INFLATION AND STOCK MARKET VOLATILITY IN KENYA

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DECLARATION

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

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This study is presented with my approval as supervisor

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DEDICATION

This study is dedicated to my father Daniel Kilele my mother Mary Kilele, my beloved wife Faith Chebichii Chebor and our lovely daughter Patience Chepkoech Islo for their inspiration.

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I am greatly indebted to the almighty God for giving me knowledge and good health. I am also grateful to my supervisor Dr. Julius Korir for the advice and the time accorded throughout the duration of the project. Thanks to all the lecturers at the School of Economics, Kenyatta University.

I also owe a lot of thanks to my parents Daniel Kilele and Mary Kilele. Special thanks to my colleague Salome Thinguri for the encouragement in the entire period of study. To my wife Faith Chebor, brothers and sisters thank you for the encouragement and emotional support throughout my study.

Nonetheless, I take responsibility for the errors and shortcomings in this study.

TABLE OF CONTENTS

OPERATIONAL DEFINITION OF TERMS

Asymmetry this is *the* downward movements in the stock market that is followed by higher volatilities, than the upward movements of the same size.

Increased Supply of shares this is achieved through initial public offers and privatization of state owned enterprises

Price Discovery is the process of determining the price of a financial instrument in a stock market

Stock market volatility refers to variations in the stock price over time.

Stable price levels this is low inflation

Stock market returns is the log of sector price earnings ratio

Volatility is measured using variance of the stock returns

ABBREVIATIONS

AR	Autoregressive
ARDL	Autoregressive Distributed Lag Model
Cap	Chapter
CMA	Capital Markets Authority
CPI	Consumer Price Index
EGARCH	Exponential Generalized Autoregressive Conditional Heteroscedastic
GARCH	Generalized Autoregressive Conditional Heteroscedastic
IGARCH	Integrated Generalized Autoregressive Conditional Heteroscedastic
ISE	Istanbul Stock Exchange
JSE	Jamaica Stock Exchange
LA-VAR	Lag-Augmented Vector Auto-regression
NSE	Nairobi Securities Exchange
OECD	Organization for Economic Co-operation and Development
OLS	Ordinary Least Squares
QGARCH	Quadratic Generalized Autoregressive Conditional Heteroscedastic
SADC	South African Development Community
U.K	United Kingdom
USA	United States of America
UVAR	Unrestricted Vector Auto-regression
VAR	Vector Auto-regression
VECM	Vector error Correction Models

ABSTRACT

The effect of inflation on the stock market has attracted many studies. Fisher theory postulates that the real rate of returns on common stocks do not depend on inflation, indicating that stocks should be independent of inflation. The studies have attempted to investigate how inflation affects the stock market and the studies have mainly used the aggregate stock market index. However, the use of aggregate indices may mislead on the actual performance of sector-specific indices. The empirical studies using the aggregate index across countries reveal mixed results. The negative and positive effect findings of inflation on stock market contradict the Fisher hypothesis which states that stocks should have a neutral relationship against inflation. In addition there was a difference in the effect of inflation on stock market volatility across the sectors of the stock market. This study investigated the effect of inflation on sector stock market volatility for Kenya Nairobi Securities Exchange. The sectors at the Nairobi Securities Exchange were agricultural, automobiles and accessories, the banking, commercial and services, construction and allied, energy and petroleum, insurance, investment, manufacturing and allied, telecommunication and technology sectors. Monthly secondary time series data, for the period 2006-2014, on inflation price earnings, and Nairobi Securities Exchange Index were used in the analysis. An empirical investigation on the effect of inflation on price earnings and Nairobi Securities Exchange Index was conducted. This study used Autoregressive Distributed Lag Model (ARDL) for sectors whose variables were stationary at levels. Johansen Cointegration Test was used for sectors whose variables were non- stationary. In the latter, Vector Error Correction Model (ECM) was used after confirmation of cointegration. In conclusion the results indicated that inflation affects the automobile and commercial sector price earnings ratio positively while in the short run the automobile sector, banking sector, commercial sector, construction sector, insurance sector, investment sector, manufacturing sector price earnings ratio are all positively correlated to inflation in the short run and in long run. Inflation was negatively correlated to energy sector and agricultural sector. The results indicated that inflation affects all sectors price earnings both in the long run and in the short run. Inflation affects the entire stock market positively.

CHAPTER ONE

INTRODUCTION

1.1 Background

The relationship between the stock market and macroeconomic forces has been widely studied. The extensive literature on relationship between stock market volatility and inflation in the developing and emerging markets mainly cover the linkages between the equity prices and the macroeconomic variables such as inflation, interest rate and exchange rate. The studies have discovered significant effects of macroeconomic variables on stock returns and indicated that stock prices are sensitive to macroeconomic variables. However, very few studies have been done on the interaction between inflation and stock market volatility especially on the sector-specific indices and price-earnings ratio (Diaz and Jareno (2005; Grouard, Levy and Lubochinsky, 2003).

The impact of macroeconomic variables on the stock market volatility varies when sectoral level data are used. Evidence shows that some sectors are more volatile than others. (The studies found technology and telecommunications sector, financial, real estate services, and oil and energy sectors less sensitive to inflation. These studies show that sectors respond differently to inflation across firms and sectors of the stock exchange especially the difference in the transfer of inflation shocks to the prices of their products particularly in terms of magnitude and direction (Boudoukh, Richard and Whitelaw (1994); Geyser and Lowies (2001); Grouard *et al.* (2003); Jareno (2005); Junhua (2008); Diaz and Jareno (2009); and Chinzara (2011). Thus, the ability to transfer inflation shocks is affected by how sensitive each sector is to inflation. Furthermore, other studies indicate stock market volatility is affected by money supply and exchange rates, industrial production, oil prices and interest rates.

Investors and traders of financial market when making decisions rely on their ability to assess market risk and the likely profitability of the financial assets and maximize the returns from their investments. This has led to various researches being undertaken to analyze the forces that determine the equilibrium market volatility. The major connection between inflation and stock market volatility has generated interest on how to evaluate financial risk. This has led to various models being developed to model volatility and measure volatility, the models developed aimed to assist the portfolio manager and risk manager to predict volatility. The risk manager, an investor and portfolio manager in mitigating their risk must have prior knowledge of the future performance of their portfolio. They can appropriately manage their portfolios if they are able to use inflation as a reliable indicator for where the stock market is heading.

Some explanations state that the relationship between stock return and inflation is a reflector of real activity in the economy. Researchers have documented volatility of stock markets acting as the most important factor in the economic growth of an economy (Fama (1981); Wang (2011). Additionally, literature indicates that increased price volatility can in the long run impact on the ability of listed firms in raising capital.

Volatility breeds uncertainty, which impair effective performance of the financial sector as well as the entire economy at large. An unexpected increase in volatility today leads to the upward revision of future expected volatility and risk premium which further leads to discounting of future expected cash flows (assuming cash flows remains the same) at an increased rate which results in lower stock prices or negative returns today. Stock return volatility, therefore, refers to variations in stock price changes during a period of time. This more often is perceived by investors and other agents as a measure of risk. On their part, policymakers and rational investors use market estimate of volatility as a tool to measure the vulnerability of the stock market.

According to Aliyu (2010), there is a strong asymmetric relationship exists between stock returns and stock returns volatility, and stock price volatility is higher when stock price decreases than when stock price increases. Further researches examining volatility have been done on the relationship between inflation and stock exchange volatility. Schwert (1989) attempts to relate the changes in stock market volatility to macroeconomic factors; inflation, industrial production and money supply. Schwert (1989) documented inflation and real output had weak predictive power for the stock market volatility. Some studies have found positive relationship between inflation and stock market returns (Engsted and Tanggaard (2000); Anokye and Tweneboah (2008) while others have documented negative relationship between inflation and stock market (Jaffe and Mandelker, 1976); Omran and Pointman, 2001).

The impact of inflation on industry performance can be classified into three areas: the supply side (production inputs), the demand side (consumption behavior), and the financing cost of both the supply and the demand (cost of money). The impacts of inflation on industry profitability tend to differ across industries due to different pricing power, market dynamics, and financial conditions. Consequently, the timing of the stock market reaction to the variations of inflation provides a good opportunity for investors to develop industry rotation strategies to exploit this relationship. Junhua (2008) investigated the interaction between global inflation and global industries and noted that sensitivities to inflation vary significantly across industries and tend to be higher for noncyclical industries than those of cyclical industries. Examples of the noncyclical industries included Food Products, Utilities and Tobacco, all of which provide economic "necessities", and therefore are, for the most part, considered "recession proof". In contrast, industries involved in the manufacture of durable goods, such as Electrical Equipment, Automobiles, and Household Durables, are severely impacted by economic downturns.

Despite the significance of volatility issue in decision making by investors on which sector or firm to invest in there is little research that has so far been done to find how inflation rate affects the sectors in the stock market (Chinzara, 2011; Geyser and Lowies, 2001). This study filled this gap by investigating the relationship between inflation and return on the different sectors listed on NSE.

1.2 The Stock Market in Kenya

Dealing in shares in Kenya began in 1920's through Nairobi Stock Exchange. In 1951 an estate agent Francis Drummond established the first professional stock broking firm in Kenya. In 1954 the Nairobi Stock Exchange was constituted as a voluntary association of stockbrokers and registered in 1991 as a limited company. NSE was responsible at the time for regulating and developing the trading activities in the Stock Market, Ngugi (2003). Development of the stock market involved changes in the institutional framework and policy environment. The evolution indicated a graduation n from a non-formal market to a formal organization without regulatory body. Thereafter the Capital Market Authority (CMA) was established in the year 1989 through an Act of Parliament (Cap 485A) Laws of Kenya and amended in the year 2000. In the new Act, CMA was mandated to promote, regulate and facilitate development of an orderly, fair and efficient capital markets in Kenya.

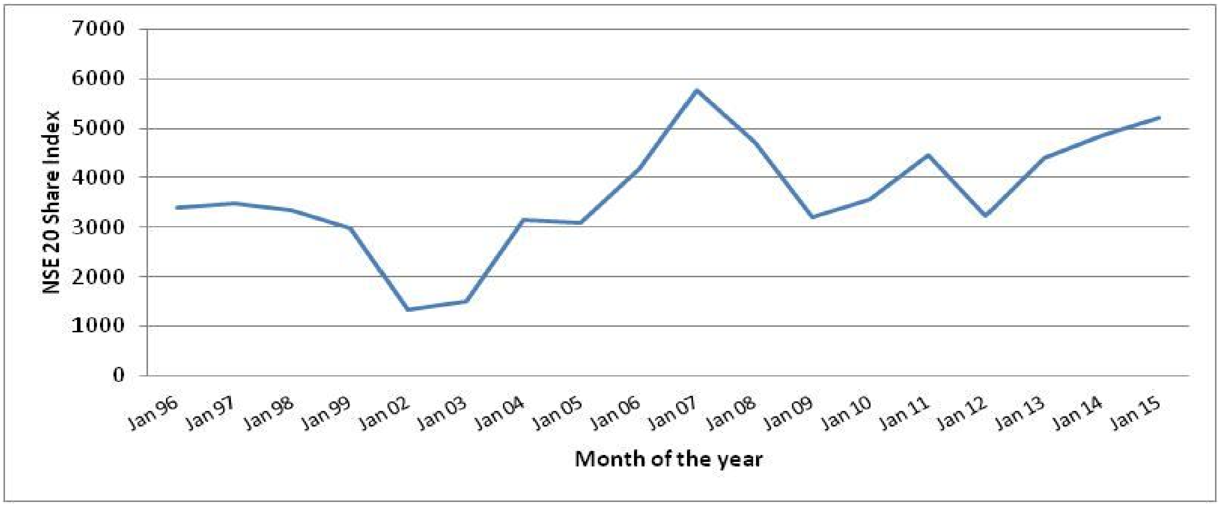

Figure 1.1: NSE 20 Share Index trends in Kenya

Source: Data used from Nairobi Securities Exchange 1996-2015

Figure 1.1 shows that there was downward trend in the stock market index from the year

1996 to the year 2002 before it began to rise. The upward trend continued to the year 2006 and reached its peak in January 2007. The lowest level ever reached by the stock exchange was in March 2009 where the NSE 20 share index was at 2,360. The index was relatively stable in the year 2007 and a decline began in the year 2008 until 2009 when it began to rise again.

In the month of November 2012 the number of listed companies stood at 55. Currently the stock market has three segments namely Main Investment Market segment, the Alternative Investment Market segment and the Fixed Income Securities Market segments. In addition the NSE has ten sectors namely the agricultural, automobiles and accessories, the banking, commercial and services, construction and allied, energy and petroleum, insurance, investment, manufacturing and allied, telecommunication and technology sectors. The Nairobi 20 share index was constructed to provide investors with a comprehensive set of index, the index measures the performance of the major capital and industry segments of the Kenyan market. The NSE 20 share index, in its calculation, has companies with the largest 20 securities in market capitalization, issued dividends and profitability. Another index was later added the Nairobi all share index which presents the performance of all companies in the Securities Exchange.

The main functions of stock market are price discovery and provision of liquidity to corporate by providing companies with a way of issuing shares through initial public offering. The stock market performs a vital role in promoting economic growth and is an avenue for investment. Government and corporate companies use the stock market for raising capital for development projects.

1.3 Inflation in Kenya

In the study of stock market volatility in Kenya, it is important to track the levels of inflation. The tracking helps in determining the impact of inflation on the stock market volatility.

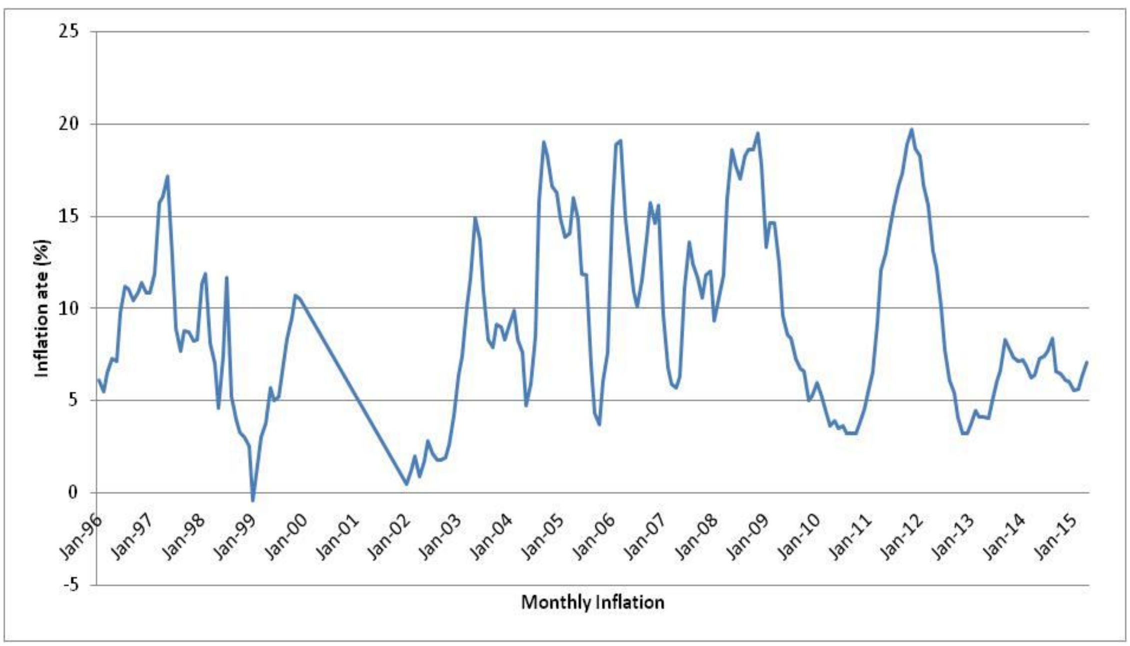

Figure 1.2 Monthly Inflation rate

Source: Kenya National Bureau of Statistics 1996-2015

From Figure 1.2 inflation has been varying between a high of 18.96 percent in September 2004 and a low of -0.44 percent in the month of January 1999. Inflation rate in Kenya has been fluctuating across the period and has not been stable. In Figure 1.2 the effect of inflation on stock market is expected to be the largest in the month of September 2004 and the lowest in the month of January 1999.

1.4 Statement of the Problem

Relationship between the stock market and macroeconomic factors has been widely studied. The extensive literature on relationship between stock market volatility and inflation in the developing and emerging markets mainly cover the linkages between the equity prices and the macroeconomic variables such as inflation, interest rate and exchange rate. However, the impact of macroeconomic variables on the stock market volatility varies when sectoral level data are used. Thus, the ability to transfer inflation shocks in to market return or index is affected by how sensitive each sector is to inflation. This notwithstanding, available literature provide evidence of mixed results of effects of inflation on stock return volatility with some studies indicating that there are sectors which react positively to inflation while others react negatively to inflation (Chinzara, 2011; Grouard *et al,* 2003; Maysami, Howe and Hamzah, 2004).

In Kenya, both inflation and stock returns exhibit volatility. Inflation is shown to be relatively more volatile than the stock market index. The emerging issue is whether or not the inflation shocks affects the stock return volatility. Additionally, in view of the mixed results, it is not clear as to what the effect is of inflation on market returns. Further, its effects on different sectors also need to be examined. This is because investors and portfolio managers need such evidence to guide portfolio investment decisions. The purpose of this study was to investigate effects of inflation on stock market volatility at sectoral and macro level.

1.5 Research questions

(i) What is the effect of inflation on stock market returns?

(ii) What are the effects of inflation on different sectors of the stock market in Kenya?

1.6 Objectives

1.6.1 General objective

In line with the research questions, the general objective of the study was to establish the effect of inflation on stock market returns in Kenya.

1.6.2 Specific objectives

(i) To investigate the effect of inflation on the entire stock market returns.

(ii) To determine the effects of inflation on the different sectors in the stock market in

Kenya.

1.7 Significance of the study

The research is important to the policy makers, investors and the general public. The research is important to the investors as it affects the stock pricing and risk decision making. The results are important to policy makers to know determinants of stock market volatility and the spill-over effects. The policy makers use the stock market condition as a leading indicator of future macroeconomic condition and the results of the study may be used to better control the direction and stability of the economy and identify critical factors that drive market volatility. The investors may improve their portfolio performance in selecting sectors that have positive returns during inflation. From a policy perspective, the conclusions may provide useful insights for the formulation and implementation of fiscal and monetary policies to achieve and safeguard future financial stability and development of stock market.

1.8 Scope and limitation

The scope of this study was limited to stock market data and inflation rate between 2006:9 to 2014:12. The price earnings ratio from 2006:1-2014:12. The study examined the effect of inflation on the sectors of the stock market in Kenya.

1.9 Organization of the study

The remaining part of this study is organized as follows; chapter two a review of literature on the effect of inflation on stock market while chapter three develops the methodology of the study, chapter four presents the results and the interpretations and chapter five summarizes the results and gives conclusions and policy implications of the study.

CHAPTER TWO

LITERATURE REVIEW

2.1 Introduction to Literature

The chapter reviews both the theoretical literature on stock market and inflation and the empirical literature on stock market and inflation.

2.2 Theoretical Literature

2.2.1 Fisher Hypothesis

Fisher theory (1930) postulates that the real rates of returns on common stocks do not depend on inflation. Fisher indicates that stocks should be independent of inflation and theoretically, stock returns should be positively related to the expected economic activity. This implies that the investors are compensated for the increase in inflation level, through increases in nominal stock returns thus real returns not being affected. The Fisher further states that, in response to a change in the money supply, the nominal interest rate changes in tandem with changes in the inflation rate in the long run. For example, if monetary policy were to cause inflation to increase by 5 percentage points, the nominal interest rate in the economy would eventually also increase by 5 percentage points.

2.2.2 Proxy Hypothesis

Fama (1981), developed proxy hypothesis that attempted to explain the anomalous negative behavior that exists between the stock return and inflation. Fama's argument was that the negative relations between inflation and stock return was proxying for positive relations between stock returns and real variables. The author argued the positive relationship between the stock returns and real activity combines with the negative relationship between inflation and real activity to induce the spurious negative relationship between the stock returns and inflation. The study also explained that the anomalous relation of the stock return-inflation disappears when both real variables and measures of expected and unexpected inflation are used to explain the stock returns.

Danthine and Donalson (1986), Stulz (1986), Boyle (1990) and Marshal (1992), predict that stocks may fail to offer a hedge against inflation, especially when inflations is due to non-monetary factors. The money enters into these models as an asset that provides transactions services and whose value is determined simultaneously with other assets, including stocks. Expectations of higher inflation reduce wealth by reducing the purchasing power of money balances carried forward through time. This, in turn reduces expected real returns on stock.

