

**THE RELATIONSHIP BETWEEN SELECTED MACROECONOMIC  
VARIABLES AND STOCK MARKET VOLATILITY OF FIRMS  
LISTED IN NAIROBI SECURITIES EXCHANGE**

**SAMUEL MWANGI MACHARIA**

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## **DECLARATION**

I hereby declare that this research project is my original work; it has not been presented to any other institution of higher learning for academic purposes.

**SAMUEL MWANGI MACHARIA**

**D63/77541/2015**

Signed ..... Date. ....

This project has been submitted for examination with my approval as the University Supervisor.

Signed ..... Date. ....

**DR. HERRICK ONDIGO**

Lecturer

Department of Finance and Accounting

School of Business

University of Nairobi

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## **DEDICATION**

To my Parents, late Rev. David Macharia and late Alicemary Waitherero for their inspiration and the passion they instilled in me, my beloved Anne G Mwangi and our children Edwin, Ian and Lynn for their encouragement, support and patience during my whole time in college. I will always be grateful to them.

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## **LIST OF ABBREVIATIONS**

**ANOVA:** Analysis of Variance

**APT:** Arbitrage Pricing Theory

**CAPM:** Capital Asset Pricing Model

**CBK:** Central Bank of Kenya

**ECM:** Error Correction Mechanism

**EPS:** Earnings per Share

**GDP:** Gross Domestic Product

**GDS:** Gross Domestic Savings

**MPT:** Modern portfolio theory

**NSE:** Nairobi Securities Exchange

**VECM:** Vector Error Correction Model

**VIF :** Variance Inflation Factor

## **ABSTRACT**

The economic development of any nation is affected significantly by, among many other factors, the market for stocks. This is because of the mediation role the market plays between investors and borrowers of funds. The economic development of a country exhibited through a well-functioning stock market is enhanced significantly by enhancing savings and providing an effective way of allocation of resources (Junkin, 2012).

A securities exchange play an intermediary financial role by providing access to capital and liquidity to companies by assisting in raising equity and debt capital, creating a platform for a secondary market for the trading of listed securities, and promoting efficiency in the mobilization, formation, and allocation of capital.

Volatility in the market is the rapid movement up or down of the prices of shares. Market volatility is fundamentally caused by movements or changes in general economic factors referred to as macroeconomic variables. Such include GDP growth rate, rate of exchange, rate of inflation, interest rate of interest, supply of money, Government bond rates and balance of trade/balance of payments. Volatility may also be caused by speculative and sentimental considerations. The volatility in stock prices pose great uncertainty to investors, regulators, stakeholders, and financial economists. The undue unpredictability of the prices often poses a challenge in the efficient performance of the financial markets and may cause investors to make alternate investing decisions where they would consider moving their assets to risk-free investments rather than investing in riskier investments

The stock markets have gained prominence in the finance discipline of risk diversification and funds mobilization, and alternative sources of capital for investment, growth, and socioeconomic development. Investment is guided by the perceived risk profile, which is subject to certain value drivers. An understanding of the dynamic behavior of stock markets is such important for investors, makers of policy, macroeconomists, and market analysts.. This study seeks to establish how these factors influence the volatility of returns of firms trading in Nairobi securities exchange, and recommend measures that may build more knowledge and confidence in the stock markets.

# CHAPTER ONE: INTRODUCTION

## 1.1 Background of the Study

The securities market has a crucial role to play within a market economy because it aids a company to have access to capital, primary investors a chance to own part of the company, and for the secondary investors an opportunity to gain from it based on its future performance (Pal & Mittal, 2011). Returns expected by investors from the mentioned equity investment are dividends and share appreciation. The returns vary based on the performance of the company, dividend policy and other factors that affect movement of share prices. Factors could be firm specific, or affecting the particular industry, or the whole economy. In sub-Saharan Africa, the stock markets have gained prominence in the finance discipline of risk diversification and funds mobilization as alternative sources of capital for investment, growth, and socioeconomic development

The study is anchored on modern portfolio theory, Arbitrage Pricing Theory (APT) and CAPM (Capital Assets pricing Model). The former enables investors to examine their expected returns primarily based on the predisposed risks. This theory seeks to maximize the investors return on the portfolio and to minimize the portfolio risk at any level of expected return of a portfolio. Arbitrage pricing theory helps in estimating asset values using the law of one price and without arbitrage. APT postulates that asset prices are affected by numerous macro-economic variables. CAPM postulates investors require a compensation for time money is invested and risk they are taking (Aguiar & Broner, 2006).

Nairobi securities exchange play an intermediary financial role by providing access to capital and liquidity to companies by assisting in raising equity capital, creating a platform for a secondary market for the trading of listed securities, promoting efficiency in the mobilization,

formation, and allocation of capital. Volatility in the market is the movement up or down of the prices of shares. Market volatility is caused by movements or changes general economic factors referred to as macroeconomic variables. Such include GDP growth rate, rate of exchange, rate of inflation, interest rate of interest, supply of money, Government bond rates and balance of trade/balance of payments. The macroeconomic variables pose great uncertainty to regulators, stakeholders, investors, and financial economists in Kenya. This study seeks to establish how these macroeconomic variables influence the shares market volatility of firms trading in Nairobi securities exchange.

### **1.1.1 Macroeconomic Variables**

According to Romer (2012), macroeconomics is centered on the behavior of an economy in totality. Macroeconomic factors are referred to in this study as macro-economic variables. These variables include interest rates, economic output, employment and unemployment, population size, inflation, the government financial and budget balances as well as those of international trade and productivity. Aguiar and Broner (2006) argued that problems affecting emerging markets are massive variations in macroeconomic fundamentals and asset prices.

A depression in share prices is influenced by investors who are motivated to alter their portfolios through trading, buying bonds and selling shares because of an increase in interest rates that make bonds an interesting venture considering their risk-return nature (Yang, 2014). Additionally, when the market interest rates go up they tend to make government securities more attractive as investors consider them to offer safer opportunities.

On the other hand, Fischer (2009) postulates and explained that, the connection seen between inflation and stock market returns can be significantly negative. The hypothesis advanced by Fischer that the nominal rate of interest is made up of real rate of interest plus rate of inflation. Inflation therefore reduces the nominal rate of interest if looked at from the purchasing power concept. “Fischer Effect” posits is that there exists a correlation between rate of inflation and the return on the stock market, which is significantly negative.

Fisher (2010) indicated that the exports improve as a factor of the devaluation in the local exchange. Conversely, appreciation will result in fall in foreign demand of an exporting company. According to Kim (2013), the currency value been among major factors that have a an impact on the returns of business and equity prices thanks to increase in world trade and capital movements.

Gross domestic product is a critical factor in the economy of any country as it provides information on the state and the direction of growth of the economy. In creating a regression on GDP and stock market volatility, Campbell (2011), discovered that the stock market volatility was both significantly and positively affected by GDP growth. Share prices will increase under an increase in an expansion, while recession is likely to cause an opposite effect (Dornbusch & Fischer 2010).

### **1.1.2 Stock Market Volatility**

Ambrosio (2007) defines volatility in the stock market as the varying of broad stock market index prices within a defined period. Stock market volatility may be viewed as standard deviation in returns on index of stock market. Investors are risk averse, and as such they

consider it to be important to monitor the fluctuations in the value of their investments as it portrays to them how much they are exposed to any level of risk. The volatility of the common stock is therefore, a benchmark for how they measure risk because it offers an indication of how the stock changes pace regarding its price over a set period. High volatility points at two possibilities, which is there is either a likelihood to make a gain or loss in the short-term. It can therefore postulate that the prices of volatile stocks vary greatly over time and it would be difficult to accurately predict the stock's future prices. Thus, less risky investment are more preferable to investors compared to those with a higher risk (Kinder, 2012).

Volatility of the stock market can be useful to investors to degree the riskiness of a given stock. Adjustments in stock markets lead to diverse societal factors like financial, political and economic elements. The corporations earnings, their techniques, accordingly, corporate profitability, enterprise approach, product great, political balance, interest fees among other elements ought to have a position to determine the intensity of market price fluctuations, as the market actions from one equilibrium to some other. On the same time records about the changes in fundamentals should spark marketplace interest changing the panorama of destiny costs(Kuranguri, 2006). Stock market volatility is associated with commercial enterprise cycle, recessions, booms or recovery times. Stock market volatility could be moderate during recessions and recovery but high during booms and depressions.

