and the second is the 'portfolio balance' models. These are two theoretical approaches on foreign exchange rate and stock returns volatility. Flow oriented models according to Richards and Simpson (2009) suggest that exchange rate fluctuations lead to movements in stock prices. The flow oriented approach is based on the macroeconomic view that since stock prices represent the discounted present value of a firm's expected future cash flows, then any incident that affects a firm's cash flow will be reflected in its stock price. According to this model, devaluation of the national currency increases the competitiveness of domestic producers causing the rise of the stock prices and in the contrary their competitiveness is eroded by a too strong national currency causing decline of stock prices, (Dornbusch and Fisher, 1980).

On the contrary, the second classical economic model; the Portfolio balance approaches, or the 'stock oriented' model which was developed by Branson *et al*,(1977) posit that through capital account dealings changes in stock prices can cause fluctuations in exchange rates. This model assigned the leading role to stock prices variations which would affect foreign exchange rate evolution through demand for domestic financial assets, (Richard and Simpson, 2009). Any form of trade of domestic securities in foreign currency (either by foreigners or domestic investors) by moving funds from offshore into domestic equities) in response to domestic stock market has a flow through effect into the currency market.

The increase in stock prices attracts foreign capitals causing the appreciation of the national currency while a decrease of stock prices could discourage the foreign investment, leading to the depreciation of the national currency. The outcomes of the literature on these two models have been mixed in terms of the evidence as to which of the models is most pertinent, or preferred within an economy. This is because the outcomes may depend on the business cycle stage and or the wider economic factors in a given stock market economy, Stefanescu and Dumitriu, (2013).

2.3 Empirical Literature

Some financial economists find the causes of volatility rooted in unexpected new information that modify expected returns on a stock .Others claim that volatility is caused mainly by changes in trading volume, practices or patterns, which in turn are driven by factors such as

modifications in macroeconomic policies, shift in investors' tolerance of risk and increased uncertainty, (Gabriel and Ugochukwu, 2012).

Chang *et al,* (2013) examined the effects of volatility spillovers for firm performance and exchange rates with asymmetry in the Taiwan found a negative correlation between exchange rate returns and stock returns. Aroni,(2011) analyzed factors influencing stock prices for firms listed in NSE and the results showed that there is a negative correlation between foreign exchange rate fluctuations and stock returns. Olweny and Omondi, (2011) studied the effects of macroeconomic factors on stock return volatility at the Nairobi Securities Exchange with foreign exchange rate being one of the explanatory factors. The results showed that foreign exchange rate affect stock return volatility negatively.

Brooks, *et al*, (2010) undertook an analysis on foreign exchange rate exposure of Australian firms and found that a greater part of firms experienced positive foreign exchange rate exposure than negative one. The strongest degree of exposure was observed in the energy, materials and industrial sectors. Australian firms illustrated irregularity and time variation in exchange rate exposure with varying results in different sectors.

Adjasi *et al,* (2008) carried a study in Ghana stock exchange on the effect of exchange rate and the results showed that exchange rate volatility and stock market returns had a negative relationship. To be specific a reduction in stock prices reduces wealth of local investors and further reduces liquidity in the economy. The liquidity level fall in addition reduces interest rates which in turn stimulate capital outflows and as a result causes currency depreciation. This is consistent with Abugri, (2008) who carried out a study in four Latin American countries on the

impact of macroeconomic variables on stock prices. For United States, the results revealed that the stock price was negatively influenced by the exchange rate.

Liu and Shrestha, (2008) observed existence of a strong association among Chinese stock market and macro economic variables. A negative and inverse relationship was observed between currency value and stock prices. Though stock market was observed risky In the short run, outcomes proved that economic basics prevail in the long run. Regardless of short term unpredictability, as Chinese market has a negative association with USA and other developed markets, it can offer shareholders with variegation and superior long-term returns.

Adjasi and Biekpe,(2005) showed that in the long-run, exchange rate depreciation leads to increase in stock market prices in some of the countries and in the short-run exchange rate depreciation reduces stock market returns. The empirical results show a negative correlation between exchange rate returns and stock returns. Subair and Salihu, (2004) also carried a study on the exchange rate volatility and the stock market in Nigeria and found that the exchange rate volatility had a negative impact on the stock markets.

Cheng *et el*, (2011) in their study covering electronic industries in Taiwan found that exchange rate was significant and had a positive effect on stock returns. Hsing, (2011) examined the effects of selected macroeconomic variables on the stock market index of Johannesburg Stock Exchange in South Africa. His study used EGARCH model and the estimates found a positive relationship between exchange rate and the stock market.

Additionally a study by Kandir, (2008) on Turkey to determine the relationship between exchange rate and stock return showed that exchange rate has a positive relationship with portfolio return. Joseph and Vezos, (2006) in their study on the understanding of stock returns to exchange rates in US banks found a strong deviation in foreign exchange rate sensitivity by financial division of banks. According to results found, coefficients of foreign exchange rate sensitivity were characteristically positive for both Ordinary Least Squares and EGARCH. The impact of foreign exchange rates was not significant regardless of employing high frequency data.

Mishra,(2004) carried a study on stock market and foreign exchange market in India and found a significant positive relationship between stock prices and exchange rates. Similarly, Apte,(2001) examined the interrelationship between the stock markets and the foreign exchange market and found a significant positive relationship between exchange rates and stock prices.

In a study carried out by Jefferies and Okeahalam, (2000) on the relationship between stock prices and selected economic variables for South Africa, Zimbabwe and Botswana, the results revealed that in South Africa, stock return volatility was positively affected by real exchange rate. A study carried by Bailey and Chung, (1995) on exchange rate fluctuations, political risk, and stock returns at the Mexican stock market that established a positive relationship between exchange rate changes and stock market return volatility.

Coleman and Tettey, (2008) examined the effect of macroeconomic pointers on stock market conduct of Ghana Stock Exchange (GSE). It was observed that exchange rate losses did not affect the equities on the market, rather the shareholders benefited from the market as the Cedi depreciated.