Danthine and Donaldson (1986) further argue that stocks provide protection against a purely monetary inflation but fail to hedge against inflation arising from real output shocks. Stulz (1986) predicts that real stock returns are adversely affected by expectations of higher inflation arising from the monetary sector. However, the impact of an increase in expected inflation on stock returns will be greater when the source of these expectations is due to a worsening of the investment opportunity set rather than an increase in money growth. Marshall (1992) predicts negative correlations between expected asset returns and expected inflation, and that the association will be more strongly negative when inflation arises from fluctuations in real economic activity than from the monetary sector.

Lee (1989), Giovannini and Labadie (1991) employ stochastic general equilibrium models to explore the stock returns-inflation relationship. In these models, money demand arises through a cash-in-advance constraint. Using simulation results from a four-variable VAR, Lee (1989) finds negative cross-correlations between real stock returns and inflation. Giovannini and Labadie (1991) use simulations to show that stocks do provide a good hedge against inflation in the post-war time period.

2.3 Empirical Literature

Research studies have been conducted to determine the effects of inflation on aggregate stock market. Most studies reveals inflation had negative effect on stock return. Fisher Theory states that equities are a hedge against the increase of price level due to the fact that they represent a claim to real assets and, hence, the real change on the price of the equities should not be affected i.e. earnings should be consistent with the inflation rate, and therefore the real value of the stock market should remain unaltered in the long-run. However, Fama (1981) found a negative relationship between stock returns and stated that the negative association found between stock returns and inflation is the result of two underlying relationships between stock returns and expected economic activity; and expected economic activity and inflation. Expectation of higher future dividend account for a positive relationship between stock returns and inflation while money demand effects account for a negative relationship between expected activity and inflation. This argument is certainly plausible and is supported by compelling empirical evidence. However, something of a puzzle still remains in Fama's (1981) empirical results. Various measures of real activity did not, by themselves, entirely eliminate the negative inflation and stock returns relation. The main aim of the section is to review empirical literature relating to inflation and stock market.

Jaffe and Mandelker (1976) using data from New York Stock Exchange in the USA measured return to the market as a whole using the Lawrence Fisher Index and consumer price index as the measure of price level. The dependant variable is the market return while the independent variable is the consumer price index while using simple regression model in the study. The study used both monthly an annual data. Using monthly data the results indicated a negative relationship between inflation and stock market while using annual data the inflation rate had a positive coefficient which suggested that stock market is a partial hedge against inflation. The study in general found a negative relationship between inflation and stock returns in the short run. In the long run the relationship was positive between inflation and stock returns.

Lee (1992) using multivariate VAR approach investigated the causal relations and dynamic interactions among asset returns, real activity and inflation in the U.S.A. The study was a criticism on a study done by Geske and Roll's (1983) and Ram and Spencer's (1983), the studies were on a bivariate causal test and believed that the result may not lead to valid causal relations. The study used monthly data for real stock returns, real interest rates, growth in industrial production and the rate of inflation. Based on cross correlations between the period January 1947 and December 1987 the results indicated that there was no causal link between stock returns and money supply growth hence no causal relationship between inflation and both nominal and real stock returns.

Boudoukh and Richardson (1993) examined the long run relationship between stock returns and inflation. The study was an extension of previous studies that had dwelt more on shorter periods of between one year and less. The study was to fill the gap for the long run relationship since the Fisher model is expected to hold over longer horizons. Inflation was the independent variable in the study influencing the stock returns while using annual data on inflation, stock returns and short term and long term interest rates from 1890-1990 from USA and UK. The study looked at contemporaneous relationship between stock returns and inflation using regression analysis. The results of the study indicated evidence that long horizons nominal stock returns are positively related to both *ex ante* and *ex post* long term inflation. The one year stock returns were regressed on one year inflation while the five year (long-horizon) stock returns was regressed on five year inflation. The regression coefficient for the long horizon was positive, this showed that the stock returns and inflation moved together in the long run. The results support the view that stocks provide compensation for movements in inflation in the long run.

Using regression model Adrangi, Chatrah and Sanvincente (2000) studied the association between inflation, output and stock prices in Brazil. In the study inflation was the independent variable influencing both the output and the stock prices. Using the Johansen and Juselius cointegration tests, the study observed a long-run equilibrium between monthly stock prices, general price levels and the real economic activity. The findings of the study indicated that real stock returns were not related to expected inflation. The study concluded that the negative relationship between inflation rates and real stock returns stemmed from the unexpected component of the inflation rate. The real stock return and activity for Brazil had a positive relationship, in addition the study reports a negative relationship between inflation and real activity.

Engsted and Tanggaard (2000) analyzed the relationship between asset returns as dependent variable and inflation as independent at short and long horizons. The authors criticized the study by Boudoukh and Richardson (1993) in that the approach of looking over longer horizons, may cause time over-lap in data and requires a correction for the estimated matrix. The authors noted that these corrections are unreliable especially when the horizon is large. The study was a proposal for an alternative model to analyze the relationship between more than two periods for asset returns and inflation. The study measured multi-period expected returns and inflation from a VAR model involving one-period variables. Annual inflation was computed from consumer price index and the US stock market data from S&P Composite Stock price Index while for Danish market annual data was used. The results for the US had a moderately positive relationship between stock returns and expected inflation, but the relationship weakened as the time horizon increased from 1 and 5 years to 10 years. In Denmark the relationship between expected stock returns and inflation was positive in all the horizons and became stronger when the horizon was increased.

Geyser and Lowies (2001) using regression analysis focused on the impact of inflation which was an independent variable on stock prices as dependent variable in the South African Development Community (SADC) using annual data. The study focused on the effect of inflation on the sectors of the Johannesburg Stock Exchange and the Namibian Stock exchange. The results of the study indicated that share prices for selected companies in South Africa, listed in the mining sectors are correlated negatively with inflation. Whereas the selected companies in financial services, IT, food and beverage sectors revealed a slightly positive relationship between changes in stock prices and inflation. In addition selected companies in Namibia except Alex Forbes, had a positive correlation between changes in stock prices and inflation. The study concluded that inflation affects the different sectors of the stock market differently.

Davis and Kutan (2003) extended the study done by Schwert (1989). The authors studied the predictive power of inflation and real output on stock returns and volatility. Inflation being the independent variable while real output on stock returns and volatility were expected to depend on inflation. The study covered 13 industrial and developing countries, Austria, Belgium, Canada, Finland, Germany, Israel, Italy, Japan, Korea, Netherlands, Spain, UK and USA. Monthly data on stock price indices, industrial production index, and consumer price index was used. The stock returns, inflation and real output growth was constructed using logarithmic difference of the variables respectively. GARCH and EGARCH model was used in the study. The impact of inflation on the stock market volatility was insignificant for nine countries studied while for four the impact was positive and significant (Netherlands, Japan, Finland and Germany).

Kim and In (2004) using the wavelet multiscaling method decomposed a given time series on a scale by scale. The authors were proposing a new approach for investigating stock returns and inflation relationship over different time scales and how the nominal stock returns correspond differently to inflation over different periods. Inflation as the explanatory variable to explain the stock returns. Wavelet analysis is used to investigate the relationship of the variables over different time scales. The approach according to the study is superior since it has the ability to decompose data into different time scales. The study used monthly data from USA to investigate the relationship between nominal stock returns and inflation over different time scales. Nominal stock returns was compared to real returns on how it corresponds differently to inflation over the different time horizons. The empirical results indicated a positive relationship between stock returns and inflation at the shortest scale (1-month period) and at the longest scale (128-month period). In the intermediate scale the relationship was negative.

Christos (2004) examined the relationship between the stock returns and inflation using monthly data. The study used OLS model which produced a positive relationship between inflation and stock returns but the relationship was not significant. The study used monthly data on general price index as dependent on the consumer price index in the study. The use of a system of equations including lagged values of inflation in the study produced negative relationship between stock returns and inflation. The use of Johansen cointegration test, indicated no long-run relationship between stock returns and inflation in Greece. In conclusion the results indicated inflation rate was not correlated with stock returns in Greece in the long run. The Granger-Causality test indicated evidence of no causality between stock returns and inflation in Greece.

Maysami *et al.,* (2004), the study aimed at filling a void in literature in relation to the cointegration between macroeconomic variables and stock market's sector indices. The study used the Johansen's (1990) vector error correction model and examined the relationship between macroeconomic variables as explaining the effect of sector stock indices. The study used monthly time-series data from Singapore's stock market and the variables used were (the equities finance index, the hotel index, properties index, inflation rate, industrial production interbank rates and money supply data were all logged). The results from the study documented a significant positive relationship between inflation and Singapore stock returns. In the results the all equities finance index and equities property index was influenced positively by inflation while the equities hotel index was affected by inflation negatively. The results indicates that different sectors of the stock market are affected by inflation differently.

Diaz and Jareno (2005) focused on behavioral finance hypothesis and flow through hypothesis. The study aimed at contributing to the literature on the flow through capability of each sector of activity. The sectors of the Spanish stock exchange covered in the study were Petrol and Power, Consumer Services, Basic material, industry and construction, Consumer goods, Financial Services and Real Estate, Technology and Telecommunications. The authors used event study methodology to study the relationship between unexpected inflation news to explain the abnormal stock returns using daily data. The study focused the analysis on the sector of the activity. The study observed a significant positive relationship between stock returns and inflation changes for the Spanish market as a whole and for some sectors.

Chowdhurry, Mollick and Akhter (2006) investigated the relationship between predicted macroeconomic volatility being the independent variable and stock market volatility as the dependent variable for Bangladesh. The study used monthly data for the study and GARCH model to find predicted volatility and VAR model to capture the relationship between macroeconomic volatility and stock market volatility. The study used composite Bangladesh stock exchange index, industrial production index, foreign exchange rate and consumer price index. The results indicated stock market volatility granger causes inflation volatility.

Aga and Kocaman (2006) used regression models and monthly index to investigate the relationship between inflation explaining the movements of price-earnings ratios and stock price behavior in Turkey. In addition the study used simple GARCH models to examine the effects of both returns and volatility simultaneously in the study. The results of the EGARCH model CPI indicated that CPI does not affect both stock return mean and volatility. The study concluded that the inflation is not good at explaining stock returns and volatility for Turkey.

Saryal (2007) extended a study done by Engle and Rangel (2005). The author used the QGARCH models to estimate the impact of inflation on conditional stock market volatility. The independent variable in the study was inflation, the study aimed to analyse how the dependent variable stock market volatility is impacted by inflation. Monthly data from Turkey and Canada was used in the study. The study looked at impact of inflation and indicated that the rate of inflation had high predictive power for stock market volatility in

Turkey. The impact for Canada was weaker but still significant. For Canada the results indicated that a decrease in inflation in the previous period increases conditional volatility this month, for Turkey the impact was weaker. The findings of the study suggested that the higher the interest rates the greater the stock market volatility.

Anokye and Tweneboah (2008) studied the impact of macroeconomic factors on stock market movement for Ghana and employed cointegration and the estimation of a vector error correction model, to analyse the time series behavior of the data. Macroeconomic factors were used as independent variables in the study. The study used quarterly data from Ghana, the variables used were inflation, databank stock index, interest rate, exchange rate and net foreign direct investment. The study specifically employed the Johansen likelihood procedure to explore the long run relationship between the variables. In addition the study used the log of the variables. The results indicated that there was a positive relation between consumer price index (as a measure of inflation) and Databank Stock Index.

Wei (2008) studied stock market reaction to unexpected inflation on different business cycle. Unexpected inflation in the study was used to explain the stock market reaction on different business cycle. The study focused on Fama-French book-to-market and size portfolios. Monthly data from USA and a four-factor model was used to break inflation beta components related to each of the common factors. The common factors in the study were excess market return, size and value premium and the momentum factor. The study concluded that equity returns of firms with smaller book-to-market ratio and medium size companies are negatively correlated with unexpected inflation compared to larger size companies.

Tong and Poon (2009) extended the study by Davis and Kutan (2003). The study was done to estimate the predictive power of output growth and inflation, the extension of the Davis and Kutan (2003) study was the inclusion of interest rate to compare the effect between three mature markets i.e. the US, Japan and Singapore and four emerging markets, the Malaysia, India, Korea and Philippines. The study used GARCH and EGARCH models, and examined the predictive power of output growth and inflation on stock return and its volatility depending on inflation. In addition the study used monthly data on stock prices indices, industrial production index and consumer price index, treasury bills and money market rates. The results revealed strong evidence of output growth and inflation predicting stock return volatility. The results revealed a mixed negative impact to predict stock return was significant in US, Korea and Philippines. In the US, Korea, India, Singapore and Malaysia the effect of inflation on stock market volatility was positive while for Japan and Philippines the impact was negative.

Raymond (2009) used the vector error correction model to investigate the interrelationship between stock prices depending on monetary indicators for Jamaica. The study used monthly lagged data for government of Jamaica treasury bill yields, the exchange rate against US dollar, inflation rate and money supply. The Johansen test was used to determine the existence of a long term relationship between stock prices and monetary variables. The coefficients from co-integrating vectors suggest that JSE main index is positively influenced by inflation. The results of the impulse response functions from inflation rate shock on the stock index was positive for the 24 month horizon. The overall conclusion of the study was that the JSE index is influenced positively by inflation and negatively by exchange rate.

Chen and Xu (2009) used the GARCH model to estimate the conditional volatility of stock market and macroeconomic variables. The study used monthly observations on the returns of China, Shanghai stock market and business cycle variables (growth in industrial production, growth of money supply, the rate of inflation, growth of import, growth of export, and the 30-day interbank rate). The study used a six-variable VAR model to investigate the potential links between selected macroeconomic variables explaining stock returns in China. The response of stock returns to rate of inflation was positive and significant around the fourth month but the response died quickly and returned to steady state or equilibrium following a disturbance. These results indicated that the response of stock returns to inflation is shorter compared to the other variables in the study.

Aliyu (2010) investigated whether inflation has an impact on stock returns and volatility in Nigeria and Ghana, the study employed a step wise approach, where a standard linear GARCH was first applied to capture the stock returns volatility and the QGARCH was applied to test the nonlinearities in the effect of asymmetric information on stock return volatility. The dependant variable in the study was stock returns while the independent variable was inflation. Monthly data was used for both countries, in the period of study the results indicated that the impact of inflation on conditional stock market volatility in Nigeria was negative implying inflation decreases conditional stock market volatility while for Ghana the impact of inflation was positive.

Arjoon, Botes, Chesang and Gupta (2010) used quarterly observations of the nominal stock price index depending on the consumer price index (CPI) for South Africa. The study applied the use of structural bivariate vector autoregressive (VAR) framework in the analysis, the methodology is able to detect the integration and cointegration properties of variables. The study evaluated a possible long run relationship between inflation and real stock prices using time series data. The empirical results provided considerable support of the view that, in the long run real stock prices are invariant to permanent changes in the rate of inflation. The overall finding of the study was in support of the long run real stock prices being invariant to permanent changes in the rate of inflation. The impulse responses indicated a positive real stock price response to a permanent inflation shock in the long run, the results indicated that deviations in the short run will be corrected towards the long run.

The study therefore concluded that inflation does not lower the real value of stocks in South Africa, at least in the long run.

Al-Zoubi and Al-Sharkas (2010) using cointegration methods, in addition the study used the generalized forecast error variance decomposition components and the generalized impulse response functions computed from unrestricted vector autoregressive (UVAR) models. The study investigated the monthly stock prices as dependent variable and CPI as independent variable for the four countries Jordan, Saudi Arabia, Kuwait and Morocco. The study used regression analysis for stock returns and inflation rates while for the cointegration analysis, the levels of stock prices and the changes in inflation. In Jordan, Saudi Arabia and Morocco the empirical results revealed that the stock prices have a long memory with respect to inflation shocks making it a good inflation hedge over a long holding period.

Shahbaz and Islam (2010) examined the relationship between stock returns and inflation being independent in the context of hedge for Pakistan. The study used the autoregressive distributed lag model (ARDL) approach to test for a long run relation. Error correction model for short run dynamics. In addition monthly data was used for the variables stock index (for returns), treasury bills 6 month proxied for interest rate and inflation rate proxied for producer price index. The findings indicate that the stock market returns are positively related hence stock returns act as a good hedge against inflation both in the long run and in the short run.

Olweny and Omondi (2011) studied the effect of macro-economic factors as independent variable that affects stock return volatility in the NSE. The study used the NSE 20 share index monthly data from 2001 to 2010. The study used EGARCH and TGARCH model in the analysis of the data, the model was used in determining the effect of the variables on stock return volatility in NSE. The TGARCH model was used to confirm the results of the EGARCH model. The variables in the study were exchange rate, interest rate and inflation rate. The exchange rate and inflation had a negative and positive impact with stock returns respectively though not significant according to the mean equation.

Oseni and Nwosa (2011), used the AR (k)- EGARCH (p,q) technique to estimate the volatility in stock market and macroeconomic variables being independent. In addition the study used LA-VAR Granger causality to test the relationship between stock market volatility and macroeconomic variables in Nigeria. The study used annual data on stock price index, real gross domestic product and consumer price index as measure of economic activities and inflation rate, short-term interest rate which also influence the economic activity and stock market. The results of the study revealed a bi-causality between stock market volatility and GDP volatility in Nigeria. The results revealed that there is no causal relationship between stock market volatility and inflation volatility.

Rashid, Ahmad and Rehman (2011) measured the impact of inflation on conditional stock market volatility for Pakistan. The study used Integrated GARCH model, in addition the study used monthly log data for CPI as the explanatory variable and stock exchange. The time varying volatility of the stock exchange and the effect of inflation was captured by the model. The results indicated positive but negligible evidence of inflation impacting on stock market volatility.

Wang (2011) analyzed the association between stock market volatility the dependent variable and macroeconomic variables volatility using monthly data from China. The study adjusted quarterly GDP to monthly GDP and CPI as the measures of domestic macroeconomic activity in China, the study also used short term interest rate. All the variables were logged. The study used a two-step approach where the first step was to use AR-EGARCH model to estimate volatility of each variable. In the second step Lag-Augmented Vector Auto-regression (LA-VAR) was applied in investigating causal relationship between stock market volatility and macroeconomic variable volatility. In the study Wang noted a bilateral causal relationship between inflation volatility and stock market volatility.

2.4 Overview of Literature

This chapter highlights the theories and overview of literature on stock return and inflation. The chapter also gives the empirical review of the effect of inflation on stock market. The linkage between inflation and stock market returns has drawn enormous attention among researchers in the past century. The main foundation of the study and debate is Fisher theory (1930) on equity stocks. According to the Fisher theory, equity stocks represent claims against real assets and as such serve as a hedge against inflation.

The studies have had mixed results some documenting positive relationship, others documenting negative relationship while other studies found no-causal relationship.

The theories on the effect of inflation rates on stock return indicate that stocks do not depend on inflation and that the negative relation between inflation and stock return was proxying for positive relations between stock returns and real activity. Further explanations have been given that stocks may fail to provide hedge against inflation especially if its due to non-monetary factors while providing hedge against monetary inflation. From the empirical literature review there has been a study by Olweny and Omondi (2011) on the effect of macroeconomic factors on stock market volatility in Kenya. The study used monthly NSE 20 share index to study the relationship. Geyser and Lowies (2001) conclude that inflation affects the sectors in the stock market differently while Chinzara (2011) notes that use of aggregate data ignores the sector level data hence creating a possibility of losing sector-level information. On the other hand Wei (2008) argues that smaller book-to-market ratio and medium sized companies are more negatively related to unexpected inflation than the bigger book-to-market ratio. It is therefore not clear from the literature how inflation affects the sectors in the Kenyan stock market since there is no available empirical literature. This is the gap that the study attempted to fill in the Kenyan case which is the first contribution in the Kenyan stock market, the results are expected to indicate the response of the sector returns to the inflation rate.

The findings of this study using the monthly data are consistent to Jaffe and Mandelker (1976), Adrangi *et al.* (2000) Maysami *et al.* where using the monthly data the NSE 20 share index has a positive and statistically significant relationship with inflation. The agricultural sector, automobiles sector and energy sector price earnings ratio have a positive relationship with inflation in the long-run. banking sector, commercial sector, construction sector, investment sector, insurance sector and manufacturing sector price earnings ratio earnings ratio in the in the long run have a negative relationship with inflation.

In addition to the testing of the long run relationship for the telecommunication sector and investment sector using ARDL, the study used the Johansen cointegration test and error correction model to test the long run and short run relationship of the sector price earnings ratio to inflation. The results indicated that both in the short run the agricultural sector and energy sector price earnings ratio are affected positively by inflation rate. The automobile sector, banking sector, commercial sector, construction sector, insurance sector, investment sector, manufacturing sector price earnings ratio were all negatively correlated to inflation rate.