### **1.1.3 Macro Economic Variables and Stock Market Volatility**

Studies about financial markets have over the years evolved around the issue of volatility of stock markets because of the significant risks it poses, and which could lead to deterioration of the financial system. Volatility is affected by different factors that include expectations and

news; that influence adjustments to be made to stock markets. A collapse of stock market would be such severe as to send an economy into the dip because of the detrimental consequences it would cause to economic growth, employment, and poverty levels. Therefore, if forces that influence volatility are explored and defined further the result would be more efficient strategies in managing macro economic factors in the economy. Furthermore, getting to understand the connection macro economic factors and stock market would result in better strengthening of both the monetary and fiscal policies, and additionally, set the foundation on which sound investment decisions can be made. Ewing (2012) studied the interaction between stock market return and macro-economic variables contributing towards the topic explored by other researchers, where asserted that prices of stocks were the effect of several economic forces that included rate of interest, rate of inflation, GDP and the rate of exchange. The result of Ewing's study showed that macroeconomic forces had a tremendous impact on stock market investors risk mitigation strategies.

Economic development for a nation among many other factors is affected significantly by the market for stocks because of mediation role between lenders and borrowers. The economic development of a country exhibited through a well-functioning stock market is enhanced in two significant ways, which are enhancing savings and providing a better way of allocation of resources (Junkin, 2012). Companies also benefit from efficient stock markets as they are able to access capital easily and efficiently due to improved business environment around which the transactions happen. A study by Yang and Doong (2014), posits that a flow-oriented approach explains imbalances between the forces of demand and supply of funds regarding exchange rates. A country's ability to trade internationally and its competitive position are affected by the imbalances, which consequently influences its real income and the output produced. The

interaction between market for stocks and rate of exchange is highlighted through the use of the stock-oriented approach models whereby they equate demand and supply for capital assets. Thus, the stock market prices are influenced by the currency exchange movements. The investor is thus be moved to shift funds from local markets with the depreciation of currency, which in the end will lead to the depression of stock prices (Adjasi, 2012).

#### **1.1.4 Nairobi Securities Exchange**

Nairobi Securities Exchange (NSE) was formed in 1954 as a willing association of stockbrokers primarily for the European community. It was registered under Kenya's Societies Act. Currently NSE comprises of 67 listed companies as at 30<sup>th</sup> April 2017. The market players in the Nairobi Security Exchange include Investment banks, stockbrokers, investors and regulatory authorities (NSE, 2012). The 67 listed firms are classified into eleven sectors that exhibit similar products and/or similar markets. The sectors also have unique characteristics and risk profiles. The NSE segments include; Agricultural segment, Commercial and Services segment, Telecommunication and Technology segment, Investment Services segment (NSE Shares), The Automobiles and Accessories segment, The Banking segment, The Insurance segment, The Investment segment, The Manufacturing and Allied segment, The Construction and Allied segment, and the Energy and Petroleum segment. An additional segment, Growth Enterprise Market Segment, was introduced in 2013 (Ongore, 2013).

The Modern Portfolio theory provides that the macroeconomic factors can have different risk profiles for the different industrial sectors and therefore different industrial risk. The risk factors create different expected returns to the different sectors of the market. However, they net off to the market return which is regarded as the market index, which represents the market risk.



Nairobi Securities Exchange has three market indices. The NSE 20 Share index (1966 = 100), the NASI (Nairobi All Shares Index – 1<sup>st</sup> Jan 2008 = 100) and the NSE 25 Share index (1<sup>st</sup> Sept 2015 = 4101.67) the indices indicating the period it commenced operating and the comparative index then.

## **1.2 Research Problem**

Volatility in the stock market is the movement up and down of stock prices within a short span of time. The undue unpredictability of the prices often poses a challenge in the efficient performance of the financial markets and eventually negatively affects the market, which is evident in past occurrences. The volatility may cause investors to make alternate investing decisions where they would consider moving their assets to risk-free investments rather than investing in riskier investments (Habibullah & Baharumshah, 2011). An understanding of the dynamic behavior of stock markets is such important for makers of policy, macroeconomists, and market analysts. Investments is guided by the perceived risk profile, which is subject to macroeconomic variables.

Economies around the world are becoming more globalized because of the increasing globalization process. This global integration exposes the local stock markets to effects of global market volatility. Studies on macroeconomic variables and stock market volatility have been done locally and internationally.

Liu and Shrestha (2008) did a study of the markets in China to investigate the long term relationship between macroeconomic factors and the returns of the stock market. Returns of the stock market were positively associated with money supply and industrial production while on

the other hand returns on stocks had a negatively associated with inflation, exchange rates and rates of interest.

On the other hand, Acikalin (2008), conducted a study of the Istanbul Stock Exchange (ISE) with to establishing the influence of macroeconomic variables on the return on stocks. Their results showed there exists a long term and steady relationship between ISE index and macroeconomic variables.

Gunsel & Cukur (2007) did a study on the London Stock Exchange between 1980 and 1993, and results showed that macroeconomic variables have a strong influence on the London market for stocks but every factor affected different sectors differently.

Ochieng and Adhiambo (2012) carried out a study in the NSE on the effect of inflation, GDP growth rate, Treasury bill rates, interest rates. The results indicated market index is positively associated to inflation rate, Treasury bill rate and, gross domestic product but is significantly negatively related to interest rate.

Cherop (2010) conducted a survey concerning tea export earnings and the fluctuation of exchange rates among smallholders' tea factories in Kenya. The results of the survey indicated that the fluctuations in the exchange rate greatly affected the earnings of smallholders at tea factories. The percentage changes in exchange rate that were under investigations were found to have a positive relationship with the percentage effect on net pay for every kilogram of green leaf paid.

Hussein (2016) looked at the interrelation of macroeconomic variables and volatility of stock prices for those companies that were listed at the NSE. The study used money supply, export

earnings and inflation as the independent variables. The study found that broad money, interest rates negatively influences stock prices, rate of exchange and export earnings positively influences share prices.

Waweru (2013) carried out an assessment of the stock price determinants at the NSE. The study found that each unit change in inflation results to an increase in stock price, while a unit change in Interest rates and exchange results in decrease in stock price.

In Kenya, various studies have been carried out on stock market volatility; but, relating rates of interest, inflation, rates of exchange and GDP growth rate on stock market volatility has not been widely done in the Nairobi securities exchange. Motivated by this knowledge gap, therefore the research study seeks to fill this knowledge gap by answering the question: Does a relationship exist between macroeconomic variables and volatility of market returns of firms trading at the Nairobi Securities exchange?

### **1.3 Research Objective**

To determine the effect of macroeconomic variables on volatility of market returns of firms listed in Nairobi Securities Exchange.

### **1.4 Value of the Study**

For company executives whose firms have been trading on the NSE, the findings of this study would provide valuable information to guide their management decision following the changes in the macroeconomic variables in Kenya in their endeavor to maximize the stakeholders wealth. It will also be useful to investment analysts, speculators looking for quick arbitrage opportunities and market traders out to profit from the market.

The capital markets regulatory authorities will use the information to advise the Government in policy making and particularly where the local market may be seeking Foreign Direct Investments. Policies must encourage capital growth to attract investors.

The policy makers and the Government through the Central bank formulates the monetary policies, fiscal policies, and exchange rates controls to ensure stable currency rates that go a long way in enhancing economic growth and reducing its spiral effects on the economy.

To academicians and researchers as reference material in the area of macroeconomics and stock market volatility and guiding them to areas for further research.

## **CHAPTER TWO: LITERATURE REVIEW**

### **2.1 Introduction**

The section takes a relook at the macroeconomic variables and volatility in the stock market. Review will indicate broad categories that will be determined and which will help assess the crucial influences between volatility in the stock markets and macroeconomic variables. Theoretical framework guiding the study will be specifically addressed in the chapter, in addition to macroeconomic variables, empirical review conceptual framework and research gap.

### **2.2 Theoretical Review**

This part of the study analyses the different theories that are used to shed light on the macroeconomic variables volatility in the stock market. Study is guided by following theories; modern portfolio theory, arbitrage pricing theory and Capital Assets pricing model

#### **2.2.1 Modern Portfolio Theory**

In a paper published in the year 1952 in the Journal of Finance, Markowitz pioneered the Modern portfolio theory (MPT), in his paper "Portfolio Selection." The theory illustrates how portfolios can be constructed by investors who are risk averse to maximize or optimize the expected return based on a certain level of risk in the market, and he emphasized that risk is an inbuilt part of a higher reward. This theory postulates that for any given level of risk, an "efficient frontier" of optimal portfolios can be constructed to a maximum possible expected return. An important point made by the MPT is that it is not prudent to view an investment's risk and return profile alone, but should be evaluated against the investments effects the portfolios overall risk and return profile. It is possible from the theory for any investor to come up with a portfolio of multiple investments that maximize or optimize returns in the long run for a given

level of risk. In the same manner, an investor can construct a portfolio that gives the lowest possible risk given for his desired level of expected return (Doganoglu, 2007). The behavior of the entire portfolio is however more important than an individual investment's return based on statistical measures such as variance and correlation.