A study by Benita and Lauterbach, (2004) on the policy factors and exchange rate volatility in the department of foreign exchange activity, Bank of Israel, Jerusalem found that exchange rate volatility has real economic expenditure that influence the price stability of the firm and its profitability as well as country's economic stability as a whole.

2.4 Overview of the literature

Some scholars like Jefferis and Okeahalam, (2000), Hsing, (2011), Cheng' *et al* (2011) have documented a positive relationship between foreign exchange rate and stock returns. Other scholars like Chang *et al* ,(2013) Aroni,(2011), Olweny and Omondi,(2011) Brooks *et al*,(2010), Subair and Salihu, (2004), show a negative relationship between foreign exchange rate and stock returns volatility- depreciation in the local currency leads to increases in stock market prices in the long run. There is therefore no convergence on the evidence on the previous studies empirical literature; hence the study seeks to fill this gap.

CHAPTER THREE

RESEARCH METHODOLOGY

3.1 Introduction

This section provides the theoretical framework on which the study is based on. It also presents the source of data, the empirical design and variable measurement which were used during the study. In this sub-section, we discuss several models that we used to estimate the effects of foreign exchange rate fluctuations on stock returns volatility. The study used various GARCH model frameworks which builds on the ARCH model first introduced by (Engel 1982).

3.2 Model Specification

3.21 GARCH (1, 1) Model

The ARCH Model takes the form,

$$R_t = \beta_0 + \beta_1 \Delta ERT + \cdots + \varepsilon_t \quad \text{.....1}$$

$$h_t = \omega + \sum_{i=1}^{p} \alpha_i \varepsilon_{t-1}^2 \quad \text{.....2}$$

With equation 1 and 2 being the mean and the variance equation respectively, whereby $\omega > 0$ $\alpha_i \ldots\ldots \alpha_p \geq 0$ are constant parameters. The conditional variance h_t under the ARCH model reflects only information from time t_{-p} to t_{-1}

The model however has only one memory period ,therefore the study goes further to employ GARCH model as generalized by Bollerslev, (1986) which makes the variance ($\delta_t^2 = h_t$)

linear in lagged values of h_{t-j} where by the volatility in period j depends on the volatility for the previous period t.

The variance equation for GARGH (1, 1) model is as depicted as,

$$\delta_t^2 = \omega + \alpha_1 \delta_{t-1}^2 + \beta_1 \delta_{t-1}^2 \quad \text{.....3}$$

These models are well known for capturing persistence of volatility observed in time series. This is because the two models treat heteroskedasticity as a variance on each error term.

The main weaknesses with these models is that they ignore information on the direction of stock returns and foreign exchange rate since it's only the magnitude that matters to the two models while volatility is affected by direction of the information. As we try to investigate the volatility in stock returns and the fluctuations in foreign exchange rate, we are faced with the following challenges. Since the stock returns and the foreign exchange rate fluctuations have non-normal distribution, it is unlikely that the ARCH and the GARCH models are useful since they impose symmetry on conditional variance of stock returns and foreign exchange fluctuations hence producing biased estimates when price and exchange rate movements are large. Particularly they fail to model leverage effect.

In this case therefore we adopt asymmetric models with a view of establishing the validity of the symmetric distribution. Specifically, we estimate the asymmetrical EGARCH model because the data used is time series data and has a long span of period (seventeen years with daily stock returns and foreign exchange rate).

3.22 EGARCH Model.

A number of studies have investigated the performance of GARCH models on explaining volatility of mature stock markets, for example; Sentana and Wadhwani, 1992; Kim and Kon, 1994; Floros, 2007; Floros , 2008), but only a few have tested the GARCH models using daily data in the developing stock markets, (Olweny and Omondi,2011). The Exponential Generalized Autoregressive Conditional Heteroskedascity (EGARCH) model was used to determine the effect of foreign exchange rate on stock returns volatility in NSE. This is most often preferred to the symmetrical GARCH model in studying financial markets. As recognized by Koulakiotis *et al* (2006), GARCH (1,1) is relatively weaker than the EGARCH in studying financial markets phenomenon.

The EGARCH model is expressed as shown:

$$R_t = \beta_0 + \beta_1 \Delta ERT + \cdots + \varepsilon_t \quad \text{.....4}$$

$$\log\delta_t^2 = \omega + \delta_{t-1}^2 + \alpha \frac{\varepsilon_{t-1}}{\delta_{t-1}} + \lambda \frac{\varepsilon_{t-1}}{\delta_{t-1}} + \delta_t \quad \text{.....5}$$

R_t is defined as

$$R_t = \log P_t - \log P_{t-1}$$

In this case equation (4) gives the mean while equation (5) estimates the variance.

R_t -represents the returns of the NSE 20 share Index.

P_t -represents the prices of the NSE 20 share Index.

$\log\delta_t^2$ - log of conditional variance of stock market returns.

ERT- Foreign Exchange Rate

β - Vector of coefficient

ε- Error term

λ- Leverage

EGARCH Model explains the leverage effect and volatility clustering. Leverage effect is shown by $\boldsymbol{\lambda < 0}$. If $\lambda \neq 0$, then the impact of news is asymmetric. The stock return was calculated using the NSE 20 share index as, log of the stock prices. The NSE 20 share index is an indicator of the stock market performance. EGARCH model is an important model since it measures the leverage effect, volatility magnitude effect and its persistence in the market.

3.3 Definition and measurement of variables

3.31 Foreign exchange rate

An exchange rate is the price of one country's currency for another. In practice, almost all trading of currencies are quoted in terms of the U.S. dollar. This is to say that U. S.D is used as the base currency. For example, both the Euro and the British pound will be traded with their price quoted in U.S. dollars. If the quoted price is the price in dollars of a unit of foreign exchange, the quotation is said to be in direct (or American) terms, (Ross, 2002). The change in

exchange rate is given by difference between the current rates less the previous rate dividend by the previous rate which can also be taken in logarithmic form.