According to Davis and Kutan (2003), concluded that impact of inflation was insignificant, automobile and commercial sector is impacted with inflation positively although the impact is insignificant at 5 per cent significance level in the long-run. Christos (2004) examined relationship between general price index and inflation using monthly data using OLS and concluded that the relationship was positive but not significant. Boudoukh, Richard and Whitelaw (1994); Grouard *et al.* (2003); Jareno (2005); Junhua (2008); Diaz and Jareno (2009); and Chinzara (2011) where their studies found technology and telecommunication sector, financial, real estate services, and oil and energy sectors are less sensitive to inflation. The findings of this study show that sector return was affected by inflation positively or negatively and depending with the sector the effect could have been large or small.

CHAPTER THREE

RESEARCH METHODOLOGY

3.1. Introduction

This chapter discusses the methodology of the study. It starts with the research resign, followed by the empirical model, measurement and definition of variables, sources of data and data analysis sections.

3.2. The Research design

The study adopted non-experimental longitudinal (time series) design to analyze the relationship between inflation and earnings on stock market period. Monthly data on variables were collected for the years 2006 to 2014. This study determined the effect of inflation on stock market volatility in Kenya using sector specific price earnings ratio and the NSE 20 share index for the stock market.

3.3. Empirical model

Pesaran, Shin and Smith (1999), developed an approach for testing the existence of a long run level relationship between a dependent variable and a set of regressors, when it was not known with certainty whether the underlying regressors are trend-or first difference stationary. The approach uses ARDL. Pesaran *et al.* (1999) proposed tests based on standard F- and t- statistics to test the significance of the lagged levels of the variables in a first-difference regression. According to the approach, testing for the long run relationship was applicable irrespective of whether the underlying regressors are *I(0) or I(1)* or mutually cointegrated. Wald- test is used to test the significance of the lagged level variables under consideration in an unrestricted error correction regression. If the computed Wald- statistics falls outside the critical value bounds, a conclusive inference can be drawn without needing to know whether the underlying regressors are I(1), cointegrated amongst themselves or individually I(0). If the Wald statistics was within the critical value bound, inference would be inconclusive and knowledge of the order of integration of the underlying variables would be needed before conclusive inference was drawn. The model has several advantages compared to the cointegration models. The first advantage it can be applied to small sample size study, and estimates the short and long run components of the model at the same time, removing problems associated with omitted variables and autocorrelation. The technique provides unbiased estimates of the long run model and valid t-statistics and once the orders of the lags have been identified, estimation of the cointegration relationship may be done using simple ordinary least squares. The ARDL approach has been selected to determine the long run and short run relationship between the sectors and inflation. The choice of the model was based on consistency of results yielded of the long run coefficients that were asymptotically normal irrespective of the order of integration; the method provides unbiased estimates of the long run model and valid t-statistics Ragoobur (2010).

In view of the above advantages ARDL-UECM used by Srinivisan, Kumar and Ganesh (2012) was used in the study as expressed in equation 3.1 to test the relationship between the stationary sectors at levels and inflation.

$$\Delta \text{lOGSector} = \beta_0 + \sum_{i=1}^{p} \delta_1 \Delta \log Sector_{t-1} + \sum_{i=1}^{p} \beta_1 \Delta \log Sector_{t-2} + \sum_{i=1}^{p} \delta_2 \Delta \log inflation_{t-1} + \sum_{i=1}^{p} \beta_2 \Delta \log inflation_{t-2} + \varepsilon_t \qquad 3.1$$

Where sector denotes PE1 agricultural, PE2 Automobiles and accessories, PE3 The banking, PE4 Commercial and services, PE5 Construction and allied, PE6 Energy and petroleum, PE7 insurance, PE_8 investment, PE_9 manufacturing and allied, PE_{10} telecommunication PE_{11} technology sectors a*nd inflation.* Δ denotes a first difference operator; it represents a natural logarithm transformation; β_0 is an intercept and ε_t is a white noise error term.

The second step, once cointegration is established, the conditional ARDL long run model for sectors can be estimated as:

$$\text{lOGSector} = \beta_0 + \sum_{i=1}^{p} \delta_1 \log Sector_{t-1} + \sum_{i=1}^{p} \beta_1 \log Sector_{t-2} + \sum_{i=1}^{p} \delta_2 \log inflation_{t-1} + \sum_{i=1}^{p} \beta_2 \log inflation_{t-2} + \varepsilon_t \quad 3.2$$

The process involves selecting lag order for the ARDL using SIC and AIC.

The last step is obtaining the short run dynamic parameters by estimating an error correction model associated with the long run estimates. The equation is specified below.

$$\Delta\text{lOGSector} = \beta_0 + \sum_{i=1}^{p} \delta_1 \Delta\log Sector_{t-1} + \sum_{i=1}^{p} \beta_1 \Delta \log Sector_{t-2} + \sum_{i=1}^{p} \delta_2 \Delta\log inflation_{t-1} + \sum_{i=1}^{p} \beta_2 \log inflation_{t-2} + \varphi ECT_{T-1} + \varepsilon_t \quad 3.3$$

Where δ and β are the short run dynamic coefficients of the model convergence to equilibrium and φ is the speed of adjustment parameter while ECT is the error correction term derived from equation 3.1.

Nominal sector stock market returns for the selected sector, R_t, and inflation, I_t, is measured as the first difference of the natural logarithm of the stock price index (SPI) and the inflation, respectively:

To estimate the impact of inflation rate on stock market returns, Equation 3.3 was used to test the long run relationship between inflation and the NSE sectors.

3.4. Definition and measurement of variables

PE- is price earnings ratio for the sectors in the Nairobi Securities Exchange and is in logarithm form.

I-is the inflation rate.

Table 3.1a: Definition and measurement of variables

Variable	**Definition**	**Measurement**
Inflation	The is the monthly inflation rate	The change in the general price level converted in to log form. It is obtained as monthly inflation rate.
Agricultural sector **(Agricultural)**	The is the end of month price earnings rate	The change in the price earnings ratio converted in to log form. It is obtained as end of month price earnings ratio for the agricultural sector.
Automobiles and accessories sector **(Automobiles)**	The is the end of month price earnings rate	The change in the price earnings ratio converted in to log form. It is obtained as end of month price earnings ratio for the automobiles and accessories sector.
Banking sector **(Banking)**	The is the end of month price earnings rate	The change in the price earnings ratio converted in to log form. It is obtained as end of month price earnings ratio for the banking sector.
Commercial and services sector **(Commercial)**	The is the end of month price earnings rate	The change in the price earnings ratio converted in to log form. It is obtained as end of month price earnings ratio for the commercial and services sector.
Construction and allied sector **(Construction)**	The is the end of month price earnings rate	The change in the price earnings ratio converted in to log form. It is obtained as end of month price earnings ratio for the construction and allied sector.
Energy and petroleum sector **(Energy)**	The is the end of month price earnings rate	The change in the price earnings ratio converted in to log form. It is obtained as end of month price earnings ratio for the energy and petroleum sector
Insurance sector **(Insurance)**	The is the end of month price earnings rate	The change in the price earnings ratio converted in to log form. It is obtained as end of month price earnings ratio for the agricultural sector
Investment sector **(Investment)**	The is the end of month price earnings rate	The change in the price earnings ratio converted in to log form. It is obtained as end of month price earnings ratio for the insurance sector
Manufacturing and allied sector **(Manufacturing)**	The is the end of month price earnings rate	The change in the price earnings ratio converted in to log form. It is obtained as end of month price earnings ratio for the manufacturing and allied sector

Table 3.1b: Definition and measurement of variables

Telecommunication sector **(Telecom)**	The is the end of month price earnings rate	The change in the price earnings ratio converted in to log form. It is obtained as end of month price earnings ratio for the telecommunication sector
NSE 20 Share index **(NSE 20 Share index)**	The is the end of month NSE 20 Share Index	The change in the NSE 20 share index converted in to log form. It is obtained as end of month NSE 20 share index for the NSE 20 share index

3.5. Data types and sources

This study used monthly data from 2006:9 to 2014:12 for the sectors in the Nairobi Securities Exchange. The data for inflation was sourced from various Economic Surveys published by the Kenya National Bureau of Statistics. The sector data covered 9 years and the 11 sectors of the Nairobi Securities market. The number of observations were 100 and no data cleaning was done.

3.6. Data analysis

In accomplishing objective 1 the NSE 20 share index data was transformed into log form. In accomplishing objective 2 all the sectors price earnings ratio were logged. Before the data was analyzed, stationarity test, VAR order lag order selection, serial correlation and stability test were done on the data. The study addressed all the objectives. Based on the above description of data, a two-step procedure was examined to establish relationship between inflation and the stock market returns. Autoregressive distributed lag model was applied on statationary sectors at levels while the Johansen cointegration test was applied to sectors which were stationary at first difference to establish the relationship between price earnings ratio of sectors and inflation. Error correction model was applied after the data was confirmed to be cointegrated.

CHAPTER FOUR
RESULTS AND DISCUSSIONS

4.1 Introduction

This chapter presents results and their interpretations. It consists of sections on summary statistics, diagnostic tests and regression results.

4.2 Summary statistics

Table 4.1 shows the summary statistics. The statistics are monthly mean results, median, maximum, minimum and standard deviation.

Table 4.1: Summary statistics on earnings by sector

	Mean	Median	Maximum	Minimum	Std. Dev.
Sector					
Agricultural	101.7280	49.5100	1,037.41	0.00000	199.9650
Automobiles	479.6054	327.1450	1,823.70	0.00000	457.1082
Banking	14.5378	11.70500	31.89000	4.11000	6.5458
Commercial	38.5159	40.9250	103.6700	0.00000	22.70288
Construction	18.07380	16.21500	39.40000	9.10000	6.76791
Energy	11.66030	9.60500	33.46000	5.02000	6.310127
Insurance	11.14660	10.05000	31.53000	3.72000	5.707596
Investment	16.34740	13.01500	53.37000	5.93000	9.427736
Manufacturing	18.40920	16.87500	41.15000	8.14000	7.079027
Telecom	17.64210	17.28000	29.96000	7.60000	6.352431
NSE 20 Share Index	4,341.69	4,459.76	5,774.27	2,474.75	809.77
Inflation	8.57190	6.9250	17.07000	3.93000	4.20320

***Source*: Own calculations**

Table 4.1 shows that the average returns for the different sectors. The automobile has the highest mean in price earnings ratio of (479.6054), followed by agricultural sector with a mean in price earnings ratio of (101.7280), commercial sector with a mean in price earnings ratio of (38.5159). The automobiles sector had the highest standard deviation in price earnings ratio (457.1082), followed by agricultural sector with a standard deviation of (199.9650).

4.3 Diagnostic Tests

Test for unit roots

All variables were tested for non-stationarity. Augmented Dickey-Fuller (ADF) and Philips-Peron (PP) test were used to test for the unit root with the data in logarithm form. The results are in Table 4.2a and Table 4.2b.

Table 4.2a: Unit root results at levels

Variables			Unit Root Tests				Conclusion
			ADF test		PP Test		
			Statistics	Critical value	Statistics	Critical value	
Log of Nairobi Securities Exchange index	Levels	Intercept	-1.35344	1%= -3.4977 5%= -2.8909 10%= -2.5825	-1.5360	1%= -3.4977 5%= -2.8909 10%=-2.5825	Not Stationary
		Intercept and Trend	-1.53600	1%=-4.0534 5%=-3.4558 10%=-3.1537	-1.4511	1%= -4.0534 5%= -3.4558 10%=-3.1537	Not Stationary
Log of agriculture sector earnings	Levels	Intercept	-3.1094	1%= -3.4984 5%= -2.8912 10%= -2.5827	-3.2975	1%= -3.4984 5%= -2.8912 10%=-2.5827	Not Stationary
		Intercept and Trend	-3.2507	1%=-4.0544 5%=-3.4563 10%=-3.1539	-3.4429	1%= -4.0543 5%= -3.4563 10%=-3.1540	Not Stationary
Log of automobile sector earnings	Levels	Intercept	-3.6057	1%= -3.4991 5%= -2.8916 10%= -2.5828	-3.4535	1%= -3.4984 5%= -2.8912 10%=-2.5827	Not Stationary
		Intercept and Trend	-3.7094	1%=-4.0544 5%=-3.4563 10%=-3.1539	-3.5755	1%= -4.0543 5%= -3.4563 10%=-3.1540	Not Stationary
Log of banking sector earnings	Levels	Intercept	-1.8345	1%= -3.4985 5%= -2.8912 10%= -2.5827	-1.7205	1%= -3.4984 5%= -2.8912 10%=-2.5827	Not stationary
		Intercept and Trend	-2.0992	1%=-4.0544 5%=-3.4563 10%=-3.1539	-2.1084	1%= -4.0543 5%= -3.4563 10%=-3.1540	Not Stationary
Log of commercial sector earnings	Levels	Intercept	-2.9004	1%= -3.4984 5%= -2.8912 10%= -2.5827	-2.9269	1%= -3.4984 5%= -2.8912 10%=-2.5827	Not Stationary
		Intercept and Trend	-2.9224	1%=-4.0544 5%=-3.4563 10%=-3.1539	-2.9201	1%= -4.0543 5%= -3.4563 10%=-3.1540	Not Stationary
Log of constructio n sector earnings	Levels	Intercept	-2.7311	1%= -3.4985 5%= -2.8912 10%= -2.5827	-2.7538	1%= -3.4984 5%= -2.8912 10%=-2.5827	Not Stationary
		Intercept and Trend	-1.9673	1%=-4.0544 5%=-3.4563 10%=-3.1539	-2.0692	1%= -4.0544 5%= -3.4563 10%=-3.1540	Not Stationary

Table 4.2b: Unit root results at levels

Variables			Unit Root Tests				Conclusion
			ADF test		PP Test		
			Statistics	Critical value	Statistics	Critical value	
Log of energy sector earnings	Levels	Intercept	-2.9385	1%= -3.4985 5%= -2.8912 10%= -2.5827	-2.9969	1%= -3.4984 5%= -2.8912 10%=-2.5827	Not Stationary
		Intercept and Trend	-2.9234	1%=-4.0544 5%=-3.4563 10%=-3.1539	-2.9822	1%= -4.0544 5%= -3.4563 10%=-3.1540	Not Stationary
Log of insurance sector earnings	Levels	Intercept	-2.5963	1%= -3.4985 5%= -2.8912 10%= -2.5827	-3.0855	1%= -3.4984 5%= -2.8912 10%=-2.5827	Not Stationary
		Intercept and Trend	-2.6013	1%=-4.0544 5%=-3.4563 10%=-3.1539	-3.4538	1%= -4.0543 5%= -3.4563 10%=-3.1540	Not Stationary
Log of investment sector earnings	Levels	Intercept	-5.3645	1%= -3.4985 5%= -2.8912 10%= -2.5827	-5.2978	1%= -3.4984 5%= -2.8912 10%=-2.5827	Stationary
		Intercept and Trend	-5.5699	1%=-4.0544 5%=-3.4563 10%=-3.1539	-5.5117	1%= -4.0543 5%= -3.4563 10%=-3.1540	Stationary
Log of manufacturing sector earnings	Levels	Intercept	-0.0144	1%= -3.4985 5%= -2.8912 10%= -2.5827	-0.2560	1%= -3.4984 5%= -2.8912 10%=-2.5827	Not Stationary
		Intercept and Trend	-2.3399	1%=-4.0544 5%=-3.4563 10%=-3.1539	-1.8620	1%= -4.0543 5%= -3.4563 10%=-3.1540	Not Stationary
Log telecommunication sector earnings	Levels	Intercept	-2.1048	1%= -3.4985 5%= -2.8912 10%= -2.5827	-2.2299	1%= -3.4984 5%= -2.8912 10%=-2.5827	Stationary
		Intercept and Trend	-1.8895	1%=-4.0539 5%=-3.4563 10%=-3.1539	-2.0006	1%= -4.0543 5%= -3.4563 10%=-3.1540	Stationary
Log of Inflation rate	Levels	Intercept	-6.7841	1%= -3.4992 5%= -2.8916 10%= -2.5829	-2.1315	1%= -3.4984 5%= -2.8912 10%=-2.5827	Not Stationary
		Intercept and Trend	-6.7480	1%=-4.0544 5%=-3.4568 10%=-3.1543	-2.1117	1%= -4.0543 5%= -3.4563 10%=-3.1540	Not Stationary

***Source*: Own calculations**

The results in Table 4.2a and Table 4.2b show the price earnings ratios were non-stationary except the price earnings ratios for investment sector and telecommunication sector, which were stationary at levels. Additionally, the NSE index was also non-stationary. The price earnings ratios that were not stationary at levels were testing for unit root at first difference. The results of are shown Table 4.3a and Table 4.3b.

Table 4.3a: Unit Root at First Difference

Variables			Unit Root Tests				Conclusion
			ADF test		PP Test		
			Statistics	Critical value	Statistics	Critical value	
Log Nairobi Securities Exchange	First difference	Intercept	-9.6766	1%= -3.4984 5%= -2.8912 10%= -2.5827	-9.6784	1%= -3.4984 5%= -2.8912 10%=-2.5827	Stationary
		Intercept and Trend	-9.7916	1%=-4.0543 5%=-3.4563 10%=-3.1540	-9.7946	1%= -4.0543 5%= -3.4563 10%=-3.1540	Stationary
Log Agricultural sector	First difference	Intercept	-10.4297	1%= -3.5007 5%= -2.8922 10%= -2.5831	-45.7949	1%= -3.4992 5%= -2.8916 10%=-2.5829	Stationary
		Intercept and Trend	-10.4216	1%=-4.0575 5%=-3.4578 10%=-3.1549	-46.4843	1%= -4.0554 5%= -3.4568 10%=-3.1543	Stationary
Log Automobile sector	First difference	Intercept	-10.2320	1%= -3.5007 5%= -2.8922 10%= -2.5831	-45.1786	1%= -3.4992 5%= -2.8916 10%=-2.5829	Stationary
		Intercept and Trend	-10.1756	1%=-4.0575 5%=-3.4578 10%=-3.1549	-44.8212	1%= -4.0554 5%= -3.4568 10%=-3.1543	Stationary
Log Banking sector	First difference	Intercept	-10.1982	1%= -3.5007 5%= -2.8922 10%= -2.5831	-47.8672	1%= -3.4992 5%= -2.8916 10%=-2.5829	Stationary
		Intercept and Trend	-10.1452	1%=-4.0575 5%=-3.4578 10%=-3.1549	-48.0139	1%= -4.0554 5%= -3.4568 10%=-3.1543	Stationary
Log Commercial sector	First difference	Intercept	-10.7123	1%= -3.5007 5%= -2.8922 10%= -2.5831	-91.4954	1%= -3.4992 5%= -2.8916 10%=-2.5829	Stationary
		Intercept and Trend	-10.6535	1%=-4.0575 5%=-3.4578 10%=-3.1549	-90.8529	1%= -4.0554 5%= -3.4568 10%=-3.1543	Stationary
Log Construction sector	First difference	Intercept	-13.1804	1%= -3.4999 5%= -2.8919 10%= -2.5830	-43.5094	1%= -3.4992 5%= -2.8916 10%=-2.5829	Stationary
		Intercept and Trend	-9.4678	1%=-4.0575 5%=-3.4578 10%=-3.1549	-43.2714	1%= -4.0554 5%= -3.4568 10%=-3.1543	Stationary
Log Energy sector	First difference	Intercept	-10.4197	1%= -3.5007 5%= -2.8922 10%= -2.5831	-69.3983	1%= -3.4992 5%= -2.8916 10%=-2.5829	Stationary
		Intercept and Trend	-10.3623	1%=-4.0575 5%=-3.4578 10%=-3.1549	-69.0409	1%= -4.0554 5%= -3.4568 10%=-3.1543	Stationary
Log Insurance sector	First difference	Intercept	-10.4702	1%= -3.5007 5%= -2.8922 10%= -2.5831	-63.2403	1%= -3.4992 5%= -2.8916 10%=-2.5829	Stationary
		Intercept And Trend	-10.4168	1%=-4.0575 5%=-3.4578 10%=-3.1549	-63.4852	1%= -4.0554 5%= -3.4568 10%=-3.1543	Stationary

Table 4.3b: Unit Root at First Difference

Variables			Unit Root Tests				Conclusion
			ADF test		PP Test		
			Statistics	Critical value	Statistics	Critical value	
Log Manufacturing sector	First difference	Intercept	-10.5697	1%= -3.5007 5%= -2.8922 10%= -2.5831	-60.9269	1%= -3.4992 5%= -2.8916 10%=-2.5829	Stationary
		Intercept and Trend	-10.5118	1%=-4.0575 5%=-3.4578 10%=-3.1549	-60.4911	1%= -4.0554 5%= -3.4568 10%=-3.1543	Stationary
Log Inflation	First difference	Intercept	-4.9316	1%= -3.5083 5%= -2.8955 10%= -2.5849	-6.9723	1%= -3.4992 5%= -2.8916 10%=-2.5829	Stationary
		Intercept and Trend	-6.9286	1%=-4.0575 5%=-3.4578 10%=-3.1549	-6.9359	1%= -4.0554 5%= -3.4568 10%=-3.1543	Stationary

***Source*: Own Calculations**

As shown in Table 4.3a and Table 4.3b, all the variables became stationary after first difference. The results of unit root tests indicated the ARDL model as suitable for testing the relationship between price earnings ratios for investment sector and telecommunication sector and inflation rate. Since price earnings in the NSE, agricultural sector, automobile sector, banking sector, commercial sector, construction sector, energy sector, insurance sector, manufacturing sector price earnings were stationary at first difference, the Johansen Cointegration test was the next analysis to be done.