There is an assumption made by some studies that investors are risk averse according to the MPT where if given two portfolios that have the same return, an investor is more likely to go for the one that offers a less risky return (Fantazzinni, 2009). If investor are compensated by higher expected returns, then they can make a consideration of taking on increased risks. Therefore, an investor has to accept more risk if they want higher expected returns. Trade-offs presented to investors are generally the same, but based on the risk aversion characteristics of the individual, they will evaluate them differently. This means that if an investor who is rational is presented with two portfolios, the most favorable choice that he is expected to make is to go for that one with a better risk-expected return profile. Markowitz (1952) claims that there are two kinds of risks. Market or systematic risk, which may not be diversifiable and unsystematic risk or company specific that may be diversifiable through a careful selection of securities with different specific risks. A well diversified portfolio has the capacity of minimizing unsystematic risk to insignificant level. This will therefore subject the investor to only systematic risk or market risk. Market risk is essentially a matter of the macro economic variables that cannot be diversified away. Company specific risk can be diversified away. Our study is therefore to evaluate the effect of systematic risk related to macroeconomic economic variables on stock market volatility on NSE.

This theory is important to the study because it seeks to maximize the investors return on the portfolio and to minimize the portfolio risk in any level of expect return of a portfolio.

Markowitz encourages diversification of assets to minimize risks. This mitigates in controlling both the type and the magnitude of expected risk and return. The theory emphasizes determination of the numerical interactions among the specific securities that encompass the total portfolio rather than analyzing the characteristics of individual investments. However, Fantazzinni (2009), further suggest that with a consideration of both the internal and external factors it is important to the change in price in each asset relative to change in price in every other asset in the portfolio.

### **2.2.2 Arbitrage Pricing Theory**

This theory was formulated in the year 1976 by Ross; the theory makes use of linear combinations of many independent macroeconomic variables in the predictions of returns of the portfolios or individual assets. Where there is an expectation of a mispriced asset, the theory describes the price. Because of the theories flexible assumption requirements, it is a moderated alternative to the capital asset pricing model (CAPM). The difference occurs where the CAPM formula requires calls for the market's expected return, APT utilizes the risky asset's anticipated return and risk premium of a number of macroeconomic factors (Burmeister, 2006). At times securities carry prices that vary from theoretical price as posed through this model, and for such cases of mispriced securities arbitrageurs aim to profit by taking advantage of such misplacement.

Arbitrage pricing theory (APT) is one of the general theories employed in asset pricing, and modelling as a linear regression of a number of macro-economic factors or theoretical market indices. These can help to determine the return expected of the financial asset, with response to changes in a factor marked by a factor-specific “beta” coefficient. Rate of return that will be

arrived at from the model is then utilized to determine the asset price correctly, where expectation is that the price of the asset should equal the price that is arrived at from the model and discounted using the rate derived by the model (Burmeister, 2006). Factor risk is more significance in asset pricing according to the model because it states that the anticipated rate of return on assets depends on the uncertain nature of macroeconomic variables (Holbrook, 2010). In its analysis of the asset prizes, APT is considered as a moderately flexible technique. The assumptions made by use of the model is that the macroeconomic variables used are not multicollinear with each other and is additionally assumed that the prices of stocks were influenced partially by majority of the macroeconomics variables. The composition of the return on stock price according to APT includes the capital gain added to crystallization of risk premium (macroeconomics variables risk) in the course of time (Walter, 2011).

### **2.2.3 Capital Assets Pricing Model**

William Sharpe (1964) in his paper ‘Capital Assets Prices: A theory of market equilibrium under conditions of risk’ asserted that all investment carry duo risks. Risk of existing in the market also referred to systematic risk which firm has no control of and the other is the company specific risk called unsystematic risk. Unsystematic risk is mitigatable by appropriate diversifying. Systematic risk depends purely on market and it is the market risk. Expected return from a capital assets or portfolio has a bearing on the relationship between the asset and the overall market which is defined by the assets coefficient with the market called the “beta” factor. The assets beta measures the extent to which the price of the assets is influenced by the market rate of return. The beta is graduated from positive 1 to –negative (-)1, with positive 1 indicating the two are perfectly and positively correlated and negative 1 indicating perfectly but negatively correlated.



Zero means no relationship. The 'Capital Assets Prices' was later renamed Capital Assets Pricing Model' by Eugene Fama.

The general thinking behind CAPM is that investors should be compensated in twice: time value of money and risk (Aguilar & Broner, 2006). The former is compensated by the risk-free rate part in the formula and rewards the investors for having placed money in the investment for a period of time. The rate is generally derived from the yield on bonds and government securities.

According to Fletcher (2007), systematic risk only or market risk can be rewarded. Unsystematic risk or firm or industry specific risk should be diversifiable. According to the CAPM theory firm specific risk can not be included in the return of the stock and is not rewarded. Systematic risk can meanwhile not be diversified according to Moffett, Stonehill and Eiteman (2005), and is relates to the risk of the market portfolio. To identify the nature of risk in principle appear important for investors at least according to the capital asset pricing model as benchmark for pricing.

The theory is relevant to the study because the model shows that the returns expected of a security or a portfolio of firms trading in the NSE equals the rate on a risk-free asset plus a risk premium. If this anticipated return fails to meet or beat the required return, then the investment should be foregone. The supply and demand of securities are the determinants of the fluctuations in prices of stocks and thus the volatility market for stocks. Demand and supply are determined by the perception of risk in the market. Market risk is presumed in this study to be determined by the macro economic factors. The security market line plots the results of the CAPM for all different risks. Capital asset pricing model presumes a particular form of utility functions asset returns whose distribution of probability are completely described by the first two moments.

### **2.3 Determinants of Volatility in the Securities Market**

Volatility in the securities market, is the variation of returns in the securities market as measured by the market indices. It is a measure of risk and indicates the variation in the stock's price over a determined period. Important macroeconomic factors believed to be influencing the stocks in Nairobi securities exchange include foreign exchange rates, inflation, interest rates, GDP, foreign direct investment, unemployment levels, population size, the government fiscal and monetary (money supply) policies external trade and productivity among others.

Securities market volatility or variation in expected returns in the stock market is a factor of demand and supply of stocks. Demand and supply are driven by expected future cash flows and their present value. High interest rates reduce the profitability of firms and reduce the cash available to investors. It also implies an expectation of higher returns to cover the borrowing costs. Inflation increases cost of production and reduces the real value of money. Exchange rate depreciation may increase revenues for exporters by making the exports cheaper to internationally, and reduce revenues for importers by increasing cost. Stock prices are presumed to be an indicator of the underlying economy. Economic growth could as well imply improved fortunes for the productive sector, and therefore expected good return on investments.

Other macro economic factors may also impact the volatility of stock market indexes. Foreign direct investment, unemployment levels, population size, the government fiscal and monetary policies as well as international trade and productivity. The government will use the fiscal and monetary policies to influence the economic performance of a country. With the Fiscal policy the Government plans its spending levels and tax regime to monitor and adjust a nation's economy and growth. Monetary policy involves the Government's control of money supply in the

economy to inspire or slow down economic activity. It involves Banks statutory reserve requirements, which when raised, requires banks to retain more at central bank thus reducing money available for lending, which reduces money supply. The Government can control interest rates through CBRR. Increased CBRR results in banks raising their lending rates, thus making credit more expensive and less desirable. It reduces money supply in economy. It can involve open market operations where Treasury through CBK floats Treasury bonds and bills to mop up money from economy. Control of money supply is aimed at controlling demand for goods and services and thus economic activity.

Foreign Direct Investment involve cross boarder investments with objective of establishing long term interests by having enterprise in another country. It's a key component of global economic integration the volume of which can have impact in economic growth, and stock market indices. Unemployment level is an indicator of the productivity and dependency in a population. High levels of unemployment mean low productivity capacity in a nation, and a higher ratio of dependants further burdening the economy. The same does not promote savings and investment since the productivity is low and is already burdened by the unemployed who have to be supported. Population size is an indicator of the potential market. Where the population is large with a high per capital income which is fairly distributed, the market is high even for the investments or stock markets. Export earnings are the returns of a company or country that are generated through the exports of goods or services. Export earnings are essential ingredients for a country's economic growth and development (Ewing, 2012). Economic growth is earmarked by certain factors that include production and demand linkages, economies of scale because of the exposure to wider international markets, efficiency that has been stepped up, the utilization of better technology resulting from imports foreign investments, learning and

betterment of human capital together with higher productivity where they stimulate economic growth through such earnings.