3.32 Stock Returns:

Existing literature defines stock returns as earning per share that the investors generate out of their stock investment, (Murungi, 2012). It could be in form of profit through trading in secondary market or in form of dividends given by the company to its shareholders. They are not fixed ensured returns but are subject to market risk, they are not homogenous and may change from investor to investor depending on the amount of risk one is prepared to take and the quality of his stock market analysis. Contrary to the fixed return generated by bonds, the stock market returns are variable in nature .The idea behind stock return is to buy low and sell high, Choudhry, (1999). Stock market returns are subject to risk, but there are many derivative instruments for example futures, options, that are used for hedging and arbitrage against risk associated with such investment though they don't give higher returns but help in minimizing losses and in protecting the capital. The stock return is measured in logarithmic form as;

$R_t = \log P_t - \log P_{t-1}$ Whereby,

R_t - represents the returns of the NSE 20 share Index.

P_t - represents the prices of the NSE 20 share Index.

3.4 Sources of Data.

Data for this study was obtained from Nairobi Securities Exchange. The study used daily time series data for NSE-20 share index and the foreign exchange rate (USD) that covered the period 1996 to 2012. NSE 20 share index is the main stock index consisting of stocks from 20 blue chip companies. The series of index values for each month is calculated by averaging the daily values of the index. The index is selected as the proxy representing the overall stock prices since it reflects the change in different types of asset securities in the stock exchange representing all the segments in the in the market. Data on foreign exchange rate (USD) was obtained from Central Bank of Kenya database.

Previous studies that have used the same data set but with different time period and model specification include; Muriu (2003), Olweny and Omondi (2011), Aroni, (2012) and Murungi, (2012). The data used and the sample period is in Appendix I.

CHAPTER FOUR.

EMPIRICAL RESULTS

4.1 Introductions.

This chapter provides discussion on the summary statistics and empirical findings. The study relied on descriptive statistics, the unit root Augmented Dickey fuller (ADF) test as proposed by Dickey and fuller (1979, 1981) and EGARCH (Nelson 1991) models and SPSS in data analysis.

4.2 Descriptive Statistics

Table1 gives the mean, median, maximum, minimum, standard deviation, skewness and kurtosis for the variables used in the study.

Table 1: Descriptive statistics.

	Returns(R_t)	**Ksh/U.S. Exchange rate(ERT)**
Mean	-0.0008	0.0017
Median	0.0004	-0.0005
Maximum	0.1596	0.1454
Minimum	-0.2925	-0.0975
Std. Dev	0.0607	0.0254
Skewness	-0.5898	0.9379
Kurtosis	6.1964	10.712
Jarque- Bera	98.191	535.54
Probability	0.0000	0.0000
Observations	203	203

A distribution is negatively skewed when the mean is less than the median and positively skewed if the mean is more than the median. Stock return is negatively skewed while foreign exchange rate has a positive skewness. Jarque-Bera test statistics uses two statistic components which are skewness and the kurtosis. Skewness confers a measure of how symmetric the observations are about the mean which is equal to a zero value in case of a normal distribution.

A distribution can have positive skewness or a negative skewness while Kurtosis measures the thickness in the tails of a probability density function. For a normal distribution the kurtosis is equal to a value of 3.This test statistic is used to find out whether the variables in this study follow normal probability distribution. JB test take the form,

$$JB = n[\frac{S^2}{6} + \frac{K-3\ ^2}{24}]$$

Whereby n= sample size, S = Skewness coefficient k= kurtosis coefficient. Here we test the null hypothesis against the alternative hypothesis

h_o =normal distribution,

h_1 =non normal distribution.

Table 1 shows that the two variables are not normally distributed since the stock returns and foreign exchange rate Jarque-Bera values exceed the critical values for any reasonable significance level to lead to the conclusion that the stock returns and foreign exchange rate

fluctuations do not follow a normal distribution. Here we compare the $\chi 2$ (chi-square) distribution with 2 degrees of freedom at 1%, 5% and 10% significance levels the critical values being 9.21, 5.99 and 4.61 respectively.

Further descriptive statistics are given in the Appendices. These are the linear graphical representation of foreign exchange rate data (ERT) and NSE-20 share index in appendix II and III respectively, histogram and statistical figures for the two variables in appendix IV and V.

The linear graphs represent the fluctuation levels of both stock returns and foreign exchange rate. The graph shows a maximum value of 0.15 in 1997M08, a minimum value of -0.10 in 2008M03 and a mean value of 0.001. Appendix III shows maximum value of 0.16 in June 2005, minimum value of -0.29 in February 2009 and mean values of -0.001.

The histogram gives the representation of the descriptive statistics for stock returns and foreign exchange rate. In Appendix IV and V, we demonstrate that the two variables are not normally distributed since the Jarque-Bera values for the two variables exceeds the critical values for any reasonable significance level hence we conclude that stock returns and foreign exchange rate fluctuations do not follow a normal distribution. The graph in Appendix IV shows a negative skewness (it is slightly skewed to the left) while the Appendix V shows a positive skewness (it is slightly skewed to the right).

4.3 Test for stationarity

In empirical analysis, the main concern is to establish if a series is stationary (do not contain a unit root) or non-stationary (contains a unit root). This is to ensure that both the right hand side and the left hand side of the regressed variables are balanced. Time series data is often assumed to be non-stationary, therefore it's necessary to perform a pre-test to ensure there is a stationary relationship in order to avoid spurious regression problem. Therefore to tackle the issue of non-stationarity in order to avoid the problem of spurious regression, we carry out a unit root test (ADF) which is the modified version of Dickey-Fuller (DF).

The Augmented Dickey-Fuller test is specified as;

$$Y_{t} = bo + \beta Y_{t-1} + \mu_1 Y_{t-1} + \mu_2 Y_{t-2} + \ldots\ldots\ldots\ldots + \mu_p Y_{t-p} + e_t$$

Where Y_t represents time series to be tested, b is the intercept term, β is the coefficient of interest in the unit root test, μ_i is the parameter of augmented lagged first difference of $Y_{t.}$ to represent the p^{th} order autoregressive process and e_t is the white noise error term.