VAR Lag order selection

The autoregressive distributed lag model (ARDL) model, known as bounds test, was used to determine the relationship between the sector returns and inflation rate. The procedure required determining lag length. The results of VAR lag order selection are shown in

Appendix Table A1. Optimal lag length of 2 was adopted based on Akaike information criterion (AIC) and Schwarz information criterion (SC).

Results on serial correlation

The results of test for serial correlation are shown in Appendix Table A2. The results indicated that only agriculture sector had serial correlation.

Stability Test

Stability test was conducted for all the sectors by using the cumulative sum of recursive residuals for all the sectors. The results are presented in Appendix Table A3. The results indicate the agricultural sector was not stable while the automobile sector, banking sector, commercial sector, construction sector, energy sector, insurance sector, manufacturing sector price earnings sectors were stable.

4.4 Results of Bounds Testing Approach to Cointegration

The long run relationship between inflation and the sectors whose price earnings ratios were stationary, was conducted using F-test as explained in Pesaran (1999). In bound test, if the computed F-statistic lies below the lower bound critical value, the null hypothesis of no-co-integration cannot be rejected and when it is above the upper bound, the null hypothesis is rejected, implying a long-run co-integration between the variables. However, when the computed value lies within lower and upper bounds, then the inference is inconclusive.

The computed F-statistics were 7.14 and 3.91 for price earnings ratio for investment and telecommunication sectors, respectively. At 5% level of significance, the critical values were 4.94 and 5.73 for lower and upper bounds, respectively. Therefore, their null hypothesis of no long run relationship between price earnings ratio for investment sector and inflation rate was rejected at 5% level. However, the null hypothesis was not rejected with respect to price earnings ratio for telecommunication sector.

4.5 Co-integration Results and Estimated Long run-coefficients using ARDL approach

Since co-integration was established between price earnings ratio for investment sector and inflation rate, the analysis progressed to the second stage where ARDL model was used to establish the long run and short run relationship between the price earnings ratio of the sector and inflation. The results are presented in Tables 4.6.

Table 4.6: Co-integration results and estimated long run investment Sector

Cointegrating Form				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
DLOG(INVESTMENT(-1))	-0.174535	0.095698	-1.823799	0.0714
DLOG(INFLATION, 2)	-0.741241	0.394299	-1.879898	0.0632
CointEq(-1)	-0.276660	0.072286	-3.827287	0.0002
Long Run Coefficients				
Variable				
DLOG(INFLATION)	-2.679248	1.330925	-2.013072	0.0470
C	2.614256	0.108281	24.143206	0.0000
Selected Model: ARDL(2, 0)				
Included observations: 98				

***Source*: Own Calculations**

Table 4.6 results reveal that the estimated coefficient of inflation was negative and statistically significant at the 5 per cent in the long run. A one percent increase in inflation rate leads to a decrease of 2.68percent in the price earnings ratio of the sector.

Ordinary least squares method was used to estimate the relationship between price earnings share for telecommunication sector and inflation rate. Inflation rate was differenced once to induce stationarity before regression.

Table 4.7: Results and Estimated Long run Telecommunication Sector

Dependent Variable: LOG(TELECOM)				
Method: Least Squares				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
LOG(TELECOM(-1))	0.933026	0.034187	27.29189	0.0000
DLOG(INFLATION)	-0.658233	0.483559	-1.361224	0.1768
DLOG(INFLATION(-1))	1.464291	0.764014	1.916577	0.0584
DLOG(INFLATION(-2))	-1.152059	0.483399	-2.383245	0.0192
C	0.188151	0.096170	1.956441	0.0534
R-squared	0.896209	Mean dependent variable		2.787834
Adjusted R-squared	0.891696	S.D. dependent variable		0.373221
S.E. of regression	0.122825			
Sum squared resid	1.387918			
Log likelihood	68.33791			
F-statistic	198.5991	Durbin-Watson stat		2.082270
Prob(F-statistic)	0.000000			

***Source*: Own Calculations**

Since telecommunications bounds test results indicate no-long run relationship the Least squares model was used to test the relationship between the variable and inflation. Table 4.7 results reveal that the estimated coefficient of inflation is positively cointegrated and statistically significant at the 5 per cent significance level with the dependent variable in the long run. A 1 percent increase in inflation leads to a decrease of 18.81 percent in the sector.

4.6 Cointegration Analysis

Engle and Granger pointed out that a linear combination of two or more non-stationary series may be stationary, where the variables are integrated on order one, I(1). In this case, the linear combination is integrated of order zero, I(0). If such a stationary linear combination exists, the non-stationary time series data is said to be co-integrated. The linear combination is called the cointegrating equation and may be interpreted as a long-run equilibrium relationship among the variables. If the variables are co-integrated then the ECM model is applied.

The NSE, agricultural sector, automobile sector, banking sector, commercial sector, construction sector, energy sector, insurance sector, manufacturing sector price earnings were not stationary at levels and the cointegration analysis (Johansen test) was used to test the relationship between the sectors' price earnings ratios and inflation rate.

Two types of test statistics are reported for Johansen cointegration test. The first block reports the trace statistics and the second block reports the maximum Eigen value statistics. Trace statistic test is a joint test where the null is that the number of cointegrating vectors is less than or equal to r against an unspecified or general alternative that there are more than r. The maximum Eigen value test has its null hypothesis that the number of cointegrating vectors is r against an alternative of r +1 (Brooks, 2008). The results of the Johansen test are presented in Table 4.9

Table 4.8: Unrestricted Cointegration Rank Test

	Null Hypothesis	**Trace statistic**	**Critical value at 5%**	**Null Hypothesis**	**Maximum Eigen Value**	**Critical value at 5%**
Agricultural Sector	r=0*	36.35449	15.49471	r=0*	22.03620	14.26460
	1*	14.31829	3.841466	1*	14.31829	3.841466
Automobile Sector	r=0*	28.43098	15.49471	r=0*	19.61433	14.2646
	1*	8.816659	3.84166	1*	8.816659	3.84166
Banking Sector	r=0*	32.10948	15.49471	r=0*	25.06563	14.2646
	1*	7.04385	3.84166	1*	7.04385	3.84166
Commercial Sector	r=0*	29.10801	15.49471	r=0*	23.40933	14.2646
	1*	5.698676	3.84166	1*	5.698676	3.84166
Construction Sector	r=0*	35.89575	15.49471	r=0*	22.50891	14.2646
	1*	13.38684	3.84166	1*	13.38684	3.84166
Energy Sector	r=0*	28.41453	15.49471	r=0*	20.56919	14.2646
	1*	7.845337	3.84166	1*	7.845337	3.84166
Insurance Sector	r=0*	39.55773	15.49471	r=0*	28.305596	14.2646
	1*	11.25177	3.84166	1*	11.25177	3.84166
Manufacturing Sector	r=0*	23.91763	15.49471	r=0*	23.88226	14.2646
	1*	0.035372	3.84166	1*	0.035372	3.84166
NSE	r=0*	31.97175	15.49471	r=0*	27.29387	14.2646
	1*	4.677881	3.84166	1*	4.677881	3.84166

***Source*: Own Calculations**

Both the trace test and Eigen value statistics did not reject the null hypothesis of no-cointegration for all the sectors analyzed. The results indicated long run relationship between the price earnings ratios for sectors and inflation rate. The results showed that there were two cointegrating equations in all the cases (see, Appendix Table A4 and Table

A5).

The vector error correction model was then applied since cointegration existed between price earnings ratio and inflation rate in the sectors, the study applied to all the sectors.

4.7 Cointegration Results

The normalized cointegrating coefficients results indicated one cointegrating equation, with price earnings ratio for each sector normalized to one (see Appendix Table A4 for details).

Due to the normalization process, the signs are reversed to enable proper interpretation (see for example, Maggiora & Skerman, 2009). The results are shown in Table 4.9.

Table 4.9: Johansen Normalized Cointegrating Coefficients

Sector	Inflation (Standard error in Parenthesis) and [t-statistics]
Agricultural Sector	-116.25 (23.7021) [-4.90475]
Automobile Sector	1,613.5610 (364.8460) [4.42258]
Banking Sector	4.9974 (0.8421) [5.93483]
Commercial Sector	16.0195 (3.2413) [4.94230]
Construction Sector	4.4656 (0.7986) [5.59219]
Energy Sector	-8.9709 (2.1208) [-4.22997]
Insurance Sector	2.5022 (0.4313) [5.80135]
Manufacturing Sector	4.8588 (0.8588) [5.65796]
NSE 20 Share Index	510.4545 (67.0174) [7.61674]

Source: Own calculations

As shown in Table 4.9, the coefficient of logarithm of inflation was statistically significant for all sectors except agriculture and automobile. In the banking sector, a one percent increase in inflation rate (expressed in decimal form) causes 4.99% increase in the price earnings ratio in the sector in the long-run. Similar effect was indicated for the energy sector. However, effect of inflation rate on price earnings ratio was negative in the other sectors. For instance, one percent increase in inflation rate in the insurance sector caused price earnings to decline by 2.5% in the long run. The effect on the NSE index is huge, with a coefficient of 510, which was statistically significant at 5 percent level. Ratio. One percent increase in inflation rate would cause NSE index to decline by 510% in the long run. This is in line with the literature, Junhua (2008) which indicates that some sectors have high magnitude of inflation impact compared to others sectors.

4.8 Error Correction Model results

The price earnings ratio of the sectors are co-integrated, since the price earnings ratio of the sectors were cointegrated the ECM model was applied. The error correction model stands for co-integrating equation. The first part in Table 4.10 shows the estimates of cointegrating equation, while the second part shows estimates of the speed of adjustment to equilibrium coefficient with their corresponding standard errors and t-statistics.

Table 4.10: Vector Error Correction Estimates

Sector's price earnings ratio	Inflation (Standard error in Parenthesis) and [t-statistics]	Inflation (Standard error in Parenthesis) and [t-statistics]
Agriculture	-0.020074 (0.03249) [-0.61782]	0.000210 (0.000044) [4.80892]
Automobile	0.001375 (0.00555) [0.24795]	-0000137 (0.000003) [-4.50806]
Banking	-0.001602 (0.01315) [-0.12184]	-0.005581 (0.00116) [-4.79426]
Commercial	-0.030854 (0.02612) [-1.18128]	-0.001438 (0.00031) [-4.58084]
Construction	-0.007874 (0.01564) [-0.50360]	-0.006075 (0.00126) [-4.84100]
Energy	-0.009771 (0.01066) -0.91661]	0.00203 (0.000510 [4.52695]
Insurance	-0.055278 (0.03804) [-1.45334]	-0.010045 (0.00202) [-4.97086]
Manufacturing	-0.001363 (0.02063) [-0.06608]	-0.005729 (0.00114) [-5.03319]
NSE	0.023551 (0.01788) [1.31695]	-0.0000723 (0.000013) [-5.43751]

***Source*: Own Calculations**

As shown in Table 4.10, in the agricultural sector, about 0.02 per cent disequilibrium is adjusted by changes in price earnings of the agricultural sector, while only 0 per cent (0.000210 per cent) of disequilibrium is corrected by changes in inflation rate considered in the present analysis, the first error correction term is statistically insignificant while the second error correction term is statistically significant at 5 per cent level. Similar effect was indicated for the banking commercial, construction, energy, insurance and manufacturing sectors. In addition, the NSE share index normalized with respect to inflation indicated that 0.02 per cent of disequilibrium is adjusted by changes in the NSE share index and 0 per cent of the disequilibrium is corrected by changes in the inflation rate, the error correction term is statistically significant. (See, Appendix Table A6).

CHAPTER FIVE

SUMMARY, CONCLUSION AND IMPLICATIONS

5.1 Summary

The main objective of the study was to examine the impact of inflation on stock market volatility in aggregate and the specific sectors in the stock market using monthly time series data from 2006:9 to 2014:12. To achieve the objective, the study used ARDL model for the stationary time series data (investment sector) while ordinary least squares was used to analyse the relationship between telecommunication sector and inflation. Johansen Cointegration and Vector error correction model was applied to the non-stationary time series data to investigate both the short and the long run relationship between the automobile sector, banking sector, commercial sector, construction sector, energy sector, insurance sector, manufacturing sectors and inflation.

The coefficient of logarithm of inflation was statistically significant for all sectors except agriculture and automobile. In the banking sector, a one percent increase in inflation rate (expressed in decimal form) causes 4.99% increase in the price earnings ratio in the sector in the long-run. Similar effect was indicated for the energy sector. However, effect of inflation rate on price earnings ratio was negative in the other sectors. For instance, one percent increase in inflation rate in the insurance sector caused price earnings to decline by 2.5% in the long run. The effect on the NSE index is huge, with a coefficient of 510, which was statistically significant at 5 percent level. One percent increase in inflation rate would cause NSE index to decline by 510% in the long run. This is in line with the literature, Junhua (2008) which indicates that some sectors have high magnitude of inflation impact compared to others sectors.

In the short run the agricultural sector, about 0.02 per cent disequilibrium is adjusted by changes in price earnings of the agricultural sector, while only 0 per cent (0.000210 per cent) of disequilibrium is corrected by changes in inflation rate considered in the present analysis, the first error correction term is statistically insignificant while the second error correction term is statistically significant at 5 per cent level. Similar effect was indicated for the banking commercial, construction, energy, insurance and manufacturing sectors. In addition, the NSE share index normalized with respect to inflation indicated that 0.02 per cent of disequilibrium is adjusted by changes in the NSE share index and 0 per cent of the disequilibrium is corrected by changes in the inflation rate and the error correction term is statistically significant.

5.2 Conclusion

It can be concluded that the impact of inflation measured by inflation coefficients is negative/positive and significant implying that an increase/decrease in inflation rate in the previous period increases conditional market volatility the following month. The results supports the Fisher theory which states that, in response to a change in the money supply, the nominal interest rate changes in tandem with changes in the inflation rate in the long run. For example, if monetary policy were to cause inflation to increase by 5 percentage points, the nominal interest rate in the economy would eventually also increase by 5 percentage points for the sectors. Thus, it may be concluded that during times of high inflation, stock returns move with the rate of inflation low and investment channeled from stock exchange into areas less affected by inflation. In addition the results may differ when time horizon is changed.

The fact that specific sectors were represented in the NSE and were individually affected by inflation to a different extent points to the possibility of superior stock returns based on selecting the sectors from specific sectors of the NSE. In addition there is benefit for diversifying investment through selecting stocks from different sectors of the NSE.

5.3 Policy Implications

Based on the findings of the study, the study presents recommendations important to the policy makers, investors, financial market regulators and future researchers.

1. The study recommends the government to come up with measures and policies to help control and stabilize inflation thus creating investor confidence in the securities market. This will accordingly lower the risk and increase investor confidence and increase market investment. This will then have a significant impact on the performance of the Nairobi Securities Exchange hence raise economic growth.

2. Inflation should be maintained at low levels to encourage investment and growth of the financial market. A rise in general level of prices reduces the expected cash inflow from an investment, as result investors who own some assets are exposed to potential reduction of the real value of the asset they hold due to inflation.

3. The regulator should ensure that all the market players comply with the policies and regulations in an effort to ensure efficiency and effectiveness of the stock market.

5.4 Suggestions for Further Research

This study was limited to the impact of inflation on stock return volatility and the sector return volatility for the period 2006:9 to 2014:12. This leaves some further research and in particular the need to determine the impact of inflation on the size of the sector in the stock market (in capitalization), the impact of daily news to the sector in the NSE and the daily sector volatility. More studies may also be done using the exchange rate and the impact to the sector price earnings ratio.

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Appendix

Table A1: Result for VAR Lag Order Selection Criteria

VAR Lag Order Selection Criteria
Endogenous variables: AGRICULTURAL
INFLATION Exogenous variables: C
Sample: 1 100
Included observations: 90

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-864.8341	NA	795899.6	19.26298	19.31853	19.28538
1	-648.3762	418.4852	7086.804	14.54169	14.70835	14.60890
2	-514.7046	252.4909	397.2546	11.66010	11.93786*	11.77211
3	-512.7539	3.597911	415.9306	11.70564	12.09450	11.86245
4	-510.8668	3.396839	436.2358	11.75260	12.25256	11.95421
5	-506.2380	8.126089	430.6626	11.73862	12.34969	11.98504
6	-502.6957	6.061241	435.7677	11.74879	12.47096	12.04001
7	-484.6815	30.02374	319.8621	11.43737	12.27064	11.77339
8	-470.9746	22.23556	258.5496	11.22166	12.16603	11.60249*
9	-468.4846	3.928686	268.3659	11.25521	12.31069	11.68084
10	-461.8673	10.14656*	254.3754*	11.19705*	12.36363	11.66748

* indicates lag order selected by the criterion
LR: sequential modified LR test statistic (each test at 5%
level) FPE: Final prediction error
AIC: Akaike information criterion
SC: Schwarz information criterion
HQ: Hannan-Quinn information criterion

VAR Lag Order Selection Criteria
Endogenous variables: AUTOMOBILES
INFLATION Exogenous variables: C
Sample: 1 100
Included observations: 90

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-937.2829	NA	3981625.	20.87295	20.92850	20.89535
1	-732.4666	395.9781	45920.41	16.41037	16.57702	16.47757
2	-600.5087	249.2539*	2674.012*	13.56686*	13.84462*	13.67887*
3	-598.8047	3.143039	2815.110	13.61788	14.00674	13.77469
4	-597.2390	2.818228	2973.706	13.67198	14.17194	13.87359
5	-594.8392	4.212848	3084.797	13.70754	14.31860	13.95396
6	-594.6341	0.351021	3361.640	13.79187	14.51404	14.08309
7	-592.9821	2.753375	3549.528	13.84405	14.67732	14.18007
8	-591.9896	1.609987	3805.907	13.91088	14.85525	14.29171
9	-589.1987	4.403432	3924.078	13.93775	14.99322	14.36338
10	-586.2222	4.563964	4032.951	13.96049	15.12707	14.43093

* indicates lag order selected by the criterion
LR: sequential modified LR test statistic (each test at 5%
level) FPE: Final prediction error
AIC: Akaike information criterion
SC: Schwarz information criterion
HQ: Hannan-Quinn information criterion

VAR Lag Order Selection Criteria
Endogenous variables: BANKING
INFLATION Exogenous variables: C
Sample: 1 100
Included observations: 90

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-527.4416	NA	441.2519	11.76537	11.82092	11.78777
1	-268.2432	501.1169	1.519815	6.094293	6.260947	6.161498
2	-125.0692	270.4397*	0.068977*	3.001538*	3.279295*	3.113546*
3	-123.1111	3.611630	0.072208	3.046913	3.435773	3.203724
4	-121.6416	2.645102	0.076439	3.103147	3.603109	3.304761
5	-116.3109	9.358276	0.074294	3.073576	3.684641	3.319994
6	-112.2409	6.964332	0.074298	3.072019	3.794187	3.363240
7	-109.5399	4.501636	0.076644	3.100887	3.934156	3.436910
8	-107.6250	3.106388	0.080512	3.147222	4.091595	3.528049
9	-103.7037	6.186940	0.080953	3.148971	4.204446	3.574601
10	-99.58045	6.322313	0.081105	3.146232	4.312810	3.616665

* indicates lag order selected by the criterion
LR: sequential modified LR test statistic (each test at 5%
level) FPE: Final prediction error
AIC: Akaike information criterion
SC: Schwarz information criterion
HQ: Hannan-Quinn information criterion