While recognizing all these macroeconomic variables, our study will focus on effects of changes in rates of interest, rates of exchange and rates of inflation on volatility in the stock market.

## **2.4 Empirical Review**

Liu and Shrestha (2008) performed a study of the Chinese market by trying to establish the correlation between stock market returns and macroeconomic factors. Dependent variable for their study was the stock exchange indices while they provided the rate of interest, supply of money, rate of exchange, inflation rate and industrial production as the independent variables. The eventual relationship between the stock returns macroeconomic factors was achieved by applying heteroskedastic co-integration methods. Positive correlation was established between money supply and industrial production with the stock returns, whereas the negative relations were established between the rate of exchange, inflation interest rates and the stock returns. Macroeconomic factors in China were confirmed to have an effect on the county's stock market.

Chen et al. (2009) did a study in the Stock Exchange of Taiwan where the researchers investigated the correlation between macroeconomic variables and the returns on hotel stocks. Macroeconomic factors utilized included money supply, industrial growth rate, future inflation, the unemployment rate change, and the yield spread. The study also considered some non-macroeconomic factors that included some crises especially the 9/21 earthquake, the Iraqi war in 2003, the financial crisis that hit the Asian market, the 9/11 terrorist attacks, and the outbreak of SARS, while in addition the presidential elections, sports mega-events were also included. The movement of hotel stock returns was only significantly explained by the unemployment rate and

money supply, which were among the macroeconomic factors. The stock returns were however significantly affected by all of the non-macroeconomic factors.

Similarly, Pal and Mittal (2011) carried out an examination of the Indian capital markets by examining the long time correlation between key macroeconomic variables and the Indian market for stocks. The two stock indices, India stock market were used as the dependent variables while macroeconomic variables were gross domestic savings (GDS), exchange rates, interest rate, and inflation rates. To determine the short time and long time relationship study made use of the error correction mechanism (ECM), co-integration test, the unit root test. The findings of the study pointed to a long term correlation between macroeconomic variables the two indices investigated.

On the other hand, a study was also conducted in Japan to determine the connection between six macro-economic factors and the country's stock market. The macroeconomic factors included: money supply, rate of exchange, rate of inflation, industrial production index, call deposit rate and the government bond rate (Ukherjee and Naka, 2010). The macroeconomic variables were determined to be co-integrated with the Japan stock market revealing a time stable correlation, which was achieved through the use of a "Vector Error Correction Model" (VECM).

Locally, Waweru (2013), a study was conducted on the Nairobi Securities Exchange in an analysis of determinants of stock price volatility. This study used four variables and considered monthly data on interest rate, inflation, exchange rate. The data utilized in the study was sourced collected monthly spanning January 2003 to December 2013. The correlation between rates of inflation, rates of interest, exchange rates and market stock price volatility was determined by the use of regression analysis and descriptive statistics. The study found that any unit change in

inflation rate results to an increase in stock prices. In addition any unit change in Interest rates results to a decrease in stock prices, while a unit changes in exchange rate results to a decrease in stock price.

Similarly, Hussein (2016) conducted a study in the Nairobi Securities Exchange to establish the correlation between the macro economic variables and share price volatility for firms quoted on its trading floors. The research design that was adopted by the study was casual. The study used a five year (2011 to 2015) secondary data obtained from NSE. The study used the regression coefficients to test the magnitude of the stock sensitivity to macroeconomic variables. Also, the study used correlation, ANOVA and coefficient of determination (R<sup>2</sup>) to determine the models significance. The study used money supply, export earnings and inflation as the independent variables. The study found that broad money negatively influences stock price volatility, interest rates negatively influences stock price volatility, exchange rates positively influences stock price volatility and export earnings positively influences stock price volatility and inflation rate had a negative effect on stock price volatility.

Again, Wanjala (2014) investigated macro-economic causal factors of stock market performance of Nairobi securities exchange. The study followed descriptive research design and used secondary data. The data spanned the period between 2000 and 2013. The data was analyzed using SPSS version 20. The study variables were rate of exchange, inflation rate and money supply. The study concluded that there existed a notable but insignificant relationship between inflation rate and stock market performance though inverse. The study concluded that the regulators including CBK should read the signals earlier to manage the macroeconomic variables for better results. Also, since the study established that the macro-economic variables

and stock market performance deteriorated just before, during and immediately after electioneering periods, strong political and election structures should be established and regulations upheld to avert possible distortions of macro-economic factors and stock market performance and other economic agents.

## **2.5 Conceptual Framework**

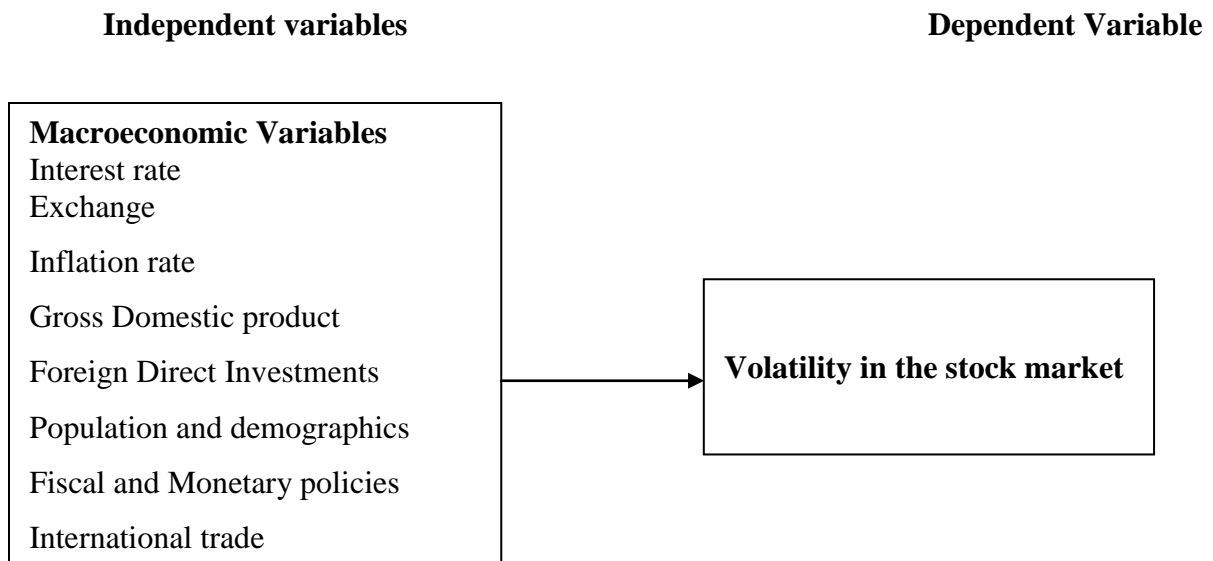
A conceptual framework is a set of general ideas and principals taken from related field of enquiry and used to construct a subsequent presentation (Reichel and Ramey – 1987)

According to Markowitz; the modern portfolio theory, a well diversified portfolio has the capacity of minimizing unsystematic risk to insignificant level. This will therefore subject the investor to only systematic risk or market risk. Market risk is essentially the macro economic variables that cannot be diversified away. Our study is therefore to evaluate the effect of systematic risk related to macroeconomic economic variables on stock market volatility on NSE. The capital asset pricing model (CAPM) explains the co-integration between systematic risk and return anticipated on risky investments. The expected return on risky assets the risk free rate, on Treasury securities and systematic risk adjusted to reflect the correlation between the same and the assets return. The systematic risk also referred to as market risk in CAPM brings together all macroeconomic variables and their correlation with the returns of a particular risky asset in one coefficient referred to as the assets beta factor. The coefficient measures the correlation between variation in the market return and the assets return. Arbitrage pricing Theory breaks down the beta factor from one coefficient to a number of coefficients correlating the variation in the risky assets return to numerous macro economic variables and attempting to arrive at the intrinsic value of the asset.

The conceptual framework presents major macro economic variables that affect volatility in the stock through diagrammatical presentation. It further shows the covariance between the dependent (response) variable and independent (predictor) variables. The independent (predictor) variables for the study are: Exchange rates, Interest rates, and Inflation rate while the dependent (response) variable is the stock market volatility measured by the standard deviation of NSE All share index..