$h_{o;\ a=0\ (}$non stationary$_{)}$.....Null hypothesis

$h_{o;\ a\neq 0\ (}$stationary$_{)}$.....Alternative hypothesis.

If the null hypothesis is rejected, this means that the time series data is stationary. The decision criteria involve comparing the computed tau (ADF) values with the MacKinnon critical

values for the rejection of a hypothesis for a unit root. If the computed tau (ADF) statistic is less negative (i.e. lies to the right of the MacKinnon critical values relative to the critical values. we do not reject the null hypothesis of non -stationarity in time series variables.

Table 2: Results of Augmented Dickey Fuller (ADF) stationarity test at level

ADF Test at Level (Trend and Intercept) Variable	**ADF Statistic**	**Critical value**	**Durbin Watson**	**Lag**	**Inference**
$\mathbf{R_t}$	-12.12	-3.43	2.01	0	I(0)
ERT	-12.09	-3.43	1.95	0	I(0)
***MacKinnon critical values for rejection of hypothesis of a unit root at 5%.**					

The ADF test for the stock returns and foreign exchange rate at level reveal that both variables are stationary (do not contain a unit root) as indicated. Since the computed tau (ADF) statistic is more negative (i.e. it lies to the left of the MacKinnon critical values relative to the critical values. we reject the null hypothesis of non -stationarity and accept the alternative hypothesis that the two variable are stationary.

4.4 Testing for correlation

Correlation is a measure that indicates the extent to which two or more variables move together. This study carried a correlation test between stock returns and foreign exchange rate fluctuation using SPSS statistical software to determine the level of significance of the two variables. Table 3 shows that the two variables are negatively correlated as shown by the Pearson r statistic for correlation (-0.22) which is a weak correlation. Correlation is statistically significant

at the 0.01 level (2-tailed), meaning that increase or decrease in stock returns significantly relate to increase or decrease in foreign exchange rate. The results show that when foreign exchange rate increases by 1%, stock return decreases by 22%. This has an inference that when exchange rate increases, investors shy away from the market and divest or offload their stocks . This consequently results in the decrease of stock return.

Table 3: Correlation matrix

Variable		Rt	ERT
Rt	Pearson Correlation	1	-0.22
	Sig. (2-tailed)		0.002
	Sample size(N)	203	203
ERT	Pearson Correlation	-0.22	1
	Sig. (2-tailed)	0.002	
	Sample size(N)	203	203

4.5 Estimation of the EGARCH model.

Table 4 shows EGARCH estimation results. Table 4 shows that the magnitude of volatility, as denoted by β is relatively low and highly significant . This implies that investors prefer using local currency as opposed to the foreign currency which is deemed less risky. The volatility persistence of foreign exchange rate is low (-0.25) but it is significant as indicated by the p-values (0.0003).

Table 4: EGARCH model results

Dependent Variable: R_t				
Method: ML - ARCH (Marquardt) - Normal distribution				
Sample (adjusted): 1996M02 2012M12				
Included observations: 203 after adjustments				
Convergence achieved after 33 iterations				
Mean equation				
Variable	Coefficient	Std. Error	z-Statistic	Prob.
ERT	-0.43	0.13	-3.35	0.0008
Variance Equation				
ω	-6.38	1.71	-3.72	0.00
β	0.50	0.14	3.58	0.00
α	-0.25	0.09	-3.59	0.00
λ	-0.05	0.31	-0.15	0.88
R-squared	0.05	Mean dependent var		0.00
Adjusted R^2	0.05	S.D. dependent var		0.06
S.E. of regression	0.06	Akaike info criterion		-2.87
Sum squared resid	0.71	Schwarz criterion		-2.77
Log likelihood	296.09	Hannan-Quinn criter.		-2.83
Durbin-Watson stat	1.76			

The negative sign (-0.05) suggest that there are leverage effects in the returns series and that bad news has a larger impact on stock returns volatility and its insignificant meaning that these effects are not pronounced during the sample periods. The results show that bad news impact more on stock return volatility than good news in the market. The findings are consistent with Olweny and Omondi (2011) and Subair and Salihu, (2004).

Table 5: Summary statistics from estimated GARCH Model.

Co-efficient	**EGARCH**
ω	-6.38
α	-0.25
β	0.50
λ	-0.05
Mean	0.00
Std deviation	0.06
Skewness	-0.56
Kurtosis	6.08
Jarque-Bera	88.91
Probability	0.00

Table 5 shows the values of the Ljung box test statistics. The ARCH procedure does not normalize residuals as indicated by presence of kurtosis, skewness and Jarque-Bera statistic. The skewness statistics indicate rejection of the symmetric distribution null hypothesis while the values for kurtosis show that there is leptokurtosis in the distribution of the residuals from the stock returns and the foreign exchange series. These findings indicate that the estimated asymmetric conditional variance process is appropriate for explaining the evolution of the variance in both variables.

CHAPTER FIVE

5.1 Introduction

This section provides summary of the empirical findings, conclusions and policy implications of the study. Additionally it suggests areas for further research.

5.2 Summary of the findings

This study sought to establish whether changes in foreign exchange rate had any effect on the stock returns volatility. The analysis covered firms listed in the NSE, sampled monthly average which was computed from the daily NSE-20 Share index and monthly USD Exchange rate data for 204 months covering the period 1996-2012. The study used Eviews 7.0 software in estimation of the EGARCH model and SPSS statistical software to analyze the time series data with tests being carried to establish the uniqueness of the two variables in this study. The estimates for descriptive statistics for the two variables reveal that stock returns is negatively skewed while foreign exchange rate has a positive skewness.

A test on the normal distribution was carried out using the JB test. This was mainly carried out to find out whether the variables in the study follow a normal distribution. The results show that stock returns and foreign exchange rate are not normally distributed because the JB values for both variables exceeds the critical values as per the chi square values with 2(two) degrees of freedom. The test for stationarity using the ADF test indicate that time series for

stock returns and foreign exchange rate at level are stationary hence we rejected the null hypothesis that time series is non stationary.