VAR Lag Order Selection Criteria
Endogenous variables: COMMERCIAL
INFLATION Exogenous variables: C
Sample: 1 100
Included observations: 90

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-669.9985	NA	10483.39	14.93330	14.98885	14.95570
1	-463.8373	398.5782	117.3457	10.44083	10.60748	10.50803
2	-323.4691	265.1400	5.668352*	7.410424*	7.688180*	7.522431*
3	-322.7584	1.310778	6.100650	7.483520	7.872379	7.640331
4	-319.9462	5.062018	6.268280	7.509915	8.009877	7.711529
5	-316.4431	6.149791	6.344958	7.520958	8.132023	7.767375
6	-312.4323	6.863007	6.353668	7.520717	8.242884	7.811937
7	-309.9415	4.151354	6.584894	7.554255	8.387524	7.890278
8	-305.3484	7.450899	6.517595	7.541076	8.485449	7.921903
9	-298.9379	10.11446*	6.200597	7.487508	8.542983	7.913138
10	-294.9151	6.168304	6.226169	7.487001	8.653579	7.957434

* indicates lag order selected by the criterion
LR: sequential modified LR test statistic (each test at 5%
level) FPE: Final prediction error
AIC: Akaike information criterion
SC: Schwarz information criterion
HQ: Hannan-Quinn information criterion

VAR Lag Order Selection Criteria
Endogenous variables: CONSTRUCTION
INFLATION Exogenous variables: C

Sample: 1 100
Included observations: 90

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-510.7880	NA	304.7635	11.39529	11.45084	11.41769
1	-280.9504	444.3526	2.015711	6.376677	6.543331	6.443881
2	-138.7206	268.6563*	0.093423*	3.304903*	3.582660*	3.416911*
3	-136.1295	4.779296	0.096432	3.336210	3.725070	3.493021
4	-134.4312	3.056936	0.101565	3.387359	3.887321	3.588973
5	-132.6303	3.161487	0.106771	3.436229	4.047294	3.682646
6	-129.9437	4.597029	0.110111	3.465417	4.187584	3.756637
7	-126.6036	5.566894	0.111984	3.480080	4.313350	3.816104
8	-125.1123	2.419249	0.118749	3.535829	4.480201	3.916655
9	-121.4723	5.743079	0.120148	3.543829	4.599304	3.969459
10	-117.8275	5.588704	0.121661	3.551722	4.718300	4.022155

* indicates lag order selected by the criterion
LR: sequential modified LR test statistic (each test at 5%
level) FPE: Final prediction error
AIC: Akaike information criterion
SC: Schwarz information criterion
HQ: Hannan-Quinn information criterion

VAR Lag Order Selection Criteria
Endogenous variables: ENERGY
INFLATION Exogenous variables: C
Sample: 1 100
Included observations: 90

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-540.9716	NA	596.0259	12.06604	12.12159	12.08844
1	-338.6256	391.2023	7.261908	7.658347	7.825001	7.725552
2	-200.5055	260.8936*	0.368754*	4.677900*	4.955656*	4.789908*
3	-198.2408	4.177080	0.383406	4.716462	5.105322	4.873273
4	-195.8732	4.261714	0.397852	4.752738	5.252699	4.954352
5	-192.2668	6.331239	0.401795	4.761484	5.372549	5.007901
6	-189.6907	4.408038	0.415381	4.793126	5.515293	5.084346
7	-185.3981	7.154206	0.413602	4.786625	5.619895	5.122649
8	-183.2145	3.542295	0.431891	4.826990	5.771362	5.207816
9	-179.1090	6.477548	0.432481	4.824645	5.880121	5.250275
10	-175.9585	4.830832	0.442764	4.843522	6.010100	5.313955

* indicates lag order selected by the criterion
LR: sequential modified LR test statistic (each test at 5%
level) FPE: Final prediction error
AIC: Akaike information criterion
SC: Schwarz information criterion
HQ: Hannan-Quinn information criterion

VAR Lag Order Selection Criteria
Endogenous variables: INSURANCE
INFLATION Exogenous variables: C
Sample: 1 100
Included observations: 90

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-495.8937	NA	218.8864	11.06431	11.11986	11.08671
1	-319.3984	341.2243	4.736845	7.231076	7.397730	7.298281
2	-174.5842	273.5379*	0.207286*	4.101872*	4.379628*	4.213879*
3	-172.4393	3.956243	0.216097	4.143095	4.531954	4.299906
4	-169.4081	5.456041	0.220957	4.164625	4.664587	4.366239
5	-167.1636	3.940489	0.230003	4.203635	4.814699	4.450052
6	-166.0602	1.887889	0.245691	4.268005	4.990173	4.559226
7	-164.1847	3.125960	0.258138	4.315215	5.148485	4.651238
8	-162.7509	2.325899	0.274082	4.372242	5.316615	4.753069
9	-159.7371	4.755035	0.281196	4.394159	5.449634	4.819788
10	-154.9523	7.336807	0.277614	4.376717	5.543295	4.847150

* indicates lag order selected by the criterion
LR: sequential modified LR test statistic (each test at 5%
level) FPE: Final prediction error
AIC: Akaike information criterion
SC: Schwarz information criterion
HQ: Hannan-Quinn information criterion

VAR Lag Order Selection Criteria
Endogenous variables: INVESTMENT
INFLATION Exogenous variables: C
Sample: 1 100
Included observations: 90

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-573.5159	NA	1228.426	12.78924	12.84479	12.81164
1	-384.3665	365.6888	20.06759	8.674811	8.841465	8.742016
2	-251.4878	250.9932	1.144896*	5.810839*	6.088596*	5.922847*
3	-250.0636	2.626743	1.212829	5.868080	6.256940	6.024891
4	-248.5011	2.812568	1.281247	5.922246	6.422208	6.123860
5	-245.0486	6.061085	1.298377	5.934413	6.545477	6.180830
6	-244.3235	1.240741	1.398644	6.007188	6.729355	6.298408
7	-234.0018	17.20278*	1.218024	5.866706	6.699976	6.202730
8	-232.5333	2.382230	1.292258	5.922962	6.867335	6.303789
9	-229.6833	4.496687	1.330633	5.948517	7.003993	6.374147
10	-226.8700	4.313639	1.372522	5.974890	7.141468	6.445322

* indicates lag order selected by the criterion
LR: sequential modified LR test statistic (each test at 5%
level) FPE: Final prediction error
AIC: Akaike information criterion
SC: Schwarz information criterion
HQ: Hannan-Quinn information criterion

VAR Lag Order Selection Criteria
Endogenous variables: MANUFUCTURING
INFLATION Exogenous variables: C
Sample: 1 100
Included observations: 90

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-557.8933	NA	868.1128	12.44207	12.49763	12.46448
1	-330.5247	439.5794	6.065525	7.478326	7.644980	7.545530
2	-184.6321	275.5748*	0.259145*	4.325158*	4.602915*	4.437166*
3	-184.0631	1.049445	0.279788	4.401403	4.790262	4.558214
4	-179.7722	7.723692	0.278183	4.394938	4.894900	4.596552
5	-176.6545	5.473227	0.284008	4.414545	5.025610	4.660962
6	-174.8075	3.160543	0.298407	4.462388	5.184555	4.753608
7	-173.0616	2.909849	0.314429	4.512479	5.345749	4.848502
8	-171.9579	1.790357	0.336308	4.576842	5.521215	4.957669
9	-168.2404	5.865414	0.339683	4.583120	5.638595	5.008749
10	-165.9068	3.578133	0.354131	4.620152	5.786730	5.090584

* indicates lag order selected by the criterion
LR: sequential modified LR test statistic (each test at 5%
level) FPE: Final prediction error
AIC: Akaike information criterion
SC: Schwarz information criterion
HQ: Hannan-Quinn information criterion

VAR Lag Order Selection Criteria
Endogenous variables: TELECOM
INFLATION Exogenous variables: C
Sample: 1 100
Included observations: 90

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-529.4595	NA	461.4892	11.81021	11.86576	11.83261
1	-292.1685	458.7626	2.586387	6.625967	6.792621	6.693171
2	-151.7820	265.1746*	0.124884*	3.595155*	3.872911*	3.707163*
3	-149.9020	3.467420	0.130961	3.642267	4.031127	3.799078
4	-146.7227	5.722830	0.133466	3.660504	4.160466	3.862118
5	-144.7773	3.415185	0.139857	3.706163	4.317227	3.952580
6	-144.1963	0.994153	0.151141	3.782141	4.504308	4.073361
7	-139.0207	8.625970	0.147569	3.756017	4.589286	4.092040
8	-135.7472	5.310422	0.150407	3.772160	4.716533	4.152987
9	-133.4451	3.632136	0.156771	3.809892	4.865367	4.235522
10	-130.4376	4.611532	0.161009	3.831947	4.998525	4.302380

* indicates lag order selected by the criterion
LR: sequential modified LR test statistic (each test at 5%
level) FPE: Final prediction error
AIC: Akaike information criterion
SC: Schwarz information criterion
HQ: Hannan-Quinn information criterion

VAR Lag Order Selection Criteria
Endogenous variables: NSE
INFLATION Exogenous variables: C
Sample: 2006M09 2014M12
Included observations: 92

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-964.8246	NA	4602789.	21.01793	21.07275	21.04005
1	-723.0132	467.8525	26170.94	15.84811	16.01258	15.91449
2	-575.7774	278.4678	1162.991*	12.73429*	13.00840*	12.84492*
3	-573.2150	4.734774	1200.362	12.76554	13.14929	12.92043
4	-571.3163	3.425984	1257.303	12.81122	13.30462	13.01036
5	-563.8691	13.11342	1167.746	12.73629	13.33932	12.97968
6	-562.5433	2.277061	1239.511	12.79442	13.50710	13.08206
7	-556.2491	10.53589*	1181.647	12.74455	13.56687	13.07644
8	-554.7009	2.524238	1249.727	12.79785	13.72981	13.17399

* indicates lag order selected by the criterion
LR: sequential modified LR test statistic (each test at 5% level)
FPE: Final prediction error
AIC: Akaike information criterion
SC: Schwarz information criterion
HQ: Hannan-Quinn information criterion

Table A2: Results on Serial Correlation

Agricultural Sector

Breusch-Godfrey Serial Correlation LM Test:

F-statistic	24.98110	Prob. F(2,88)	0.0000
Obs*R-squared	35.12798	Prob. Chi-Square(2)	0.0000

Test Equation:
Dependent Variable: RESID
Method: Least Squares
Sample: 4 100
Included observations: 97
Presample missing value lagged residuals set to zero.

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.980943	0.339395	2.890267	0.0048
DLOG(AGRICULTURAL(-1))	-0.493473	0.119543	-4.128015	0.0001
DLOG(AGRICULTURAL(-2))	-0.062640	0.107846	-0.580829	0.5628
DLOG(INFLATION(-1))	0.455984	1.703953	0.267604	0.7896
DLOG(INFLATION(-2))	0.447395	1.746537	0.256161	0.7984
LOG(AGRICULTURAL(-1))	-0.238431	0.075482	-3.158787	0.0022
LOG(INFLATION(-1))	0.001751	0.104031	0.016829	0.9866
RESID(-1)	1.072379	0.179435	5.976425	0.0000
RESID(-2)	-0.003293	0.187284	-0.017581	0.9860

R-squared	0.362144	Mean dependent var	-3.93E-16
Adjusted R-squared	0.304157	S.D. dependent var	0.474884
S.E. of regression	0.396135	Akaike info criterion	1.074069
Sum squared resid	13.80921	Schwarz criterion	1.312960
Log likelihood	-43.09235	Hannan-Quinn criter.	1.170665
F-statistic	6.245276	Durbin-Watson stat	1.966736
Prob(F-statistic)	0.000002		

Automobiles

Breusch-Godfrey Serial Correlation LM Test:

F-statistic	1.206840	Prob. F(2,88)	0.3040
Obs*R-squared	2.589508	Prob. Chi-Square(2)	0.2740

Test Equation:
Dependent Variable: RESID
Method: Least Squares
Sample: 4 100
Included observations: 97
Presample missing value lagged residuals set to zero.

Variable	Coefficient	Std. Error	t-Statistic	Prob.

C	0.692499	5.768155	0.120056	0.9047
DLOG(AUTOMOBILES(-1))	-0.279044	0.242318	-1.151560	0.2526
DLOG(AUTOMOBILES(-2))	0.252682	0.217825	1.160020	0.2492
DLOG(INFLATION(-1))	-0.093028	3.341005	-0.027844	0.9778
DLOG(INFLATION(-2))	-0.219708	4.200043	-0.052311	0.9584
LOG(AUTOMOBILES(-1))	-0.120698	1.010077	-0.119494	0.9052
LOG(INFLATION(-1))	0.008247	0.222046	0.037141	0.9705
RESID(-1)	0.431065	1.149659	0.374951	0.7086
RESID(-2)	-0.320868	0.559515	-0.573474	0.5678

R-squared	0.026696	Mean dependent var	-3.34E-16
Adjusted R-squared	-0.061786	S.D. dependent var	0.791852
S.E. of regression	0.815948	Akaike info criterion	2.519260
Sum squared resid	58.58785	Schwarz criterion	2.758151
Log likelihood	-113.1841	Hannan-Quinn criter.	2.615856
F-statistic	0.301710	Durbin-Watson stat	1.994926
Prob(F-statistic)	0.963506		

Banking

Breusch-Godfrey Serial Correlation LM Test:

F-statistic	2.630496	Prob. F(2,88)	0.0777
Obs*R-squared	5.471915	Prob. Chi-Square(2)	0.0648

Test Equation:
Dependent Variable: RESID
Method: Least Squares
Sample: 4 100
Included observations: 97
Presample missing value lagged residuals set to zero.

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-0.226388	0.266060	-0.850891	0.3971
DLOG(BANKING(-1))	-0.493536	0.587236	-0.840440	0.4029
DLOG(BANKING(-2))	0.880400	0.406777	2.164331	0.0331
DLOG(INFLATION(-1))	-0.217202	0.668605	-0.324859	0.7461
DLOG(INFLATION(-2))	0.178224	0.684752	0.260275	0.7953
LOG(BANKING(-1))	0.064715	0.071720	0.902331	0.3693
LOG(INFLATION(-1))	0.030454	0.052582	0.579184	0.5639
RESID(-1)	0.390147	0.624078	0.625157	0.5335
RESID(-2)	-1.093685	0.502383	-2.176996	0.0322

R-squared	0.056411	Mean dependent var	-5.78E-17
Adjusted R-squared	-0.029369	S.D. dependent var	0.153207
S.E. of regression	0.155441	Akaike info criterion	-0.796912
Sum squared resid	2.126239	Schwarz criterion	-0.558022
Log likelihood	47.65025	Hannan-Quinn criter.	-0.700317
F-statistic	0.657624	Durbin-Watson stat	1.970556
Prob(F-statistic)	0.727110		

Commercial

Breusch-Godfrey Serial Correlation LM Test:

F-statistic	0.031748	Prob. F(2,88)	0.9688
Obs*R-squared	0.069940	Prob. Chi-Square(2)	0.9656

Test Equation:
Dependent Variable: RESID
Method: Least Squares
Sample: 4 100
Included observations: 97
Presample missing value lagged residuals set to zero.

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.002670	2.026142	0.001318	0.9990
DLOG(COMMERCIAL(-1))	-0.227116	1.584780	-0.143311	0.8864
DLOG(COMMERCIAL(-2))	0.120794	0.529063	0.228317	0.8199
DLOG(INFLATION(-1))	0.011544	2.923450	0.003949	0.9969
DLOG(INFLATION(-2))	0.009297	3.961432	0.002347	0.9981
LOG(COMMERCIAL(-1))	0.005242	0.528496	0.009919	0.9921
LOG(INFLATION(-1))	-0.009930	0.211610	-0.046926	0.9627
RESID(-1)	0.221887	2.025086	0.109569	0.9130
RESID(-2)	-0.219464	0.871020	-0.251962	0.8017

R-squared	0.000721	Mean dependent var	-1.26E-16
Adjusted R-squared	-0.090123	S.D. dependent var	0.678250
S.E. of regression	0.708153	Akaike info criterion	2.235880
Sum squared resid	44.13032	Schwarz criterion	2.474771
Log likelihood	-99.44018	Hannan-Quinn criter.	2.332476
F-statistic	0.007937	Durbin-Watson stat	1.999202
Prob(F-statistic)	1.000000		

Construction

Breusch-Godfrey Serial Correlation LM Test:

F-statistic	0.539538	Prob. F(2,88)	0.5849
Obs*R-squared	1.175028	Prob. Chi-Square(2)	0.5557

Test Equation:
Dependent Variable: RESID
Method: Least Squares
Sample: 4 100
Included observations: 97
Presample missing value lagged residuals set to zero.

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-0.171260	0.245256	-0.698293	0.4868

DLOG(CONSTRUCTION(-1))	0.457219	0.453688	1.007783	0.3163
DLOG(CONSTRUCTION(-2))	0.164571	0.351060	0.468784	0.6404
DLOG(INFLATION(-1))	0.044982	0.447118	0.100604	0.9201
DLOG(INFLATION(-2))	0.089093	0.479318	0.185875	0.8530
LOG(CONSTRUCTION(-1))	0.050248	0.068516	0.733377	0.4653
LOG(INFLATION(-1))	0.016073	0.035738	0.449741	0.6540
RESID(-1)	-0.532872	0.513077	-1.038580	0.3018
RESID(-2)	-0.066642	0.369544	-0.180336	0.8573

R-squared	0.012114	Mean dependent var	-1.14E-16
Adjusted R-squared	-0.077694	S.D. dependent var	0.103377
S.E. of regression	0.107318	Akaike info criterion	-1.537847
Sum squared resid	1.013511	Schwarz criterion	-1.298956
Log likelihood	83.58556	Hannan-Quinn criter.	-1.441251
F-statistic	0.134885	Durbin-Watson stat	2.007801
Prob(F-statistic)	0.997464		

Energy

Breusch-Godfrey Serial Correlation LM Test:

F-statistic	0.339421	Prob. F(2,88)	0.7131
Obs*R-squared	0.742542	Prob. Chi-Square(2)	0.6899

Test Equation:
Dependent Variable: RESID
Method: Least Squares
Sample: 4 100
Included observations: 97
Presample missing value lagged residuals set to zero.

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-0.881463	1.166281	-0.755790	0.4518
DLOG(ENERGY(-1))	0.068846	1.033992	0.066582	0.9471
DLOG(ENERGY(-2))	0.381727	0.689596	0.553552	0.5813
DLOG(INFLATION(-1))	-0.188706	1.085642	-0.173820	0.8624
DLOG(INFLATION(-2))	0.203253	1.176535	0.172756	0.8632
LOG(ENERGY(-1))	0.239521	0.317588	0.754188	0.4527
LOG(INFLATION(-1))	0.159865	0.216750	0.737555	0.4627
RESID(-1)	-0.319014	1.184414	-0.269343	0.7883
RESID(-2)	-0.531318	1.005472	-0.528427	0.5985

R-squared	0.007655	Mean dependent var	-3.37E-16
Adjusted R-squared	-0.082558	S.D. dependent var	0.246638
S.E. of regression	0.256617	Akaike info criterion	0.205728
Sum squared resid	5.794997	Schwarz criterion	0.444619
Log likelihood	-0.977814	Hannan-Quinn criter.	0.302324
F-statistic	0.084855	Durbin-Watson stat	2.005919
Prob(F-statistic)	0.999529		

Insurance

Breusch-Godfrey Serial Correlation LM Test:

F-statistic	0.943048	Prob. F(2,88)	0.3933
Obs*R-squared	2.035368	Prob. Chi-Square(2)	0.3614

Test Equation:
Dependent Variable: RESID
Method: Least Squares
Sample: 4 100
Included observations: 97
Presample missing value lagged residuals set to zero.