When clearly defined, a conceptual framework is a usefulness tool to assist the researcher in making meaningful eventual findings. It is part of the agenda for negotiation to be interrogated, tested, reviewed and reformed from the results of investigations ( Guba and Lincoln 1989)

**Figure 2. 1: Conceptual Model**



**Source: Researcher (2017)**

## **2.6 Summary of Literature Review**

Studies on macroeconomic variables and stock market volatility have been done locally. Waweru (2013) conducted a study in the Nairobi Stock Exchange and performed an analysis of the



determinants of volatility in the stock market. This study used four variables and considered monthly data on interest rate, inflation, exchange rate. The study looked at these factors for a period 2003 to 2013. The study used Regression analysis and descriptive statistics in the data analysis. The current study will apply correlation and ANOVA in the data analysis to further expound the relationship between rates of exchange, rate of interest, rates of inflation and volatility in the stock market. The study will use data on rates of interest, rates of inflation, rates of exchange and volatility in the stock market for a period 2012-2016. On the other hand, Wanjala (2014) investigated macro-economic determinants of securities market performance of Nairobi securities market. The study variables were money supply, exchange rate, and inflation rate. The current study focuses on interest rate, exchange rates and inflation.

Ochieng and Adhiambo (2012) conducted a study of the stock market and selected macroeconomic variables to illustrate their relationship also in the NSE. The variables were GDP growth rate, inflation, interest, Treasury bill rates. Cherop (2010) used only exchange rate fluctuations as a variable in the study. Hussein (2016) looked at the correlation between macroeconomic variables and investment market volatility for companies trading at the Nairobi market exchange. The case used money supply, export earnings and inflation as the independent variables. The current study focuses to use interest rate, exchange rates and inflation. From the studies done locally, this study finds a research gap in methodology and variables used by previous studies hence the study is motivated by this research gap.

## **CHAPTER THREE: RESEARCH METHODOLOGY**

### **3.1 Introduction**

The section specified the research methodology utilized. It explains the choice of research design, the population of study, data collection methods, sample design, data analysis method and research procedures.

### **3.2 Research Design**

In order to avoid ambiguousness in data collection and that the data obtained answers all the initial questions, it was important to employ a research design (Clark, 2007). It was important to obtain utmost information and to have different possible opportunities to consider various aspects of the problem, reveals a good research design (Kothari : 2004).

The research design utilized in the study was a combination of descriptive research design and correlation design. A descriptive survey describes the situation of affairs as it exists and reports the findings (Kombo &.Tromp, 2014). A correlation design facilitates the researcher to examine the degree of covariance between two or more variables. It analyzes the correlation between two, or more variables (Orodho, 2003). The study was about correlation between macroeconomic variables and price volatility in stock market of firms trading in Nairobi securities exchange (NSE). The two research designs were most suitable and justifiable to bring out the relationships clearly. Additionally, the characteristics of a large population are effectively handled.

### **3.3 Target Population**

Kothari (2004) states a target population as being a means used in generalization of the results by using a universal set of study of all members of real or hypothetical set of people, events or

objects that is used by investigators. According to Nairobi Securities Exchange NSE, (2016) there are 67 listed companies in Nairobi Securities Exchange. The study focused on all 67 companies listed in NSE. (Appendix 1) by use of the singular index, the Nairobi Security Exchange All Share Index.

### **3.4 Data Collection**

Secondary data was collected from respective government authorities in custody of such. Data on the securities and their movement was obtained from Nairobi securities Exchange. Central Bank of Kenya was the source of Information on rates of exchange and rates of interest over the period of interest. Data on inflation trends was obtained from the Kenya National Bureau of Statistics.. The study collected data for the five years 2012 to 2016.

### **3.5 Data Analysis**

The Statistical Package for Social Sciences (SPSS) version 20 was applied to analyse quantitative data generated from data collection. Presentation of data was done using tables, frequencies and percentages. Descriptive statistics was applied to quantitatively describe the important aspects of the variables using: standard deviation, frequency, and mean. The findings were presented using tables, frequencies and percentages.

#### **3.5.1 Analytical Model**

Multiple regressions was utilized to determine the correlation between macro economic variables and volatility in stock market of firms trading in the Nairobi securities exchange. The regression model was as illustrated below;

$$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \varepsilon$$

Y = Stock market volatility (Measured by Quarterly Standard Deviation of NSE All share index (NASI) 2012 to 2016)

$\beta_0$  = Constant

X<sub>1</sub> = Interest Rate (Measured by Quarterly CBRR - 2012 TO 2016)

X<sub>2</sub> = Inflation (Measured by Quarterly change in consumer price index - 2012 to 2016 quarterly percentage.)

X<sub>3</sub> = Exchange Rate (Measured by Kenya shillings exchanges to the US Dollars Average Quarterly Rate)

X<sub>4</sub> = GDP – GDP growth rate

$\beta_1$  –  $\beta_4$  are the regression co-efficient representing change introduced in Y by change in each independent variable

$\epsilon$  is the random error term representing all other variables that influence Stock market volatility but not captured in the model.

ANOVA test was conducted to establish the level of significance of the variance by the use of a one-Way ANOVA so as to determine the existence of significant correlation between the variables.

### **3.5.2 Test of Significance.**

The results considered statistically significant within the 0.05 level, which means that the significance value must be smaller than 0.05. The Pearson Product Moment Correlation Coefficient was utilized in assessing the direction and magnitude of the correlation between the independent and dependent variables at 5% level of significance (Kothari, 2004). The model significance was tested by use of the analysis of the variance (ANOVA), at 5% level of

significance. Statistical inference techniques was utilized in making conclusions as to the accuracy of the model.

# CHAPTER FOUR: DATA ANALYSIS, RESULTS AND INTERPRETATION

## 4.1 Introduction

This chapter presents the analysis, the findings and interpretation of the research. The objective of the present study is to reveal the effect of macroeconomic variables on volatility of market returns of firms listed in Nairobi Securities Exchange.

## 4.2 Descriptive Statistics

Descriptive Statistics is the analysis of data to help describe, arrange and summarize data in a meaningful style such that trends and patterns clearly show from the data. This study sought to collect descriptive statistics of NSE All share index, rate of interest, rate of inflation, rate of exchange and Gross Domestic product for analysis on their effect on the returns of firms listed in Nairobi securities exchange for the period 2012 to 2016 observed on a quarterly basis.

Table 4.1 shows the summary of descriptive results on the NASI, exchange rates, Interest Rate, Inflation rates and GDP variables used in the study. The results are presented in terms of mean and standard deviation and number of observations.

**Table 4.1: Descriptive Statistics: Quarterly figures 2012 to 2016**

	Mean	Std. Deviation	N
NASI	129.3085	32.22670	20
EXCHANGE RATE	91.1645	7.41084	20
CBK RATE	10.9500	3.15353	20
INFLATION RATE	8.0880	3.57236	20
GDP	5.4650	.89282	20

**Source; Researchers findings**

From the results recorded, it can be noted that for the 20 observations observed quarterly for the period 2012 to 2016, the Nairobi Stock exchange all share index had an average of 129.31 and a standard deviation of 32.23. The exchange rate of the Kenya shilling to the US Dollar had an average of 91.16 and standard deviation of 7.41. The CBK rate had an average of 10.95 and a standard deviation of 3.15. The inflation rate had an average of 8.09 and a standard deviation of 3.57, while the GDP growth rate had an average of 5.46 and a standard deviation of 0.89

### 4.3 Diagnostic Testing

#### 4.3.1 Linearity

Linearity is the degree of association between two variables, which are the dependent and independent variables.

Pearson Product Moment Correlation Coefficient was used to test for linearity of the variables in the regression model. The direction and magnitude of the relationship between the dependent and independent variables was found acceptable at 5% level of significance.

**Table 4.3:1 Correlations**

		NASI	EXCHANGE RATE	CBK RATE	INFLATION RATE	GDP
Pearson Correlation	NASI	1.000	.563	-.743	-.777	.346
	EXCHANGE RATE	.563	1.000	-.146	-.420	.314
	CBK RATE	-.743	-.146	1.000	.914	-.400
	INFLATION RATE	-.777	-.420	.914	1.000	-.509
	GDP	.346	.314	-.400	-.509	1.000

**Source; Research findings**

From the recording in the table above, the study revealed that there was significant relationship between Stock market volatility and macroeconomic variables. There was positive correlation with exchange rate, as depicted by a correlation factor of 0.563. The correlation was found to be significant as it is over 0.5. The study found a negative correlation between Stock market volatility and CBK rate as depicted by correlation of -0. 743. The study also found a negative correlation between Stock market volatility and inflation rate as indicated by correlation of - 0.777. Further, a positive correlation between Stock market volatility and gross domestic product was established as shown by correlation coefficient of 0. 346.