The study also did correlation analysis in order to establish the extent to which the two variables move together. The results reveal that the two are negatively correlated and a week correlation in this case is found. That is when foreign exchange rate increases by 1% stock returns decrease by 22%. When local currency appreciates against the U.S.D, there is increased investment because the investors are assured of higher returns. EGARCH estimates revealed that the magnitude of volatility as denoted by β is relatively low but is significant. The volatility persistence of foreign exchange rate is also low.

5.3 Conclusions and policy implications

Though there is a weak correlation between the two variables as depicted by the estimation results, important policy implications arise out of the findings of the study. The Capital Markets Authority and other policy makers should be conscious of the effects of exchange rate on stock returns. The aim should be to stimulate development of the financial markets to mobilize long term capital for the economic development. In setting relevant strategies policy makers, need to consider the effects of foreign exchange rate such that effective decisions can be made for long term financial market sustainability. The study therefore makes the following recommendation.

There should be a deliberate policy framework aimed at creating favourable foreign exchange market to provide stability to the national currency. This would reinforce investors' confidence, attracting more foreign investments into the equity market which will enhance market liquidity.

5.4 Limitation of the study.

The study used the NSE- 20 share index which includes all listed companies in the NSE. The use of NSE- 20 share index makes the sample selection to be biased and so excludes those companies that have not been listed at NSE. It also limits itself to one currency (USD). Therefore the policy implications relate to only those firms that are listed at NSE.

5.5 Areas for further research.

This study sought to explore the effects of foreign exchange rate fluctuations on stock return volatility in the NSE .The finding in this study reveal that there is a weak correlation between the two variables. Since the stock market is a very vital institution to drive economic growth and development, efficiency should be a core value in this market. Therefore, further research may be undertaken to find out how money supply will impact stock returns volatility in NSE and which exchange rate regime will be most suitable for CBK to adopt, either the fixed exchange rate regime, floating exchange rate regime or both depending on the situation in the market. It could also be interesting to research on stock returns volatility in NSE relative to another developing stock market in Africa.

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Appendices

Appendix I: Sample Data

Year	Month	NSE-20 Share Index	Ksh/U.S.D Exchange rate(ERT)	Stock returns (Rt)	Δ ERT
1996	Jan	3409.40	56.71		
	Feb	3230.08	58.29	-0.0555	0.0271
	Mar	3041.79	58.41	-0.0619	0.0021
	Apr	3019.20	58.37	-0.0075	-0.0007
	May	3031.02	58.24	0.0039	-0.0022
	Jun	3144.33	57.99	0.0360	-0.0043
	Jul	3150.06	57.31	0.0018	-0.0119
	Aug	3073.88	56.99	-0.0248	-0.0056
	Sep	3089.80	56.43	0.0052	-0.0099
	Oct	3055.97	55.86	-0.0111	-0.0102
	Nov	3042.06	55.63	-0.0046	-0.0041
	Dec	3114.11	55.15	0.0231	-0.0087
1997	Jan	3479.67	54.74	0.1051	-0.0075
	Feb	3473.99	54.93	-0.0016	0.0035
	Mar	3354.72	54.89	-0.0356	-0.0007
	Apr	3288.44	54.38	-0.0202	-0.0094
	May	3460.55	53.75	0.0497	-0.0117
	Jun	3530.43	54.24	0.0198	0.0090
	Jul	3466.92	57.36	-0.0183	0.0544
	Aug	3403.22	67.12	-0.0187	0.1454
	Sep	3447.41	63.77	0.0128	-0.0525
	Oct	3314.84	62.64	-0.0400	-0.0180
	Nov	3046.60	63.93	-0.0880	0.0202
	Dec	3115.14	63.05	0.0220	-0.0140
1998	Jan	3348.11	61.16	0.0696	-0.0309
	Feb	3362.23	60.52	0.0042	-0.0106
	Mar	3213.30	60.13	-0.0463	-0.0065
	Apr	3015.01	59.61	-0.0658	-0.0087

	May	3016.44	62.6	0.0005	0.0478
	Jun	2907.55	60.52	-0.0375	-0.0344
	Jul	2853.07	59.34	-0.0191	-0.0199
	Aug	2862.66	59.37	0.0034	0.0005
	Sep	2810.32	60.01	-0.0186	0.0107
	Oct	2783.73	59.87	-0.0096	-0.0023
	Nov	2583.73	59.63	-0.0774	-0.0040
	Dec	2962.06	61.82	0.1277	0.0354
1999	Jan	2983.48	61.8	0.0072	-0.0003
	Feb	2988.88	62.5	0.0018	0.0112
	Mar	2815.29	64.01	-0.0617	0.0236
	Apr	2767.89	65.65	-0.0171	0.0250
	May	2760.05	68.82	-0.0028	0.0461
	Jun	2756.43	73.6	-0.0013	0.0649
	Jul	2744.85	73.1	-0.0042	-0.0068
	Aug	2493.50	74.41	-0.1008	0.0176
	Sep	2428.09	75.68	-0.0269	0.0168
	Oct	2309.33	75.57	-0.0514	-0.0015
	Nov	2294.12	74.79	-0.0066	-0.0104
	Dec	2303.18	73.94	0.0039	-0.0115
2000	Jan	2308.43	70.68	0.0023	-0.0461
	Feb	2277.00	73.22	-0.0138	0.0347
	Mar	2233.18	74.43	-0.0196	0.0163
	Apr	2162.20	74.36	-0.0328	-0.0009
	May	2052.90	75.97	-0.0532	0.0212
	Jun	2003.00	77.55	-0.0249	0.0204
	Jul	1966.52	76.41	-0.0186	-0.0149
	Aug	1958.00	76.45	-0.0044	0.0005
	Sep	2001.00	78.2	0.0215	0.0224
	Oct	2043.47	79.26	0.0208	0.0134
	Nov	1926.67	78.86	-0.0606	-0.0051
	Dec	1913.35	78.73	-0.0070	-0.0017