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-0.258763	0.300186	-0.862008	0.3910
DLOG(INSURANCE(-1))	0.430932	0.410970	1.048574	0.2972
DLOG(INSURANCE(-2))	0.269694	0.264808	1.018451	0.3113
DLOG(INFLATION(-1))	-0.046413	1.079240	-0.043006	0.9658
DLOG(INFLATION(-2))	-0.049721	1.101652	-0.045133	0.9641
LOG(INSURANCE(-1))	0.112265	0.105296	1.066185	0.2893
LOG(INFLATION(-1))	0.002739	0.065906	0.041557	0.9669
RESID(-1)	-0.577998	0.480014	-1.204129	0.2318
RESID(-2)	-0.181778	0.317149	-0.573163	0.5680

R-squared	0.020983	Mean dependent var	-1.70E-16
Adjusted R-squared	-0.068018	S.D. dependent var	0.243026
S.E. of regression	0.251155	Akaike info criterion	0.162699
Sum squared resid	5.550931	Schwarz criterion	0.401589
Log likelihood	1.109113	Hannan-Quinn criter.	0.259294
F-statistic	0.235762	Durbin-Watson stat	2.017206
Prob(F-statistic)	0.983109		

Investment

Breusch-Godfrey Serial Correlation LM Test:

F-statistic	0.743599	Prob. F(2,88)	0.4784
Obs*R-squared	1.612055	Prob. Chi-Square(2)	0.4466

Test Equation:
Dependent Variable: RESID
Method: Least Squares
Sample: 4 100
Included observations: 97
Presample missing value lagged residuals set to zero.

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.223106	0.630846	0.353661	0.7244
LOG(INVESTMENT(-1))	-0.717918	0.621039	-1.155996	0.2508
LOG(INVESTMENT(-2))	0.625553	0.596284	1.049086	0.2970
DLOG(INFLATION(-1))	0.102409	1.220512	0.083907	0.9333
DLOG(INFLATION(-2))	-0.444112	1.295549	-0.342799	0.7326
INVESTMENT(-2)	-0.001006	0.014414	-0.069784	0.9445
INFLATION(-1)	0.003685	0.009248	0.398509	0.6912
RESID(-1)	0.734824	0.632205	1.162320	0.2482

RESID(-2)	-0.240245	0.216871	-1.107780	0.2710

R-squared	0.016619	Mean dependent var	-9.30E-18
Adjusted R-squared	-0.072779	S.D. dependent var	0.287529
S.E. of regression	0.297808	Akaike info criterion	0.503461
Sum squared resid	7.804710	Schwarz criterion	0.742351
Log likelihood	-15.41784	Hannan-Quinn criter.	0.600056
F-statistic	0.185900	Durbin-Watson stat	2.009293
Prob(F-statistic)	0.992293		

Manufacturing

Breusch-Godfrey Serial Correlation LM Test:

F-statistic	0.789580	Prob. F(2,88)	0.4572
Obs*R-squared	1.709980	Prob. Chi-Square(2)	0.4253

Test Equation:
Dependent Variable: RESID
Method: Least Squares
Sample: 4 100
Included observations: 97
Presample missing value lagged residuals set to zero.

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-0.109551	0.278573	-0.393257	0.6951
DLOG(MANUFUCTURING(-1))	-0.686280	0.969074	-0.708181	0.4807
DLOG(MANUFUCTURING(-2))	0.345794	0.301465	1.147044	0.2545
DLOG(INFLATION(-1))	-0.093501	0.679727	-0.137557	0.8909
DLOG(INFLATION(-2))	0.030825	0.704302	0.043766	0.9652
LOG(MANUFUCTURING(-1))	0.034436	0.075511	0.456033	0.6495
LOG(INFLATION(-1))	0.006938	0.047069	0.147408	0.8831
RESID(-1)	0.635168	0.976584	0.650397	0.5171
RESID(-2)	-0.668231	0.574388	-1.163378	0.2478

R-squared	0.017629	Mean dependent var	-1.71E-17
Adjusted R-squared	-0.071678	S.D. dependent var	0.156349
S.E. of regression	0.161856	Akaike info criterion	-0.716029
Sum squared resid	2.305362	Schwarz criterion	-0.477139
Log likelihood	43.72743	Hannan-Quinn criter.	-0.619434
F-statistic	0.197395	Durbin-Watson stat	2.039592
Prob(F-statistic)	0.990572		

Telecommunications

Breusch-Godfrey Serial Correlation LM Test:

F-statistic	0.681650	Prob. F(2,88)	0.5084
Obs*R-squared	1.479803	Prob. Chi-Square(2)	0.4772

Test Equation:
Dependent Variable: RESID
Method: Least Squares
Sample: 4 100
Included observations: 97

Presample missing value lagged residuals set to zero.

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-0.006185	0.535548	-0.011549	0.9908
LOG(TELECOM(-1))	0.089121	0.566553	0.157303	0.8754
LOG(TELECOM(-2))	-0.073235	0.416898	-0.175666	0.8610
DLOG(INFLATION(-1))	0.089270	0.537691	0.166026	0.8685
DLOG(INFLATION(-2))	-0.048940	0.583896	-0.083816	0.9334
TELECOM(-1)	-0.001872	0.015744	-0.118914	0.9056
INFLATION(-1)	-0.000617	0.004808	-0.128305	0.8982
RESID(-1)	-0.052657	0.458262	-0.114906	0.9088
RESID(-2)	0.138974	0.119644	1.161563	0.2486

R-squared	0.015256	Mean dependent var	3.73E-16
Adjusted R-squared	-0.074267	S.D. dependent var	0.120372
S.E. of regression	0.124761	Akaike info criterion	-1.236635
Sum squared resid	1.369755	Schwarz criterion	-0.997744
Log likelihood	68.97680	Hannan-Quinn criter.	-1.140039
F-statistic	0.170412	Durbin-Watson stat	1.993609
Prob(F-statistic)	0.994268		

NSE 20 Share

Breusch-Godfrey Serial Correlation LM Test:

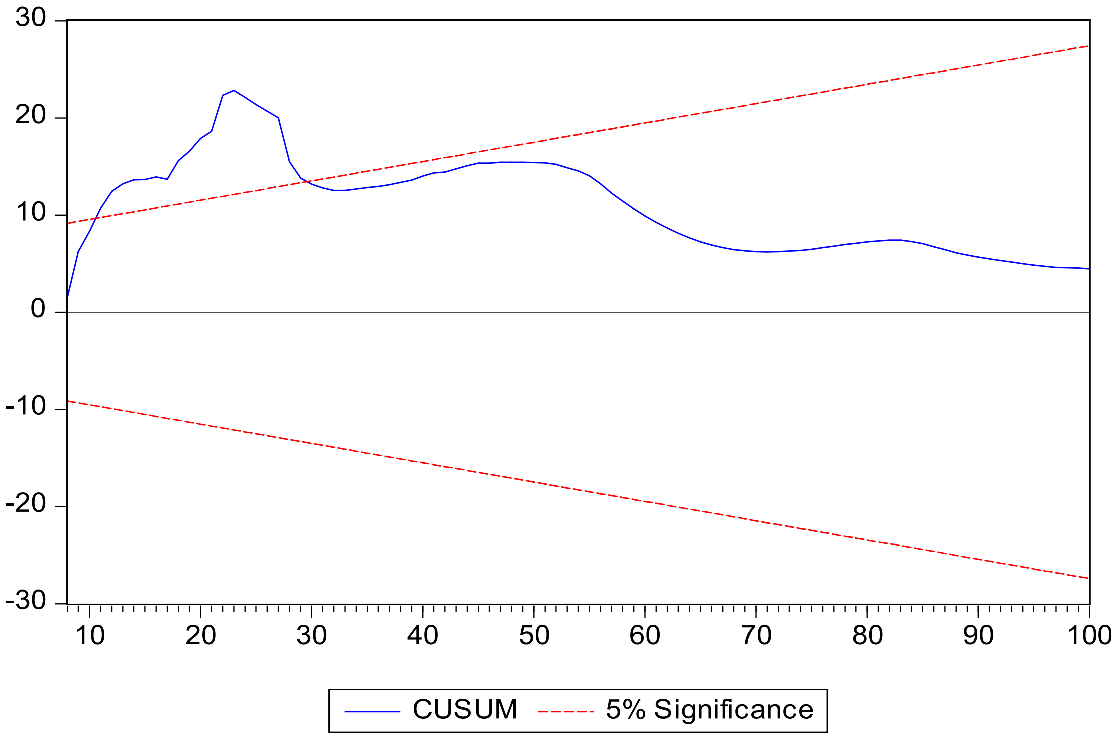
F-statistic	2.518488	Prob. F(2,89)	0.0863
Obs*R-squared	5.195687	Prob. Chi-Square(2)	0.0744

Test Equation:
Dependent Variable: RESID
Method: Least Squares
Sample: 2006M12 2014M12
Included observations: 97
Presample missing value lagged residuals set to zero.

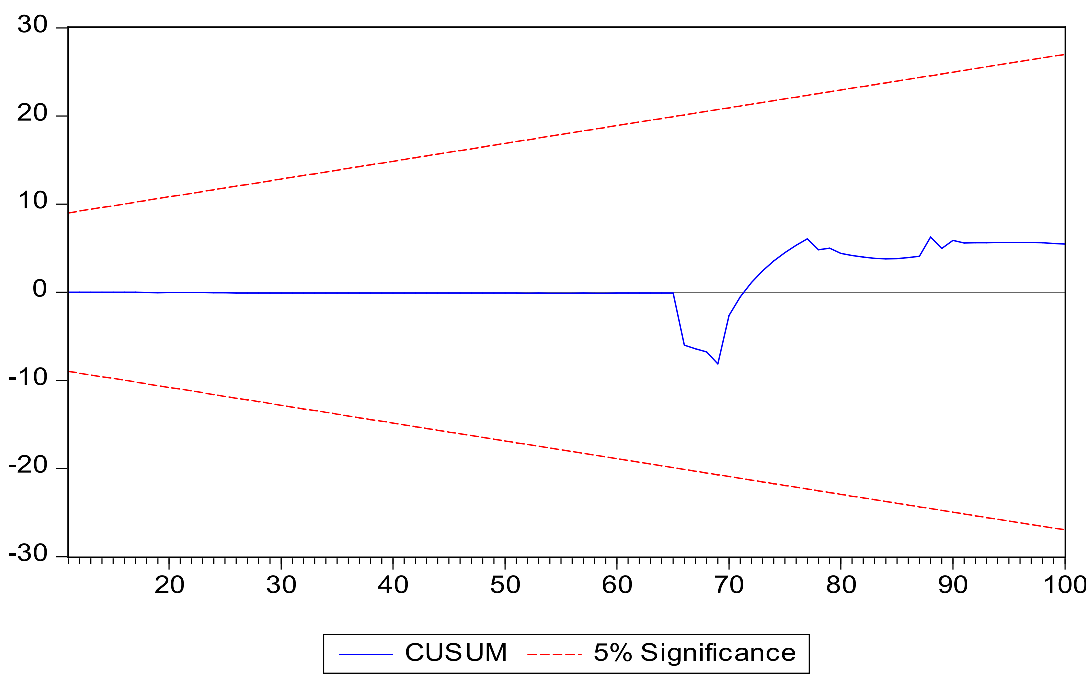
Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-0.064408	0.080275	-0.802342	0.4245
DLOG(NSE(-2))	0.548791	0.268630	2.042928	0.0440
DLOG(INFLATION(-1))	-0.058606	0.242642	-0.241535	0.8097
DLOG(INFLATION(-2))	0.105313	0.251345	0.418998	0.6762
NSE(-1)	1.12E-05	1.38E-05	0.806339	0.4222
INFLATION(-1)	0.001815	0.002692	0.674222	0.5019
RESID(-1)	0.001818	0.115932	0.015682	0.9875
RESID(-2)	-0.662514	0.302358	-2.191156	0.0311

R-squared	0.053564	Mean dependent var	-1.02E-17
Adjusted R-squared	-0.020875	S.D. dependent var	0.054695
S.E. of regression	0.055263	Akaike info criterion	-2.874560
Sum squared resid	0.271804	Schwarz criterion	-2.662213
Log likelihood	147.4162	Hannan-Quinn criter.	-2.788697
F-statistic	0.719568	Durbin-Watson stat	2.001461
Prob(F-statistic)	0.655634		