### 4.3.2 Multicollinearity

**Table 4.3.2 Collinearity statistics**

<b>Variable</b>	<b>Tolerance</b>	<b>VIF</b>
Exchange rate	.480	2.085
CBK rate	.094	10.647
Inflation rate	.075	13.421
GDP	.715	1.398

**Source; Research findings**

Collinearity statistics indicate that there exists a slight multicollinearity between the CBK and the inflation rate. The tolerance test show that the P-Values for the two variables are just less than 0.1, at 0.094 and 0.075 for CBK rates and inflation rates respectfully. Tolerance values below 0.1 would indicate presence of multicollinearity between variables. The VIF (Variance Inflation Factor) test recorded P-values of 10.647 for CBK rate and 13.421 for inflation rate



which are slightly above 10. VIF value above 10 would similarly indicate presence of multicollinearity. That the government results to the CBK rate in the monetary policy to manage inflation in the country, increasing rates when inflation is high and reducing rates to increase money circulation which can be inflationary. This explains the slight Collinearity appearing between the two variables. Exchange rate and GDP have tolerance above 0.1 and VIF below 10 indicating no linear relationship. The null hypothesis was that the data was not multicollinear at 5 % level of significance.

#### **4.3.3 Normality:**

##### **Skewness test.**

Skewness measures the degree of asymmetry exhibited by the data, with a perfectly normal distribution measuring 0 skewness and that beyond 1 and -1 considered significant.

Skewness test conducted revealed statistics NASI, -0.659 exchange rate were 0.748 CBK rate were 1.410 Inflation recorded 1.588 while GDP recorded skewness at -0.192. The results were considered to be within range of normal distribution and therefore dependable at 5% significance level

#### **4.3.4 Homoscedasticity Test**

**Table 4.3.3 Breusch-Pagan and Koenker test**

	LM	Sig-values
Breusch-Pagan	4.073	.396
Koenker	4.253	.373

Null hypothesis: heteroskedasticity does not present (homoskedasticity exists)

If significant-value less than 0.05, reject the null hypothesis

**Source; Research findings**

#### 4.4 Regression Analysis

For this study, a multiple regression analysis test was conducted to establish the joint or collective impact of the predictor variables upon the response variable. The research employed statistical package for social sciences (SPSS V 21.0) to encode, key and calculate the parameters of the multiple regressions.

Table 4.4 Model Summary

**Table 4.4 Model Summary**

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.884 <sup>a</sup>	.781	.722	16.97966

#### Source; Research findings

a. Predictors: (Constant), GDP, EXCHANGE RATE, CBK RATE, INFLATION RATE

The study used coefficient of determination which was 78.1 % in assessing the model fit and in the model was statistically significant. This implies that 78.1% of the variations in Stock market volatility is explained by the independent variables under study (Interest Rate, Inflation, Exchange Rate and GDP) at 5% significance level.

#### 4.5 Analysis of variance (ANOVA)

The ANOVA test conducted revealed that the regression model had a significance level of 0.00. This is less than the P.Value of 5%. It is indicates the data is statistically significant.

The calculated F value was greater than the critical value (13.361>3.56) an indication that Interest Rate, Inflation, Exchange Rate and GDP together have a significant effects on the volatility of returns of firms listed in the Nairobi securities exchange. The significance value of 0.000 was less than 0.05%

**Table 4.5 ANOVA<sup>b</sup>**

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	15408.013	4	3852.003	13.361	.000 <sup>a</sup>
	Residual	4324.633	15	288.309		
	Total	19732.646	19			

Source; Research findings

#### 4.6 REGRESSION EQUATION

The results emerging from the equation is that the return on stock market volatility is influenced by exchange rates, Interest rates inflation rates and GDP growth rate. Given all the predictor variables constant at zero (0), volatility of stock market return will be -7.872 plus the error factor of 21.9% (100%-78.1%).

**Table 4.6 Coefficients of Regression**

Model	Unstandardized Coefficients		Standardized Coefficients
	B	Std. Error	
(Constant)	-7.872	71.955	
Exchange rate	2.584	.759	.594
CBK rate	-10.620	4.031	-.1.039
Inflation rate	3.561	3.995	.395
GDP	-1.993	5.158	-.055

Source; Research findings

The SPSS generated statistic as presented in table 4.5 above. The regression equation can be written with the coefficients as under.

$(Y = \beta_0 + \beta_1X_1 + \beta_2X_2 + \beta_3X_3 + \beta_4X_4 + \epsilon)$  becomes:

$$Y = -7.872 + 2.584X_1 - 10.620X_2 + 3.561X_3 - 1.993X_4 + \epsilon$$

From the regression model obtained above the study is indicative that a unit change in exchange rate if other factors are held constant would change the volatility of market returns of firms listed in Nairobi Securities Exchange by a factor of 2.584. A unit change in CBK rate if other factors are held constant would change the volatility of market returns of firms listed in Nairobi Securities Exchange by a factor of -10.620 and a unit change in inflation rate if other factors are held constant would change the volatility of market returns of firms listed in Nairobi Securities Exchange by a factor of 3.561. Further, a unit change in gross domestic product if other factors are held constant would change the volatility of market returns of firms listed in Nairobi Securities Exchange by a factor of -1.993.

The study was undertaken at 95% confidence level. Where the probability of the predictor variable was within 95% then it is significant otherwise it is not. The predictor variables under the study were accepted.

#### **4.7 Discussion of Research findings**

The study objective was to investigate the impact of the four key macro-economic variables: Interest Rate, Inflation, Exchange Rate and GDP on volatility of market returns of firms trading in Nairobi Securities Exchange for the period 2012 to 2016. The observation were done on a quarterly basis.

Exchange rate recorded a positive correlation with stock market volatility of 0.563. The relationships were statistically significant. The results are consistent with the conclusion of Cherop (2010) who arrived at a positive correlation between exchange rates and tea export earnings in Kenya, and Hussein (2016) who arrived at a positive correlation between exchange rate and NSE 20 Share index. However, Liu and Shrestha (2008) on the China market and Waweru (2013) on the NSE market found significant negative relationships. The Kenyan economy is more of an importer rather than an exporter as posited by the balance of payment/ balance of trade accounts. The stronger Kenya shilling makes imports cheaper and which comprises much of the economic input, and can have a bigger impact on the index, than the volume of exports.

Interest rate was found to be negatively related to market returns with a correlation of -0.743. Liu and Shrestha (2008) reported that the expected returns on common stocks have a systematic relationship with the interest-rate risk. Hussein (2016) and Waweru (2013) - on a study of NSE 2003 to 2012, also found that interest rate is significantly negatively related with the Stock market return index. An increase in interest rate will definitely affect a larger sector of the borrowing economy, that grow the economy, relative to the smaller sector that will benefit from the fixed income return. The effect will be the reverse for a reduction in interest rates.

The productive capacity of an economy measured by the Gross Domestic Product naturally rise during economic expansion, which in turn creates capacity for firms to generate cash flows. That is why the industrial production would have an impact on expected future cash flows, and therefore a positive relationship to real economy and stock prices exist. Stock returns index improves during economic expansion and deteriorates during contractions in the economy. Waweru (2013) indicates that the expansion rate of industrial production had a strong and stable

relation with stock returns. Ochieng and Othiambo (2012) found a positive relationship between GDP Growth and Stock market index. Liu and Shrestha (2008) found a positive relation between stock market index and industrial production. The study showed a positive but not very strong relationship between GDP growth rate, 0.346, and stock market index. Market perception and anticipation, added to speculators activities and information have the capacity to distort the market.

The study revealed that inflation rate has a correlation of  $-0.777$  with NASI. Pal and Mittal (2011) studied the relationship between inflation rate and stock market returns for the stock market in Athens Greece. Their findings were that inflation and stock market returns are negatively related with a correlation coefficient of  $-0.211$ . Liu and Shrestha (2008) found a negative relationship between the variables. Cherop (2010) established a negligible positive correlation between inflation rate and the stock market index. Ochieng and Othiambo (2012) and Waweru (2013) found a significant positive relationship between inflation rate and the Stock market return index. Our study found strong multicollinearity between interest rates and inflation rates. This is where Monetary Authorities use interest rates to check inflation rates.