2001	Jan	1897.50	78.622	-0.0084	-0.0014
	Feb	1932.90	78.081	0.0183	-0.0069
	Mar	1830.50	77.817	-0.0559	-0.0034
	Apr	1767.90	77.551	-0.0354	-0.0034
	May	1636.50	78.523	-0.0803	0.0124
	Jun	1657.10	78.985	0.0124	0.0058
	Jul	1620.70	78.876	-0.0225	-0.0014
	Aug	1505.50	78.934	-0.0765	0.0007
	Sep	1400.90	79.021	-0.0747	0.0011
	Oct	1472.90	79.081	0.0489	0.0008
	Nov	1420.50	78.973	-0.0369	-0.0014
	Dec	1355.10	78.6	-0.0483	-0.0047
2002	Jan	1343.40	78.597	-0.0087	0.0000
	Feb	1313.60	78.11	-0.0227	-0.0062
	Mar	1183.10	78.058	-0.1103	-0.0007
	Apr	1129.30	78.302	-0.0476	0.0031
	May	1071.10	78.321	-0.0543	0.0002
	Jun	1086.60	78.786	0.0143	0.0059
	Jul	1097.70	78.736	0.0101	-0.0006
	Aug	1043.38	78.677	-0.0521	-0.0007
	Sep	1043.40	79.026	0.0000	0.0044
	Oct	1116.36	79.659	0.0654	0.0079
	Nov	1161.60	80.107	0.0389	0.0056
	Dec	1362.90	77.072	0.1477	-0.0394
2003	Jan	1510.60	77.743	0.0978	0.0086
	Feb	1557.70	76.603	0.0302	-0.0149
	Mar	1608.30	76.646	0.0315	0.0006
	Apr	1846.60	74.498	0.1290	-0.0288
	May	2074.70	73.114	0.1099	-0.0189
	Jun	2005.10	74.167	-0.0347	0.0142

	Jul	1935.00	75.431	-0.0362	0.0168
	Aug	2107.40	76.678	0.0818	0.0163
	Sep	2379.90	78.417	0.1145	0.0222
	Oct	2457.10	78.447	0.0314	0.0004
	Nov	2737.00	76.35	0.1023	-0.0275
	Dec	2738.00	76.139	0.0004	-0.0028
2004	Jan	3157.90	76.472	0.1330	0.0044
	Feb	3175.40	76.45	0.0055	-0.0003
	Mar	2770.60	77.762	-0.1461	0.0169
	Apr	2707.60	78.347	-0.0233	0.0075
	May	2689.10	79.372	-0.0069	0.0129
	Jun	2639.80	79.513	-0.0187	0.0018
	Jul	2708.00	80.4	0.0252	0.0110
	Aug	2708.90	80.044	0.0003	-0.0044
	Sep	2670.70	81.114	-0.0143	0.0132
	Oct	2829.70	81.272	0.0562	0.0019
	Nov	2918.20	81.242	0.0303	-0.0004
	Dec	2945.60	77.344	0.0093	-0.0504
2005	Jan	3094.30	76.801	0.0481	-0.0071
	Feb	3212.80	75.622	0.0369	-0.0156
	Mar	3208.70	75.017	-0.0013	-0.0081
	Apr	3227.60	76.602	0.0059	0.0207
	May	3505.40	77.057	0.0792	0.0059
	Jun	3972.20	76.206	0.1175	-0.0112
	Jul	3982.00	76.044	0.0025	-0.0021
	Aug	3938.70	75.696	-0.0110	-0.0046
	Sep	3832.70	74.078	-0.0277	-0.0218
	Oct	3339.50	73.606	-0.1477	-0.0064
	Nov	3974.10	74.486	0.1597	0.0118
	Dec	3973.00	72.367	-0.0003	-0.0293

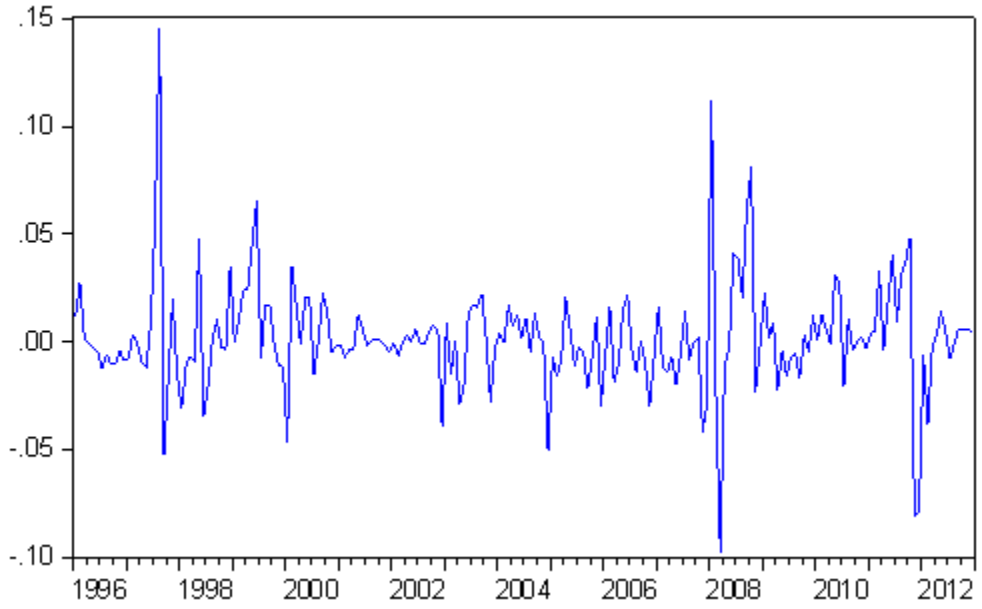
2006	Jan	4171.80	71.982	0.0477	-0.0053
	Feb	4056.60	73.198	-0.0284	0.0166
	Mar	4101.60	71.872	0.0110	-0.0184
	Apr	4025.20	71.158	-0.0190	-0.0100
	May	4349.80	72.27	0.0746	0.0154
	Jun	4260.50	73.88	-0.0210	0.0218
	Jul	4258.50	73.617	-0.0005	-0.0036
	Aug	4486.10	72.624	0.0507	-0.0137
	Sep	4879.90	72.679	0.0807	0.0008
	Oct	5314.40	72.02	0.0818	-0.0092
	Nov	5615.20	69.948	0.0536	-0.0296
	Dec	5645.70	69.397	0.0054	-0.0079
2007	Jan	5774.30	70.537	0.0223	0.0162
	Feb	5387.30	69.733	-0.0718	-0.0115
	Mar	5133.70	68.781	-0.0494	-0.0138
	Apr	5148.10	68.306	0.0028	-0.0070
	May	5001.80	66.966	-0.0292	-0.0200
	Jun	5146.70	66.564	0.0282	-0.0060
	Jul	5340.10	67.509	0.0362	0.0140
	Aug	5372.00	66.989	0.0059	-0.0078
	Sep	5146.50	66.971	-0.0438	-0.0003
	Oct	4971.00	67.114	-0.0353	0.0021
	Nov	5234.50	64.424	0.0503	-0.0418
	Dec	5444.80	62.675	0.0386	-0.0279
2008	Jan	4712.70	70.561	-0.1553	0.1118
	Feb	5072.40	68.978	0.0709	-0.0229
	Mar	4843.20	62.848	-0.0473	-0.0975
	Apr	5336.00	62.136	0.0924	-0.0115
	May	5175.80	62.029	-0.0310	-0.0017
	Jun	5185.60	64.694	0.0019	0.0412
	Jul	4868.30	67.318	-0.0652	0.0390
	Aug	4648.80	68.733	-0.0472	0.0206
	Sep	4180.40	73.219	-0.1120	0.0613
	Oct	3386.70	79.653	-0.2344	0.0808
	Nov	3341.50	77.881	-0.0135	-0.0228
	Dec	3521.20	77.711	0.0510	-0.0022