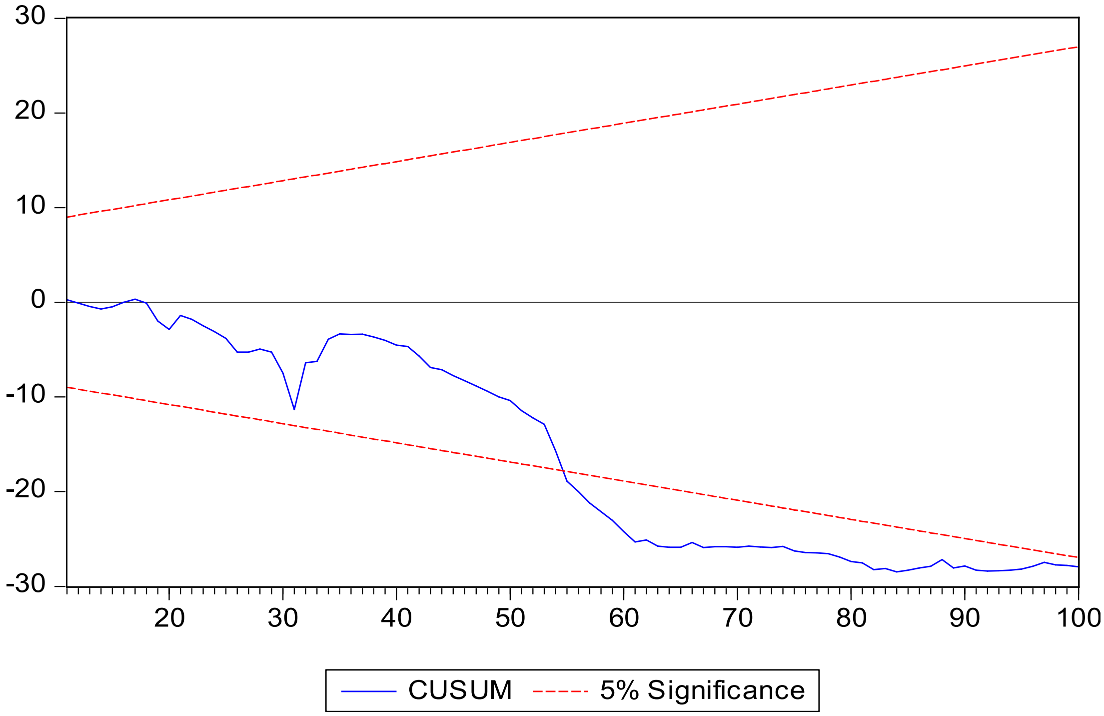
Table A3: Stability Test



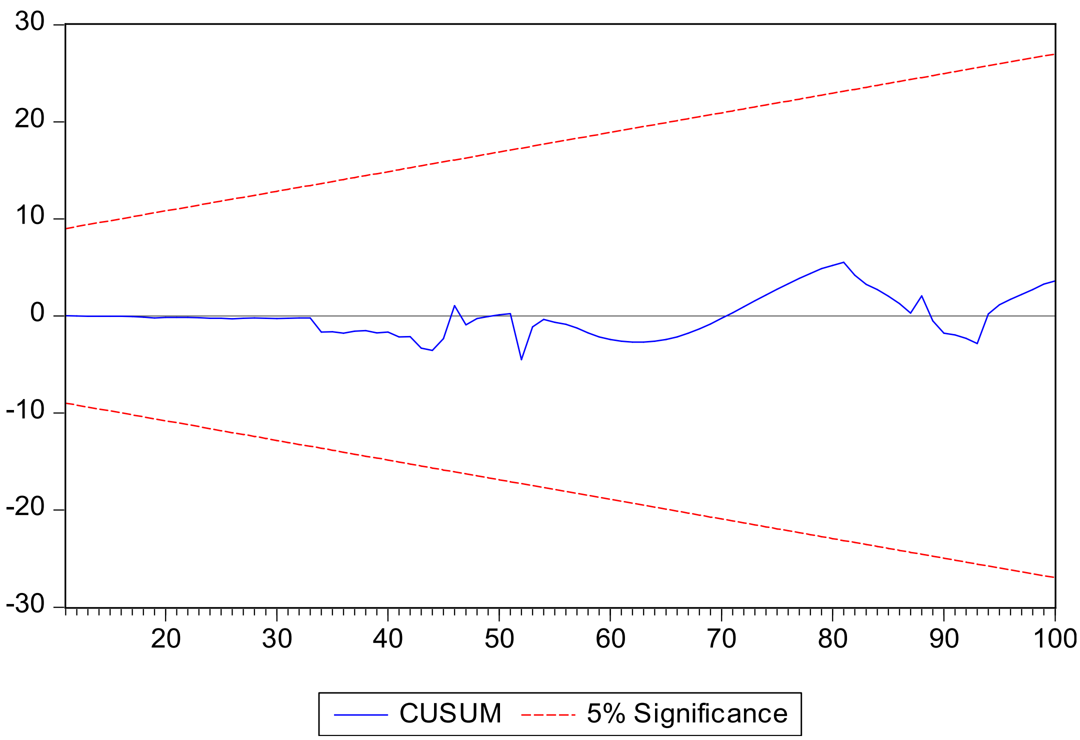
Stability test for Agricultural Sector



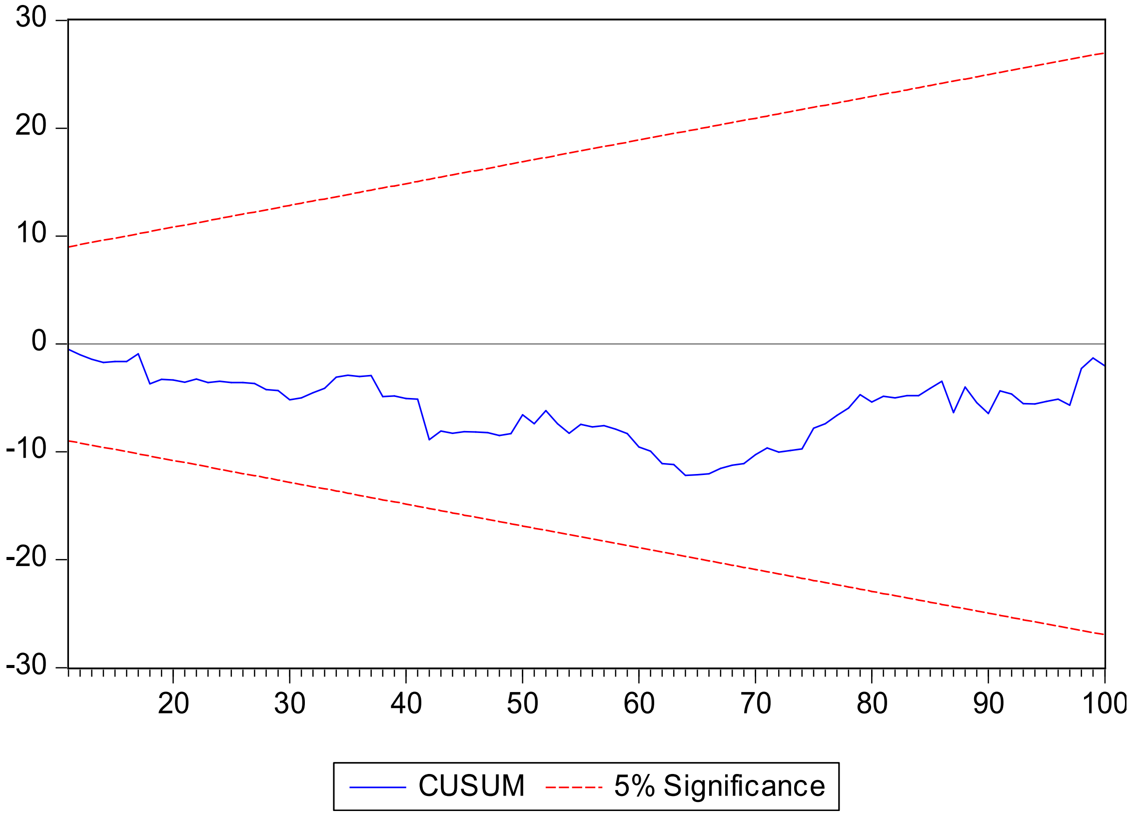
Stability test for Automobile Sector



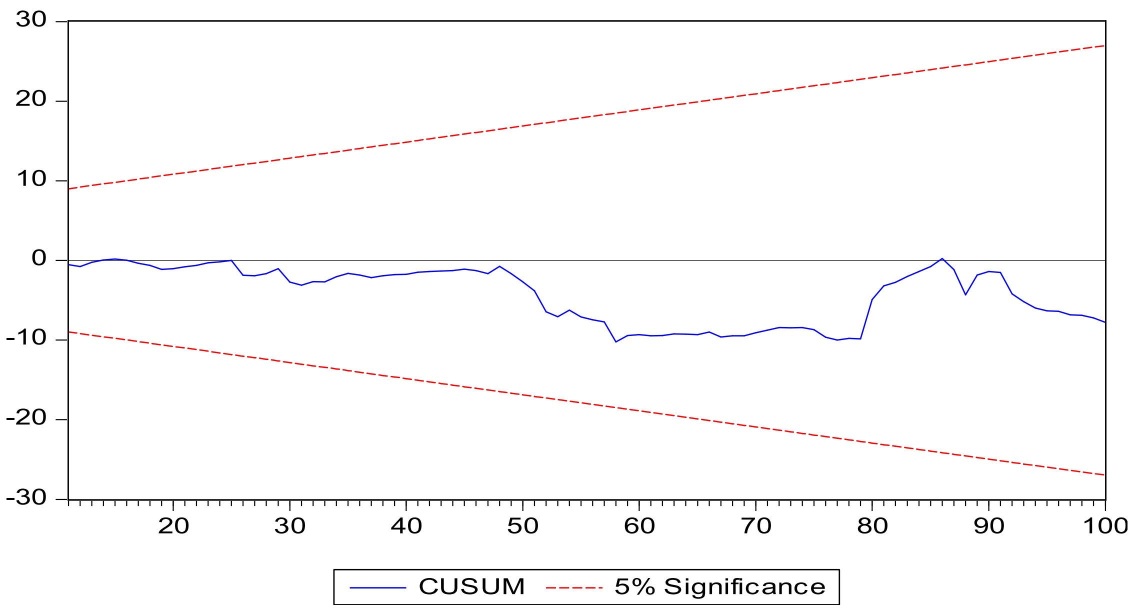
Stability test for Banking Sector



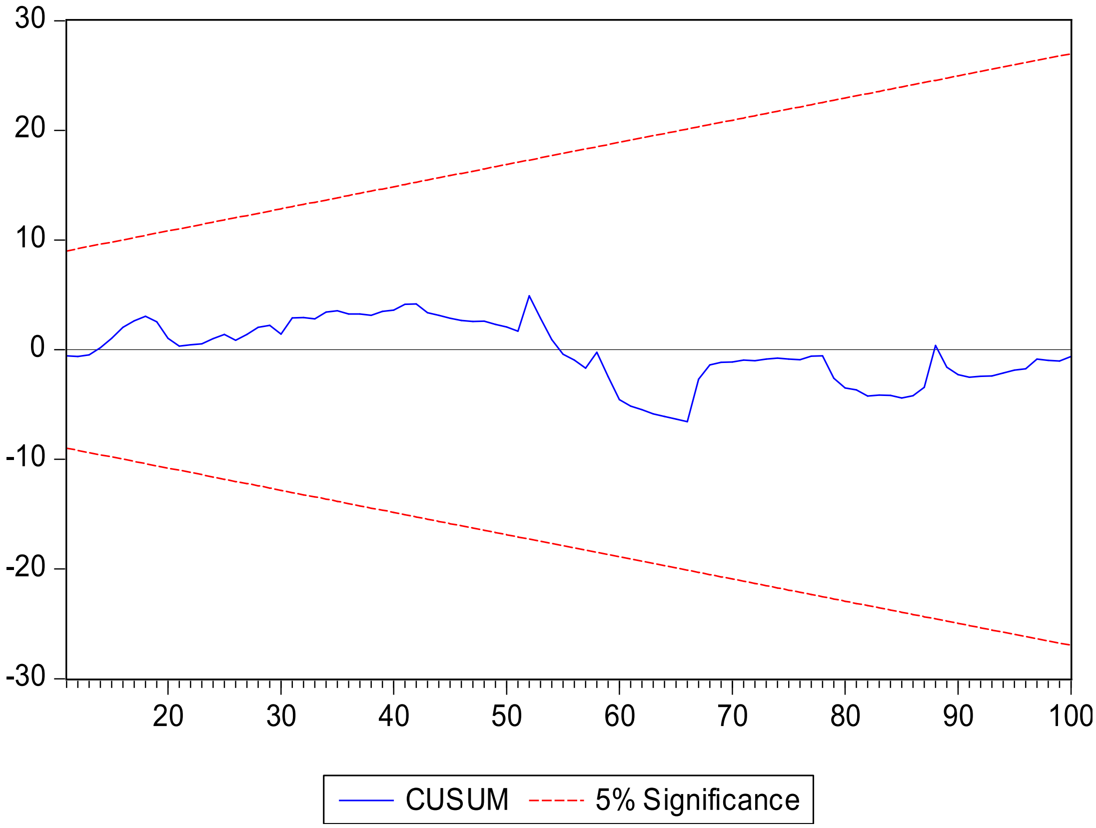
Stability test for Commercial Sector



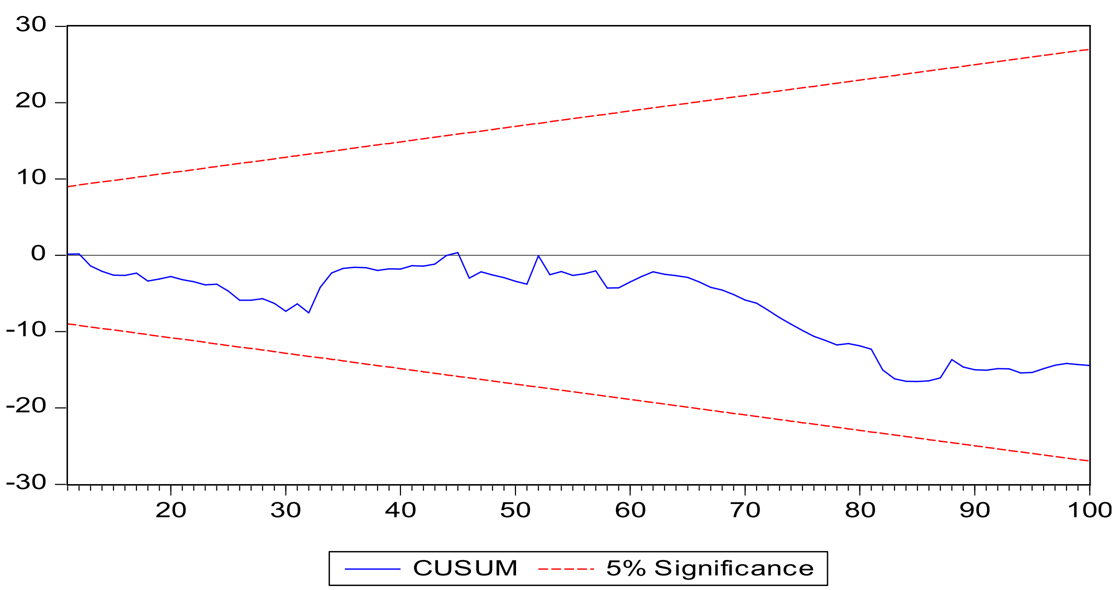
Stability test for Construction Sector



Stability test for Energy Sector



Stability test for Insurance Sector



Stability test for Investment Sector

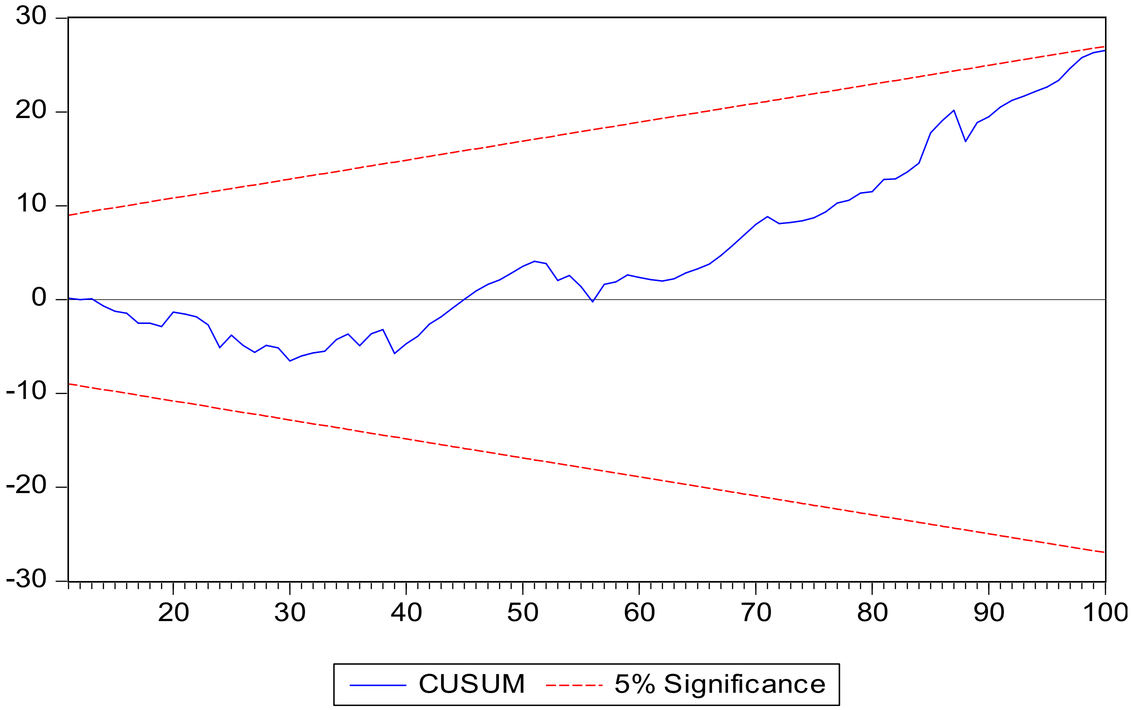


Figure 4. 1: Stability test for Manufacturing Sector

Table A4: Johansen Cointegration Test

Sample (adjusted): 4 100
Included observations: 97 after adjustments
Trend assumption: Linear deterministic trend
Series: AGRICULTURAL INFLATION
Lags interval (in first differences): 1 to 2

Unrestricted Cointegration Rank Test (Trace)

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.203221	36.35449	15.49471	0.0000
At most 1 *	0.137234	14.31829	3.841466	0.0002

Trace test indicates 2 cointegrating eqn(s) at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

Unrestricted Cointegration Rank Test (Maximum Eigenvalue)

Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen Statistic	0.05 Critical Value	Prob.**
None *	0.203221	22.03620	14.26460	0.0024
At most 1 *	0.137234	14.31829	3.841466	0.0002

Max-eigenvalue test indicates 2 cointegrating eqn(s) at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

Unrestricted Cointegrating Coefficients (normalized by b'*S11*b=I):

AGRICULTURAL	INFLATION
-0.002573	0.299122
0.005723	0.051199

Unrestricted Adjustment Coefficients (alpha):

D(AGRICULTURAL)	7.801747	-44.25673
D(INFLATION)	-0.081765	-0.003615

1 Cointegrating Equation(s):	Log likelihood	-563.3679

Normalized cointegrating coefficients (standard error in parentheses)

AGRICULTURAL	INFLATION
1.000000	-0.090440
	(0.50727)

Adjustment coefficients (standard error in parentheses)

D(AGRICULTURAL)	-0.020074
	(0.03249)
D(INFLATION)	0.000210
	(4.4E-05)

Sample (adjusted): 4 100
Included observations: 97 after adjustments
Trend assumption: Linear deterministic trend
Series: AUTOMOBILES INFLATION
Lags interval (in first differences): 1 to 2
Unrestricted Cointegration Rank Test (Trace)

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.183076	28.43098	15.49471	0.0003
At most 1 *	0.086885	8.816659	3.841466	0.0030

Trace test indicates 2 cointegrating eqn(s) at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

Unrestricted Cointegration Rank Test (Maximum Eigenvalue)

Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen Statistic	0.05 Critical Value	Prob.**
None *	0.183076	19.61433	14.26460	0.0065
At most 1 *	0.086885	8.816659	3.841466	0.0030

Max-eigenvalue test indicates 2 cointegrating eqn(s) at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

Unrestricted Cointegrating Coefficients (normalized by b'*S11*b=I):

AUTOMOBILES	INFLATION
0.000176	0.284640
0.002856	-0.106221

Unrestricted Adjustment Coefficients (alpha):

D(AUTOMOBILES)	7.796737	-88.28435
D(INFLATION)	-0.077854	0.002863

1 Cointegrating Equation(s):	Log likelihood	-652.9724

Normalized cointegrating coefficients (standard error in parentheses)

AUTOMOBILES	INFLATION
1.000000	-0.035320
	(-0.035320)

Adjustment coefficients (standard error in parentheses)

D(AUTOMOBILES)	0.001375
	(0.00555)
D(INFLATION)	-1.37E-05
	(3.0E-06)

Sample (adjusted): 4 100
Included observations: 97 after adjustments
Trend assumption: Linear deterministic trend
Series: BANKING INFLATION
Lags interval (in first differences): 1 to 2

Unrestricted Cointegration Rank Test (Trace)

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.227720	32.10948	15.49471	0.0001
At most 1 *	0.070043	7.043850	3.841466	0.0080

Trace test indicates 2 cointegrating eqn(s) at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

Unrestricted Cointegration Rank Test (Maximum Eigenvalue)

Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen Statistic	0.05 Critical Value	Prob.**
None *	0.227720	25.06563	14.26460	0.0007
At most 1 *	0.070043	7.043850	3.841466	0.0080

Max-eigenvalue test indicates 2 cointegrating eqn(s) at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

Unrestricted Cointegrating Coefficients (normalized by b'*S11*b=I):

BANKING	INFLATION
0.067819	0.338919
0.173527	0.054533

Unrestricted Adjustment Coefficients (alpha):

D(BANKING)	-0.023618	-0.489242
D(INFLATION)	-0.082296	0.016411

1 Cointegrating Equation(s): Log likelihood -152.7807

Normalized cointegrating coefficients (standard error in parentheses)

BANKING	INFLATION
1.000000	4.997398
	(0.84205)

Adjustment coefficients (standard error in parentheses)

D(BANKING)	-0.001602
	(0.01315)
D(INFLATION)	-0.005581
	(0.00116)

Sample (adjusted): 4 100
Included observations: 97 after adjustments
Trend assumption: Linear deterministic trend
Series: COMMERCIAL INFLATION
Lags interval (in first differences): 1 to 2

Unrestricted Cointegration Rank Test (Trace)

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.214420	29.10801	15.49471	0.0003
At most 1 *	0.057057	5.698676	3.841466	0.0170

Trace test indicates 2 cointegrating eqn(s) at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

Unrestricted Cointegration Rank Test (Maximum Eigenvalue)

Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen Statistic	0.05 Critical Value	Prob.**
None *	0.214420	23.40933	14.26460	0.0014
At most 1 *	0.057057	5.698676	3.841466	0.0170

Max-eigenvalue test indicates 2 cointegrating eqn(s) at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

Unrestricted Cointegrating Coefficients (normalized by b'*S11*b=I):

COMMERCIAL	INFLATION
0.018096	0.289897
0.050211	-0.057822

Unrestricted Adjustment Coefficients (alpha):

D(COMMERCIAL)	-1.704969	-3.195089
D(INFLATION)	-0.079466	0.015571

1 Cointegrating Equation(s):	Log likelihood	-353.8181

Normalized cointegrating coefficients (standard error in parentheses)

COMMERCIAL	INFLATION
1.000000	16.01954
	(3.24131)

Adjustment coefficients (standard error in parentheses)

D(COMMERCIAL)	-0.030854
	(0.02612)
D(INFLATION)	-0.001438
	(0.00031)

Sample (adjusted): 4 100
Included observations: 97 after adjustments
Trend assumption: Linear deterministic trend
Series: CONSTRUCTION INFLATION
Lags interval (in first differences): 1 to 2
Unrestricted Cointegration Rank Test (Trace)

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.207094	35.89575	15.49471	0.0000
At most 1 *	0.128909	13.38684	3.841466	0.0003

Trace test indicates 2 cointegrating eqn(s) at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

Unrestricted Cointegration Rank Test (Maximum Eigenvalue)

Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen Statistic	0.05 Critical Value	Prob.**
None *	0.207094	22.50891	14.26460	0.0020
At most 1 *	0.128909	13.38684	3.841466	0.0003

Max-eigenvalue test indicates 2 cointegrating eqn(s) at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

Unrestricted Cointegrating Coefficients (normalized by b'*S11*b=I):

CONSTRUCTION	INFLATION
0.074633	0.333285
0.168329	0.034850

Unrestricted Adjustment Coefficients (alpha):

D(CONSTRUCTION)	-0.105502	-0.713690
D(INFLATION)	-0.081404	0.006812

1 Cointegrating Equation(s): Log likelihood -164.9124

Normalized cointegrating coefficients (standard error in parentheses)

CONSTRUCTION	INFLATION
1.000000	4.465635
	(0.79855)

Adjustment coefficients (standard error in parentheses)

D(CONSTRUCTION)	-0.007874
	(0.01564)
D(INFLATION)	-0.006075
	(0.00126)

Sample (adjusted): 4 100
Included observations: 97 after adjustments
Trend assumption: Linear deterministic trend
Series: ENERGY INFLATION
Lags interval (in first differences): 1 to 2

Unrestricted Cointegration Rank Test (Trace)

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.191079	28.41453	15.49471	0.0003
At most 1 *	0.077695	7.845337	3.841466	0.0051

Trace test indicates 2 cointegrating eqn(s) at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

Unrestricted Cointegration Rank Test (Maximum Eigenvalue)

Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen Statistic	0.05 Critical Value	Prob.**
None *	0.191079	20.56919	14.26460	0.0044
At most 1 *	0.077695	7.845337	3.841466	0.0051

Max-eigenvalue test indicates 2 cointegrating eqn(s) at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

Unrestricted Cointegrating Coefficients (normalized by b'*S11*b=I):

ENERGY	INFLATION
-0.029400	0.263748
0.211106	0.201963

Unrestricted Adjustment Coefficients (alpha):

D(ENERGY)	0.332351	-0.945086
D(INFLATION)	-0.078348	-0.009937

1 Cointegrating Equation(s):	Log likelihood	-220.9097

Normalized cointegrating coefficients (standard error in parentheses)

ENERGY	INFLATION
1.000000	-8.970938
	(2.12080)

Adjustment coefficients (standard error in parentheses)

D(ENERGY)	-0.009771
	(0.01066)
D(INFLATION)	0.002303
	(0.00051)

Sample (adjusted): 4 100
Included observations: 97 after adjustments
Trend assumption: Linear deterministic trend
Series: INSURANCE INFLATION
Lags interval (in first differences): 1 to 2

Unrestricted Cointegration Rank Test (Trace)

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.253093	39.55773	15.49471	0.0000
At most 1 *	0.109523	11.25177	3.841466	0.0008

Trace test indicates 2 cointegrating eqn(s) at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

Unrestricted Cointegration Rank Test (Maximum Eigenvalue)

Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen Statistic	0.05 Critical Value	Prob.**
None *	0.253093	28.30596	14.26460	0.0002
At most 1 *	0.109523	11.25177	3.841466	0.0008

Max-eigenvalue test indicates 2 cointegrating eqn(s) at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

Unrestricted Cointegrating Coefficients (normalized by b'*S11*b=I):

INSURANCE	INFLATION
0.120770	0.302194
0.166006	-0.076304

Unrestricted Adjustment Coefficients (alpha):

D(INSURANCE)	-0.457715	-0.959603
D(INFLATION)	-0.083171	0.023544

1 Cointegrating Equation(s):	Log likelihood	-202.0843

Normalized cointegrating coefficients (standard error in parentheses)

INSURANCE	INFLATION
1.000000	2.502219
	(0.43132)

Adjustment coefficients (standard error in parentheses)

D(INSURANCE)	-0.055278
	(0.03804)
D(INFLATION)	-0.010045
	(0.00202)

Sample (adjusted): 4 100
Included observations: 97 after adjustments
Trend assumption: Linear deterministic trend
Series: MANUFUCTURING INFLATION
Lags interval (in first differences): 1 to 2

Unrestricted Cointegration Rank Test (Trace)

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.218241	23.91763	15.49471	0.0021
At most 1	0.000365	0.035372	3.841466	0.8508

Trace test indicates 1 cointegrating eqn(s) at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

Unrestricted Cointegration Rank Test (Maximum Eigenvalue)

Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen Statistic	0.05 Critical Value	Prob.**
None *	0.218241	23.88226	14.26460	0.0011
At most 1	0.000365	0.035372	3.841466	0.8508

Max-eigenvalue test indicates 1 cointegrating eqn(s) at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

Unrestricted Cointegrating Coefficients (normalized by b'*S11*b=I):

MANUFUCTURING	INFLATION
0.066905	0.325077
0.180492	0.043798

Unrestricted Adjustment Coefficients (alpha):

D(MANUFUCTURING)	-0.020375	0.056158
D(INFLATION)	-0.085623	-0.000164

1 Cointegrating Equation(s):	Log likelihood	-203.4598

Normalized cointegrating coefficients (standard error in parentheses)