On the regression equation, the study found that the intercept for the regression model was  $-7.872$  for the year under study. The study noted that exchange rates has a value of  $2.584$  on the combined effect of macroeconomic variables under study on the volatility of NSE All share index. CBK Rate has a value of  $-10.620$ , inflation  $3.561$  and GDP  $-1.993$ . The variables under study revealed a contribution of  $78.1\%$  of the stock market volatility. The error factor contributed  $21.9\%$ . This is where other macroeconomic factors come in and other social/political considerations.

# **CHAPTER FIVE: SUMMARY, CONCLUSION AND RECOMMENDATIONS**

## **5.1 Introduction**

This chapter provides the summary of the effect of the four main macro-economic variables i.e Interest Rate, Inflation, Exchange Rate and GDP on volatility of market returns of firms listed in Nairobi Securities Exchange as depicted by the NASI. The chapter is structured into summary of findings, conclusions, recommendations for Policy and Practice, limitations of the study and areas of further studies.

## **5.2 Summary of Findings**

The objective of this study was to determine the impact of macroeconomic variables on the volatility of returns of firms listed at the Nairobi Securities Exchange as represented by the All Shares Index. The dependent variable was the NSE All shares index. The independent variables were the exchange rate measured by the rate of the Kenya shilling to the US Dollar, the interest rate as measured by the CBK Rate, the inflation rate as measured by the Consumer Price Index and GDP as measured by the GDP growth rate. Data was collected on a quarterly basis for the period January 2012 to October 2016

To clearly bring out the relationships, the study used the Modern Portfolio Theory, the Arbitrage Pricing Theory, and the Capital Assets Pricing Model for the theoretical argument on the relationship between the macroeconomic variables and the stock market index.

The results of descriptive statistics for the period January 2012 to October 2016 show the NASI had an average of 129.31 and a standard deviation of 32.23. with a minimum index of 68.38 in

January 2012 and a maximum of 175.22 in April 2015. The trend has been generally upwards. The exchange rate had an average of 91.1645 and a standard deviation of 7.41, with a minimum of 83.10 in April 2012 and maximum of 104.68 in October 2015 the trend has been generally upwards. The CBK rate had an average of 10.95 and a standard deviation of 3.15, with a minimum of 8.5 between July 2013 and April 2015 and a maximum as at January 2012. The rate is controlled by CBK and the trend has been downwards. The inflation rate had an average of 8.09 and a standard deviation of 3.57, with a minimum of 4.44 in July 2013 and a maximum of 16.5 in April 2012. The inflation has been volatile but on a downward trend. GDP growth rate averaged 5.46 with a standard deviation of 0.892, with a minimum of 3.5 in October 2013 and a maximum of 7.5 in April 2013. Growth rate has been gently moving up.

The correlation findings revealed positive correlation between NASI and exchange rate of 0.563, a negative correlation with the CBK rate of -0.743, a negative correlation with inflation rate of -0.777 and a positive correlation with GDP growth rate of 0.346. the macroeconomic variables investigated coincidentally or collectively explain 78.1 percent of the volatility of stock market returns of firms listed in the NSE, with a standard error of estimate of 16.98

The ANOVA test had an F-Value of 13.361 with a significance level of 0.000 which is less than 0.05 meaning that it is significant.

The multi-regression equation was arrived at using SPSS version 20.1 and concluded that the constant, or Y intercept is -7.872. the exchange rate affect the stock market index by a factor of 2.584, the CBK rate by a factor of -10.620, the inflation rate by a factor of 3.561 and GDP by a factor of -1.993. The model  $Y = \beta_0 + \beta_1X_1 + \beta_2X_2 + \beta_3X_3 + \beta_4X_4 + \epsilon$  can be written as:

$$Y = -7.872 + 2.584X_1 - 10.620X_2 + 3.561X_3 - 1.993X_4 + \epsilon$$



Co linearity statistics indicate that a strong linear relationship exists between the CBK rate and the inflation rate. The tolerance test shows that the P-Values for the two variables are less than 0.1, at 0.094 and 0.075 for interest rates and inflation rates respectively. The same is confirmed by the VIF (Variance Inflation Factor) test which recorded a p-values of 10.647 for CBK rate and 13.421 for inflation rate which are above 10 and therefore significant. That the government uses the CBK rate to manage inflation in the country explains the co linearity between the two variables. Exchange rate and GDP have tolerance above 0.1 and VIF below 10 indicating no linear relationship.

For skewness and kurtosis test, the P-Value of the variable ought to be within 1 and -1 when the variables are normally distributed. Skewness and kurtosis of the test variables was 0.512 and 0.992 respectively indicating normal distribution.

### **5.3 Conclusions**

The macroeconomic variables under study have significant effect on the volatility of returns of firms listed in the Nairobi Securities Exchange as revealed by their effect on the NASI. The findings are that Exchange rates are significantly and positively related to the NSE index. GDP growth rate is significantly and positively related with the NSE index. Interest rates and Inflation rates are significantly and negatively related to the NSE All share index.

The study records that collectively or coincidentally, the variables under study contribute to up to 78.1 % of the volatility of returns for firms listed in the NSE, with a standard error of estimate of 16.98 %. There exists multi colinearity between the CBK rate and the Inflation rate which can be attributed to the application by the Central bank of the CBK rate to control inflation. The other variables do not have linear relationship.

## **5.4 Recommendations**

In formulating and implementing economic policies, the government can be guided by the stock market index as a barometer of the economic performance in addition to the growth rate from the government statistics. GDP growth improves the performance of the stock market with the related growth in wealth, employment greater confidence in the market. Emphasis should be on infrastructure development, investment and innovation rather than on current expenditure that increases broad money supply and related inflation that reduces wealth.

Interest rates have an adverse effect on the economy as depicted by the effect on the index. The government need to maintain the rates low to inspire economic growth and development as high rates will reduce borrowing. While the interest rates attract investments in fixed income securities, and is used to control inflation, inspiring growth can have a bigger effect in the economy.

In a free market economy, exchange rates are controlled by the market forces. Depreciation of the currency makes domestic goods cheaper in the international market but makes international goods dear in the domestic market. The improvement of the stock market index with depreciation of the shilling means the economy is gaining more by exports. Emphasis on export promotion will improve the local wealth and the foreign accounts.

While the growth rate as calculated by the Kenya bureau of statistics is a mathematical measure of growth, it is prone to manipulation and human error. With a belief in efficient market hypothesis, the stock market index is a strong indicator of economic performance.

### **5.5 Limitations of the study**

The gist of the investigation was on the effect of macro- economic variables on the volatility of returns of firms listed on the NSE for the period 2012 to 2016. The data was collected on a quarterly basis. While the study focused on effect of exchange rates, interest rates , inflation rates and GDP, there are other variables that affect the exchange rates whose net effect could be the error factor.

The time covered was short for a well detailed and balanced study. A longer period can reveal long term relationships between the variables. The data was collected on a quarterly basis. More frequent data can also reveal short term trends that can be significant in making predictions.

The study was limited to NSE. To really appreciate the impact of macro- economic variables on the stock market index, a comparison with other markets at different levels of development can be necessary

There were financial limitations particularly at NSE where data had to be paid for per entry. A loner and more frequent analysis would have brought the cost quite high. This limited the data analysed.

### **5.6 Suggestions for further Research**

The objective of the current study was to investigate the effect of macroeconomic variables, in particular Exchange rates, Interest rates, inflation rates, and GDP on the NSE index for the period 2012 to 2016. The study has confirmed some earlier studies but has contradicted others. Further studies could reveal more trends and patterns that can give deeper insight on the relationships.

The study can be extended to other macro economic factors to further deepen the knowledge, including impact of infrastructure development, unemployment balance of trade and balance of

payments, research and technology. Studies can be done on impact of political seasons like electioneering period, and political stability. Social and cultural factors can have an impact including tastes and change of tastes, values and beliefs that can determine demand for certain goods and therefore returns expected there.

Performance of companies not listed in the NSE could have a major impact on economic growth that can affect the market performance and thence the market index due to linkages with listed companies.