2009	Jan	3198.90	79.544	-0.1008	0.0230
	Feb	2474.80	79.687	-0.2926	0.0018
	Mar	2805.00	80.431	0.1177	0.0093
	Apr	2800.10	78.662	-0.0017	-0.0225
	May	2852.60	78.348	0.0184	-0.0040
	Jun	3294.60	77.158	0.1342	-0.0154
	Jul	3273.10	76.607	-0.0066	-0.0072
	Aug	3102.70	76.233	-0.0549	-0.0049
	Sep	3005.50	74.999	-0.0323	-0.0165
	Oct	3083.60	75.239	0.0253	0.0032
	Nov	3189.60	74.907	0.0332	-0.0044
	Dec	3247.40	75.82	0.0178	0.0120
2010	Jan	3565.30	75.886	0.0892	0.0009
	Feb	3629.40	76.897	0.0177	0.0131
	Mar	4072.90	77.331	0.1089	0.0056
	Apr	4233.20	77.266	0.0379	-0.0008
	May	4241.80	79.745	0.0020	0.0311
	Jun	4339.30	81.917	0.0225	0.0265
	Jul	4438.60	80.23	0.0224	-0.0210
	Aug	4454.60	81.071	0.0036	0.0104
	Sep	4629.80	80.778	0.0378	-0.0036
	Oct	4659.60	80.787	0.0064	0.0001
	Nov	4395.20	80.974	-0.0602	0.0023
	Dec	4464.90	80.752	0.0156	-0.0027
2011	Jan	4465.00	81.03	0.0000	0.0034
	Feb	4240.00	81.47	-0.0531	0.0054
	Mar	3887.00	84.21	-0.0908	0.0325
	Apr	4029.00	83.89	0.0352	-0.0038
	May	4078.00	85.43	0.0120	0.0180
	Jun	3968.00	89.05	-0.0277	0.0407
	Jul	3738.00	89.9	-0.0615	0.0095
	Aug	3464.00	92.79	-0.0791	0.0311
	Sep	3284.00	96.36	-0.0548	0.0370
	Oct	3507.00	101.27	0.0636	0.0485
	Nov	3155.00	93.68	-0.1116	-0.0810
	Dec	3205.00	86.86	0.0156	-0.0785

2012	Jan	3224.00	86.34	0.0059	-0.0060
	Feb	3304.00	83.18	0.0242	-0.0380
	Mar	3367.00	82.9	0.0187	-0.0034
	Apr	3547.00	83.19	0.0507	0.0035
	May	3651.00	84.38	0.0285	0.0141
	Jun	3704.00	84.79	0.0143	0.0048
	Jul	3832.00	84.14	0.0334	-0.0077
	Aug	3866.00	84.08	0.0088	-0.0007
	Sep	3972.00	84.61	0.0267	0.0063
	Oct	4147.00	85.11	0.0422	0.0059
	Nov	4083.00	85.63	-0.0157	0.0061
	Dec	4133.00	85.99	0.0121	0.0042

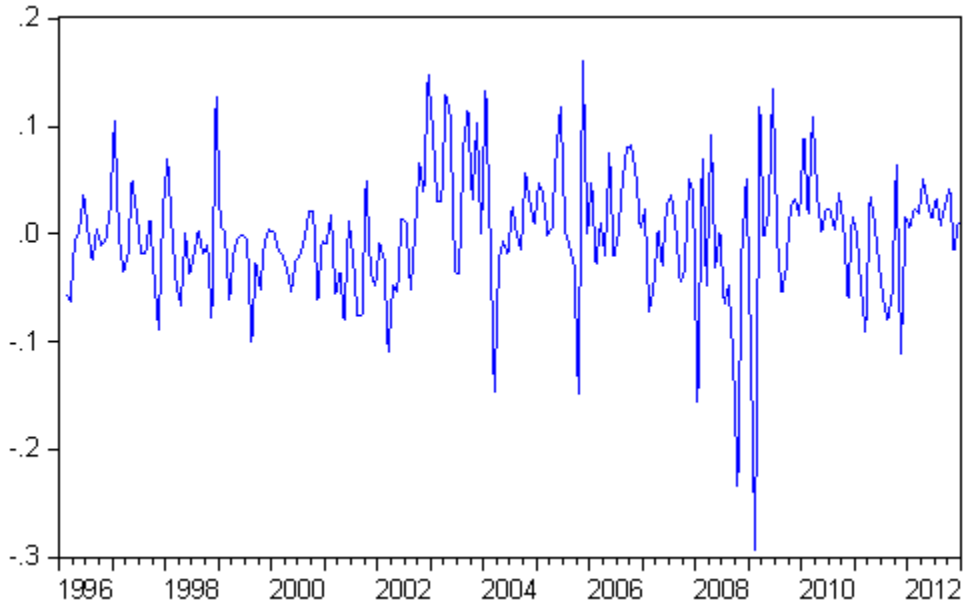
Source: NSE and CBK database.