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## APPENDICES

### APPENDIX 1

#### NASI, Exchange rates, CBK Rates, Annual Inflation Rates & GDP Growth rates

Observation Date	NSE All Share Index (NASI)	Ex/ Rate kshs/USD  Mean	CBK Rate	Annual Average Inflation	GDP Growth Rate
03-01-12	68.38	85.09	18.00	15.1	4.20%
02-04-12	73.24	83.10	18.00	16.5	4.30%
02-07-12	81.80	84.13	16.50	15.27	5.00%
01-10-12	87.17	85.28	13.00	12.04	4.70%
02-01-13	95.55	86.08	9.50	8.2	6.10%
04-04-13	121.58	84.86	9.50	5.61	7.50%
01-07-13	115.64	85.83	8.50	4.44	6.40%
01-10-13	127.69	86.15	8.50	5.05	3.50%
02-01-14	136.56	86.42	8.50	6.01	5.20%
01-04-14	143.76	86.40	8.50	6.58	6.00%
01-07-14	152.11	87.64	8.50	7.19	4.60%
01-10-14	164.23	89.33	8.50	7.08	5.50%
02-01-15	163.24	90.70	8.50	6.74	5.70%
01-04-15	175.22	92.39	11.50	6.69	5.50%
01-07-15	163.21	99.22	11.50	6.54	5.90%
01-10-15	145.65	104.68	11.50	6.31	5.80%
04-01-16	145.50	102.29	11.50	6.77	6.00%
01-04-16	147.03	101.39	10.50	6.72	5.90%
01-07-16	140.46	101.09	10.00	6.44	5.70%
03-10-16	138.15	101.22	10.00	6.48	5.80%

## **APPENDIX 2**

Firms listed at the Nairobi Securities Exchange as at 20<sup>th</sup> June 2017 ( Source NSE)

### **Agricultural Sector**

Eaagads

Kakuzi

Kapchorua Tea

The Limuru Tea Co

Sasini Ltd

Williamsons Tea Kenya

### **Automobile & Accessories**

Car & General (K)

Marshalls (E.A)

Sammer Africa

### **Banking**

Barclays Bank

Diamond Trust Bank

Housing Finance Co

I&M Holdings Ltd

KCB

NBK

NIC Bank

Stanbic Holdings

Standard Chartered

The Co-operative Bank

### **Commercial Services**

Atlas Africa Industries

Deacons (East Africa)

Eveready EA

Express Kenya

Hutchings Bremer

Kenya Airways

Longhorn Publishing

Nairobi Bussiness Ventures

Nation Media Group

Standard Group

TPS East Africa

Uchumi Supermarkets

WPP Scangroup

### **Construction and Allied**

ARM Cement

Bamburi Cement

Crown Paints Kenya

### **Energy and Petroleum**

Kengen

Kennol Kobil

KPLC Ord.

EA Cables

EA Portland Cement

KPLC 4% Pref.

KPLC 7% Pref.

Total Kenya

Umeme ltd

### **Insurance**

Britam Holdings

CIC Insurance Group

Jubilee Holdings

Kenya RE Corporations

Liberty Kenya Holdings

Sanlam Kenya PLC

### **Investments**

Centum Investments Co

Home Afrika Ltd

Kurwitu Ventures

Olympic ital Holdings

Trans Century Ltd

### **Investment Services**

Nairobi Securities Exchange

### **Manufacturing and Allied**

A.Baumann & Co

B.O.C Kenya

British American Tobacco Kenya

Carbacide Investments

E.A.Breweries

Flame Kenya Group Holdings

Kenya Orchards

Mumias Sugar Company

Unga Group

### **Telecommunications & Technology**

Safaricom ltd

Stanlib Fahari

Barclays New Gold ETF (Exchange Trade Funds)

### APPENDIX 3

#### Descriptive Statistics

	Mean	Std. Deviation	N
NASI	129.3085	32.22670	20
EXCHANGE RATE	91.1645	7.41084	20
CBK RATE	10.9500	3.15353	20
INFLATION RATE	8.0880	3.57236	20
GDP	5.4650	.89282	20

#### LINERITY TEST

#### Correlations

		NASI	EXCHANGE RATE	CBK RATE	INFLATION RATE	GDP
Pearson Correlation	NASI	1.000	.563	-.743	-.777	.346
	EXCHANGE RATE	.563	1.000	-.146	-.420	.314
	CBK RATE	-.743	-.146	1.000	.914	-.400
	INFLATION RATE	-.777	-.420	.914	1.000	-.509
	GDP	.346	.314	-.400	-.509	1.000
	EXCHANGE RATE	.005	.	.270	.033	.089
	CBK RATE	.000	.270	.	.000	.040
	INFLATION RATE	.000	.033	.000	.	.011
	GDP	.068	.089	.040	.011	.
	EXCHANGE RATE	20	20	20	20	20
CBK RATE	20	20	20	20	20	
INFLATION RATE	20	20	20	20	20	
GDP	20	20	20	20	20	

#### Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.884 <sup>a</sup>	.781	.722	16.97966

a. Predictors: (Constant), GDP, EXCHANGE RATE, CBK RATE, INFLATION RATE

**ANOVA<sup>b</sup>**

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	15408.013	4	3852.003	13.361	.000 <sup>a</sup>
	Residual	4324.633	15	288.309		
	Total	19732.646	19			

a. Predictors: (Constant), GDP, EXCHANGE RATE, CBK RATE, INFLATION RATE

b. Dependent Variable: NASI

**MULTI-COLLINERITY-TEST AND REGRESSION EQUATION**

**Coefficients<sup>a</sup>**

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	95.0% Confidence Interval
		B	Std. Error	Beta			Lower Bound
1	(Constant)	-7.872	71.955		-.109	.914	-161.241
	EXCHANGE RATE	2.584	.759	.594	3.404	.004	.966
	CBK RATE	-10.620	4.031	-1.039	-2.635	.019	-19.211
	INFLATION RATE	3.561	3.995	.395	.891	.387	-4.954
	GDP	-1.993	5.158	-.055	-.386	.705	-12.988

a. Dependent Variable: NASI

**NORMALITY TEST:JUST GET THE VALUES**

**Descriptives**

		Statistic	Std. Error
NASI	Mean	129.3085	7.20611
	95% Confidence Interval for Lower Bound	114.2259	
	Mean		
	Upper Bound	144.3911	
	5% Trimmed Mean	130.1428	
	Median	139.3050	
	Variance	1038.560	
	Std. Deviation	32.22670	
	Minimum	68.38	

	Maximum	175.22	
	Range	106.84	
	Interquartile Range	50.27	
	Skewness	-.659	.512
	Kurtosis	-.699	.992
EXCHANGE RATE	Mean	91.1645	1.65711
	95% Confidence Interval for Lower Bound	87.6961	
	Mean Upper Bound	94.6329	
	5% Trimmed Mean	90.8617	
	Median	87.0300	
	Variance	54.921	
	Std. Deviation	7.41084	
	Minimum	83.10	
	Maximum	104.68	
	Range	21.58	
	Interquartile Range	15.20	
	<b>Skewness</b>	.748	.512
	<b>Kurtosis</b>	-1.195	.992
CBK RATE	Mean	10.9500	.70515
	95% Confidence Interval for Lower Bound	9.4741	
	Mean Upper Bound	12.4259	
	5% Trimmed Mean	10.6944	
	Median	9.7500	
	Variance	9.945	
	Std. Deviation	3.15353	
	Minimum	8.50	
	Maximum	18.00	
	Range	9.50	
	Interquartile Range	3.00	
	<b>Skewness</b>	1.410	.512

	<b>Kurtosis</b>	.994	.992	
INFLATION RATE	Mean	8.0880	.79880	
	95% Confidence Interval for Lower Bound	6.4161		
	Mean			
	Upper Bound	9.7599		
	5% Trimmed Mean	7.8233		
	Median	6.7050		
	Variance	12.762		
	Std. Deviation	3.57236		
	Minimum	4.44		
	Maximum	16.50		
	Range	12.06		
	Interquartile Range	1.61		
		<b>Skewness</b>	1.588	.512
		<b>Kurtosis</b>	1.206	.992
GDP	Mean	5.4650	.19964	
	95% Confidence Interval for Lower Bound	5.0471		
	Mean			
	Upper Bound	5.8829		
	5% Trimmed Mean	5.4611		
	Median	5.7000		
	Variance	.797		
	Std. Deviation	.89282		
	Minimum	3.50		
	Maximum	7.50		
	Range	4.00		
	Interquartile Range	1.20		
		<b>Skewness</b>	-.192	.512
		<b>Kurtosis</b>	.850	.992



**HOMOSCEDASTICITY TEST**

Breusch-Pagan and Koenker test

=====

----- Breusch-Pagan and Koenker test statistics and sig-values -----

	LM	Sig
BP	4.073	.396
Koenker	4.253	.373

Null hypothesis: heteroskedasticity not present (homoskedasticity)

if sig-value less than 0.05, reject the null hypothesis

Note: Breusch-Pagan test is a large sample test and assumes the residuals to be normally distributed

----- END MATRIX -----