Appendix II: Linear graphical representation of ERT Data.



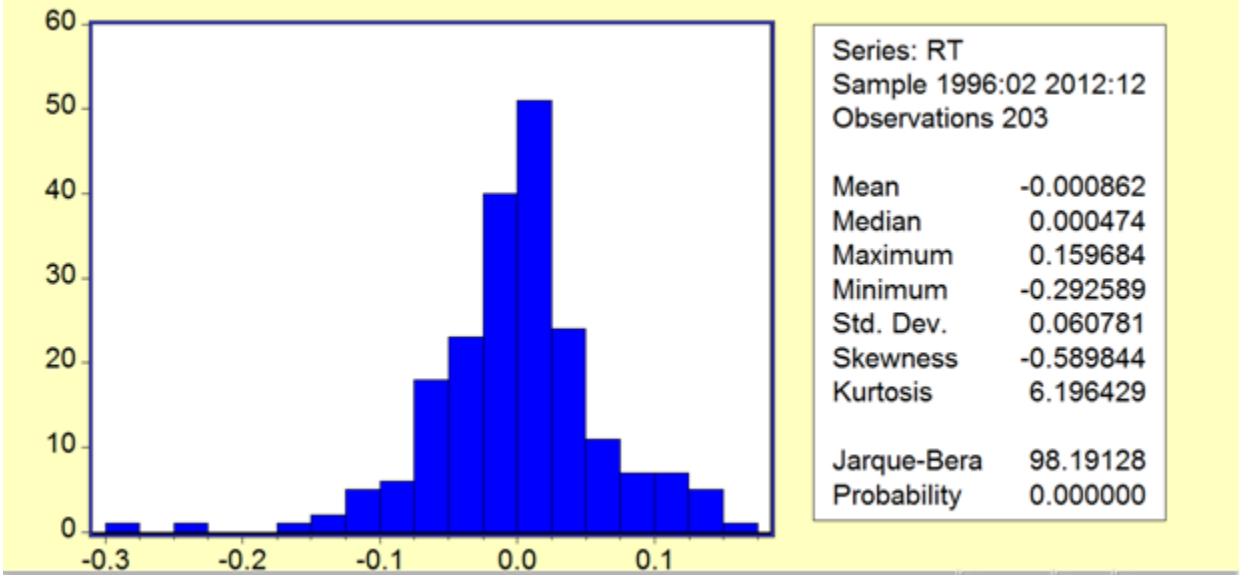
Source: CBK Data-Foreign Exchange Rate

Appendix III: Linear graphical representation of NSE- 20 share index data



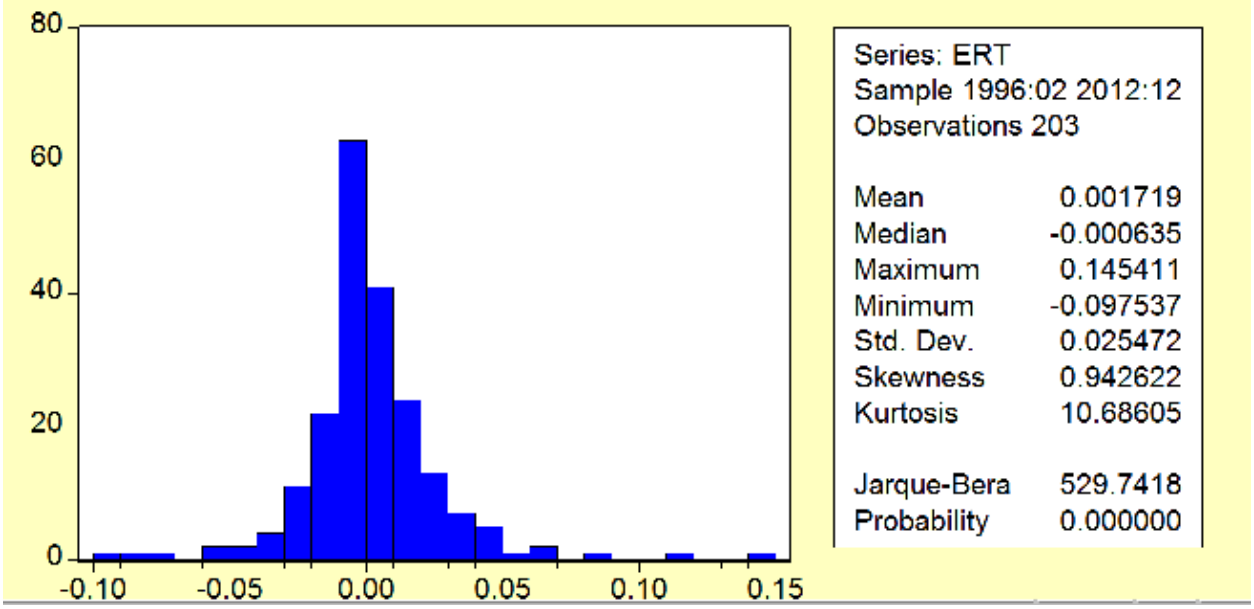
Source: NSE-20 share index Data.

Appendix IV: Histogram and statistics R_t



Source: NSE -20 Share Index Data.

Appendix V: Histogram and statistics ERT



Source: CBK Database.