MANUFUCTURING	INFLATION
1.000000	4.858807
	(0.85876)

Adjustment coefficients (standard error in parentheses)

D(MANUFUCTURING)	-0.001363
	(0.02063)
D(INFLATION)	-0.005729
	(0.00114)

Sample (adjusted): 2006M12 2014M12
Included observations: 97 after adjustments
Trend assumption: Linear deterministic trend
Series: NSE INFLATION
Lags interval (in first differences): 1 to 2

Unrestricted Cointegration Rank Test (Trace)

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.245259	31.97175	15.49471	0.0001
At most 1 *	0.047081	4.677881	3.841466	0.0305

Trace test indicates 2 cointegrating eqn(s) at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

Unrestricted Cointegration Rank Test (Maximum Eigenvalue)

Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen Statistic	0.05 Critical Value	Prob.**
None *	0.245259	27.29387	14.26460	0.0003
At most 1 *	0.047081	4.677881	3.841466	0.0305

Max-eigenvalue test indicates 2 cointegrating eqn(s) at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

Unrestricted Cointegrating Coefficients (normalized by b'*S11*b=I):

NSE	INFLATION
0.000808	0.412512
0.002004	0.235411

Unrestricted Adjustment Coefficients (alpha):

D(NSE)	29.14243	-44.44011
D(INFLATION)	-0.089458	-0.000425

1 Cointegrating Equation(s):	Log likelihood	-612.1786

Normalized cointegrating coefficients (standard error in parentheses)

NSE	INFLATION
1.000000	510.4545
	(67.0174)

Adjustment coefficients (standard error in parentheses)

D(NSE)	0.023551
	(0.01788)
D(INFLATION)	-7.23E-05
	(1.3E-05)

Table A5: Vector Error Correction Estimates

Sample (adjusted): 4 100
Included observations: 97 after adjustments
Standard errors in ( ) & t-statistics in [ ]

Cointegrating Eq:	CointEq1	
AGRICULTURAL(-1)	1.000000	
INFLATION(-1)	-116.2530 (23.7021) [-4.90475]	
C	901.0436	
Error Correction:	**D(AGRICULTURAL)**	**D(INFLATION)**
CointEq1	-0.020074 (0.03249) [-0.61782]	0.000210 (4.4E-05) [4.80892]
D(AGRICULTURAL(-1))	0.027931 (0.10981) [0.25436]	5.48E-06 (0.00015) [0.03706]
D(AGRICULTURAL(-2))	-0.001124 (0.10726) [-0.01048]	-0.000137 (0.00014) [-0.94558]
D(INFLATION(-1))	72.89619 (73.6541) [0.98971]	1.134955 (0.09917) [11.4444]
D(INFLATION(-2))	-69.71195 (73.6614) [-0.94638]	-0.196214 (0.09918) [-1.97834]
C	0.744755 (12.6324) [0.05896]	-0.001369 (0.01701) [-0.08051]
R-squared	0.010842	0.948785
Adj. R-squared	-0.043508	0.945971
Sum sq. resids	1407576.	2.551809
S.E. equation	124.3699	0.167457
F-statistic	0.199484	337.1648
Log likelihood	-602.3965	38.80153
Akaike AIC	12.54426	-0.676320
Schwarz SC	12.70352	-0.517060
Mean dependent	0.539381	0.007835
S.D. dependent	121.7496	0.720427
Determinant resid covariance (dof adj.)		431.7218
Determinant resid covariance		379.9648
Log likelihood		-563.3679
Akaike information criterion		11.90449
Schwarz criterion		12.27610

Sample (adjusted): 4 100
Included observations: 97 after adjustments
Standard errors in ( ) & t-statistics in [ ]

Cointegrating Eq:	CointEq1	
AUTOMOBILES(-1)	1.000000	
INFLATION(-1)	1613.561	
	(364.846)	
	[4.42258]	
C	-14435.26	
Error Correction:	D(AUTOMOBILES)	D(INFLATION)
CointEq1	0.001375	-1.37E-05
	(0.00555)	(3.0E-06)
	[0.24795]	[-4.50806]
D(AUTOMOBILES(-1))	-0.295314	3.99E-05
	(0.10391)	(5.7E-05)
	[-2.84192]	[0.69929]
D(AUTOMOBILES(-2))	-0.143896	-3.00E-05
	(0.10312)	(5.7E-05)
	[-1.39538]	[-0.52935]
D(INFLATION(-1))	-158.4089	1.151145
	(182.992)	(0.10050)
	[-0.86566]	[11.4539]
D(INFLATION(-2))	222.7302	-0.195099
	(187.233)	(0.10283)
	[1.18959]	[-1.89727]
C	-1.492233	-0.001612
	(31.4577)	(0.01728)
	[-0.04744]	[-0.09332]
R-squared	0.106349	0.947162
Adj. R-squared	0.057248	0.944259
Sum sq. resids	8727822.	2.632659
S.E. equation	309.6936	0.170089
F-statistic	2.165899	326.2514
Log likelihood	-690.8918	37.28872
Akaike AIC	14.36890	-0.645128
Schwarz SC	14.52816	-0.485868
Mean dependent	-0.015773	0.007835
S.D. dependent	318.9579	0.720427
Determinant resid covariance (dof adj.)		2738.860
Determinant resid covariance		2410.511
Log likelihood		-652.9724
Akaike information criterion		13.75201
Schwarz criterion		14.12362

Sample (adjusted): 4 100
Included observations: 97 after adjustments
Standard errors in ( ) & t-statistics in [ ]

Cointegrating Eq:	CointEq1	
BANKING(-1)	1.000000	
INFLATION(-1)	4.997398 (0.84205) [5.93483]	
C	-57.53761	
Error Correction:	**D(BANKING)**	**D(INFLATION)**
CointEq1	-0.001602 (0.01315) [-0.12184]	-0.005581 (0.00116) [-4.79426]
D(BANKING(-1))	-0.092110 (0.10415) [-0.88438]	-0.012055 (0.00922) [-1.30701]
D(BANKING(-2))	-0.116278 (0.10098) [-1.15147]	-0.002906 (0.00894) [-0.32498]
D(INFLATION(-1))	0.471953 (1.20361) [0.39212]	1.079984 (0.10659) [10.1325]
D(INFLATION(-2))	-0.901689 (1.23031) [-0.73289]	-0.115857 (0.10895) [-1.06339]
C	-0.224810 (0.19525) [-1.15138]	-0.004316 (0.01729) [-0.24960]
R-squared	0.050903	0.947800
Adj. R-squared	-0.001245	0.944932
Sum sq. resids	331.6608	2.600894
S.E. equation	1.909090	0.169060
F-statistic	0.976128	330.4583
Log likelihood	-197.2630	37.87747
Akaike AIC	4.190990	-0.657267
Schwarz SC	4.350251	-0.498007
Mean dependent	-0.203196	0.007835
S.D. dependent	1.907903	0.720427
Determinant resid covariance (dof adj.)		0.090906
Determinant resid covariance		0.080007
Log likelihood		-152.7807
Akaike information criterion		3.438776
Schwarz criterion		3.810384

Sample (adjusted): 4 100
Included observations: 97 after adjustments
Standard errors in ( ) & t-statistics in [ ]

Cointegrating Eq:	CointEq1	
COMMERCIAL(-1)	1.000000	
INFLATION(-1)	16.01954	
	(3.24131)	
	[4.94230]	
C	-176.3116	
Error Correction:	**D(COMMERCIAL)**	**D(INFLATION)**
CointEq1	-0.030854	-0.001438
	(0.02612)	(0.00031)
	[-1.18128]	[-4.58084]
D(COMMERCIAL(-1))	-0.170406	0.000179
	(0.10453)	(0.00126)
	[-1.63021]	[0.14237]
D(COMMERCIAL(-2))	-0.036165	0.000555
	(0.10435)	(0.00125)
	[-0.34659]	[0.44264]
D(INFLATION(-1))	-0.367063	1.129208
	(8.47464)	(0.10186)
	[-0.04331]	[11.0861]
D(INFLATION(-2))	1.889079	-0.160717
	(8.79130)	(0.10566)
	[0.21488]	[-1.52102]
C	0.422583	-0.002239
	(1.44611)	(0.01738)
	[0.29222]	[-0.12880]
R-squared	0.052006	0.946687
Adj. R-squared	-0.000082	0.943757
Sum sq. resids	18388.30	2.656363
S.E. equation	14.21510	0.170853
F-statistic	0.998428	323.1777
Log likelihood	-392.0078	36.85399
Akaike AIC	8.206347	-0.636165
Schwarz SC	8.365608	-0.476904
Mean dependent	0.341856	0.007835
S.D. dependent	14.21452	0.720427
Determinant resid covariance (dof adj.)		5.738321
Determinant resid covariance		5.050381
Log likelihood		-353.8181
Akaike information criterion		7.583878
Schwarz criterion		7.955485

Sample (adjusted): 4 100
Included observations: 97 after adjustments
Standard errors in ( ) & t-statistics in [ ]

Cointegrating Eq:	CointEq1	
CONSTRUCTION(-1)	1.000000	
INFLATION(-1)	4.465635	
	(0.79855)	
	[5.59219]	
C	-56.28767	
Error Correction:	**D(CONSTRUCTION)**	**D(INFLATION)**
CointEq1	-0.007874	-0.006075
	(0.01564)	(0.00126)
	[-0.50360]	[-4.84100]
D(CONSTRUCTION(-1))	-0.192362	0.004496
	(0.10308)	(0.00827)
	[-1.86612]	[0.54335]
D(CONSTRUCTION(-2))	0.071860	-0.013886
	(0.10306)	(0.00827)
	[0.69727]	[-1.67864]
D(INFLATION(-1))	-0.854490	1.129676
	(1.23238)	(0.09892)
	[-0.69337]	[11.4202]
D(INFLATION(-2))	0.402022	-0.169413
	(1.27734)	(0.10253)
	[0.31473]	[-1.65237]
C	-0.202286	-0.003071
	(0.21060)	(0.01690)
	[-0.96051]	[-0.18170]
R-squared	0.074917	0.949906
Adj. R-squared	0.024088	0.947153
Sum sq. resids	387.4072	2.495962
S.E. equation	2.063304	0.165614
F-statistic	1.473901	345.1161
Log likelihood	-204.7982	39.87475
Akaike AIC	4.346354	-0.698449
Schwarz SC	4.505614	-0.539188
Mean dependent	-0.189588	0.007835
S.D. dependent	2.088612	0.720427
Determinant resid covariance (dof adj.)		0.116741
Determinant resid covariance		0.102746
Log likelihood		-164.9124
Akaike information criterion		3.688915
Schwarz criterion		4.060523

Sample (adjusted): 4 100
Included observations: 97 after adjustments
Standard errors in ( ) & t-statistics in [ ]

Cointegrating Eq:	CointEq1	
ENERGY(-1)	1.000000	
INFLATION(-1)	-8.970938 (2.12080) [-4.22997]	
C	65.95419	
Error Correction:	**D(ENERGY)**	**D(INFLATION)**
CointEq1	-0.009771 (0.01066) [-0.91661]	0.002303 (0.00051) [4.52695]
D(ENERGY(-1))	-0.067764 (0.10167) [-0.66650]	-0.002072 (0.00485) [-0.42705]
D(ENERGY(-2))	-0.202251 (0.10172) [-1.98837]	0.003207 (0.00486) [0.66062]
D(INFLATION(-1))	1.821172 (2.09345) [0.86994]	1.144381 (0.09992) [11.4525]
D(INFLATION(-2))	-3.022571 (2.13745) [-1.41410]	-0.186226 (0.10202) [-1.82530]
C	-0.091199 (0.36293) [-0.25129]	-0.001562 (0.01732) [-0.09017]
R-squared	0.091314	0.946936
Adj. R-squared	0.041386	0.944020
Sum sq. resids	1160.472	2.643945
S.E. equation	3.571055	0.170453
F-statistic	1.828924	324.7811
Log likelihood	-258.0078	37.08125
Akaike AIC	5.443459	-0.640851
Schwarz SC	5.602720	-0.481590
Mean dependent	-0.090722	0.007835
S.D. dependent	3.647328	0.720427
Determinant resid covariance (dof adj.)		0.370385
Determinant resid covariance		0.325981
Log likelihood		-220.9097
Akaike information criterion		4.843499
Schwarz criterion		5.215107

Sample (adjusted): 4 100
Included observations: 97 after adjustments
Standard errors in ( ) & t-statistics in [ ]

Cointegrating Eq:	CointEq1	
INSURANCE(-1)	1.000000	
INFLATION(-1)	2.502219	
	(0.43132)	
	[5.80135]	
C	-32.57491	
Error Correction:	D(INSURANCE)	D(INFLATION)
CointEq1	-0.055278	-0.010045
	(0.03804)	(0.00202)
	[-1.45334]	[-4.97086]
D(INSURANCE(-1))	-0.316517	-0.004295
	(0.10051)	(0.00534)
	[-3.14926]	[-0.80429]
D(INSURANCE(-2))	-0.010815	-0.007931
	(0.09946)	(0.00528)
	[-0.10874]	[-1.50092]
D(INFLATION(-1))	-1.835074	1.063393
	(1.91653)	(0.10182)
	[-0.95750]	[10.4439]
D(INFLATION(-2))	2.209937	-0.102273
	(1.96315)	(0.10430)
	[1.12571]	[-0.98061]
C	-0.237558	-0.003181
	(0.31550)	(0.01676)
	[-0.75295]	[-0.18978]
R-squared	0.146900	0.950405
Adj. R-squared	0.100026	0.947679
Sum sq. resids	875.5228	2.471117
S.E. equation	3.101795	0.164788
F-statistic	3.133953	348.7689
Log likelihood	-244.3424	40.35994
Akaike AIC	5.161699	-0.708452
Schwarz SC	5.320959	-0.549192
Mean dependent	-0.193505	0.007835
S.D. dependent	3.269626	0.720427
Determinant resid covariance (dof adj.)		0.251236
Determinant resid covariance		0.221116
Log likelihood		-202.0843
Akaike information criterion		4.455347
Schwarz criterion		4.826955

Sample (adjusted): 4 100
Included observations: 97 after adjustments
Standard errors in ( ) & t-statistics in [ ]

Cointegrating Eq:	CointEq1	
MANUFUCTURING(-1)	1.000000	
INFLATION(-1)	4.858807	
	(0.85876)	
	[5.65796]	
C	-60.20418	
Error Correction:	**D(MANUFUCTURING)**	**D(INFLATION)**
CointEq1	-0.001363	-0.005729
	(0.02063)	(0.00114)
	[-0.06608]	[-5.03319]
D(MANUFUCTURING(-1))	-0.295491	0.003125
	(0.10531)	(0.00581)
	[-2.80581]	[0.53777]
D(MANUFUCTURING(-2))	-0.059657	-0.000311
	(0.10472)	(0.00578)
	[-0.56970]	[-0.05375]
D(INFLATION(-1))	0.674629	1.101522
	(1.82211)	(0.10053)
	[0.37025]	[10.9571]
D(INFLATION(-2))	-0.986895	-0.135387
	(1.88122)	(0.10379)
	[-0.52460]	[-1.30441]
C	0.342229	-0.002611
	(0.31121)	(0.01717)
	[1.09966]	[-0.15209]
R-squared	0.087900	0.948731
Adj. R-squared	0.037785	0.945914
Sum sq. resids	839.1904	2.554523
S.E. equation	3.036754	0.167546
F-statistic	1.753957	336.7872
Log likelihood	-242.2868	38.74997
Akaike AIC	5.119315	-0.675257
Schwarz SC	5.278576	-0.515997
Mean dependent	0.250515	0.007835
S.D. dependent	3.095804	0.720427
Determinant resid covariance (dof adj.)		0.258463
Determinant resid covariance		0.227477
Log likelihood		-203.4598
Akaike information criterion		4.483707
Schwarz criterion		4.855315

Sample (adjusted): 2006M12 2014M12
Included observations: 97 after adjustments
Standard errors in ( ) & t-statistics in [ ]

Cointegrating Eq:	CointEq1	
NSE(-1)	1.000000	
INFLATION(-1)	510.4545	
	(67.0174)	
	[7.61674]	
C	-8731.594	
Error Correction:	**D(NSE)**	**D(INFLATION)**
CointEq1	0.023551	-7.23E-05
	(0.01788)	(1.3E-05)
	[1.31695]	[-5.43751]
D(NSE(-1))	-0.029882	-0.000145
	(0.10054)	(7.5E-05)
	[-0.29721]	[-1.94168]
D(NSE(-2))	0.007461	-3.82E-05
	(0.10058)	(7.5E-05)
	[0.07418]	[-0.51078]
D(INFLATION(-1))	251.4124	1.039445
	(137.304)	(0.10208)
	[1.83107]	[10.1825]
D(INFLATION(-2))	-366.6933	-0.084227
	(140.194)	(0.10423)
	[-2.61561]	[-0.80808]
C	-2.706607	-0.002116
	(22.1421)	(0.01646)
	[-0.12224]	[-0.12857]
R-squared	0.149975	0.952048
Adj. R-squared	0.103271	0.949414
Sum sq. resids	4322388.	2.389216
S.E. equation	217.9421	0.162034
F-statistic	3.211148	361.3484
Log likelihood	-656.8105	41.99463
Akaike AIC	13.66620	-0.742157
Schwarz SC	13.82546	-0.582897
Mean dependent	-5.180928	0.007835
S.D. dependent	230.1498	0.720427
Determinant resid covariance (dof adj.)		1181.083
Determinant resid covariance		1039.489
Log likelihood		-612.1786
Akaike information criterion		12.91090
Schwarz criterion		13.28251

Table A6: Sectors in the Stock Market

Agricultural
1. Eaagads Ltd Ord 1.25 AIMS
2. Kakuzi Ltd Ord.5.00
3. Kapchorua Tea Co. Ltd Ord Ord 5.00 AIMS
4. The Limuru Tea Co. Ltd Ord 20.00 AIMS
5. Rea Vipingo Plantations Ltd Ord 5.00
6. Sasini Ltd Ord 1.00
7. Williamson Tea Kenya Ltd Ord 5.00 AIMS

AUTOMOBILES & ACCESSORIES
1. Car & General (K) Ltd Ord 5.00
2. CMC Holdings Ltd Ord 0.50
3. Marshalls (E.A.) Ltd Ord 5.00
4. Sameer Africa Ltd Ord 5.00

BANKING
1. Barclays Bank of Kenya Ltd Ord 0.50
2. CFC Stanbic of Kenya Holdings Ltd ord.5.00
3. Diamond Trust Bank Kenya Ltd Ord 4.00
4. Equity Bank Ltd Ord 0.50
5. Housing Finance Co.Kenya Ltd Ord 5.00
6. I&M Holdings Ltd Ord 1.00
7. Kenya Commercial Bank Ltd Ord 1.00
8. National Bank of Kenya Ltd Ord 5.00
9. NIC Bank Ltd Ord 5.00
10. Standard Chartered Bank Kenya Ltd Ord 5.00
11. The Co-operative Bank of Kenya Ltd Ord 1.00

COMMERCIAL AND SERVICES
1. Express Kenya Ltd Ord 5.00 AIMS
2. Hutchings Biemer Ltd Ord 5.00
3. Kenya Airways Ltd Ord 5.00
4. Longhorn Kenya Ltd Ord 1.00 AIMS
5. Nation Media Group Ltd Ord. 2.50
6. Scangroup Ltd Ord 1.00
7. Standard Group Ltd Ord 5.00
8. TPS Eastern Africa Ltd Ord 1.00
9. Uchumi Supermarket Ltd Ord 5.00

CONSTRUCTION & ALLIED
1. Athi River Mining Ord 1.00
2. Bamburi Cement Ltd Ord 5.00
3. Crown Paints Kenya Ltd Ord 5.00
4. E.A.Cables Ltd Ord 0.50
5. E.A.Portland Cement Co. Ltd Ord 5.00

ENERGY & PETROLEUM
1. KenGen Co. Ltd Ord. 2.50
2. KenolKobil Ltd Ord 0.05
3. Kenya Power & Lighting Co Ltd Ord 2.50
4. Kenya Power & Lighting Ltd 4% Pref 20.00
5. Kenya Power & Lighting Ltd 7% Pref 20.00
6. Total Kenya Ltd Ord 5.00
7. Umeme Ltd Ord 0.50

INSURANCE
1. British-American Investments Co (Kenya) Ltd Ord 0.10
2. CIC Insurance Group Ltd Ord.1.00
3. Jubilee Holdings Ltd Ord 5.00

4. Kenya Re Insurance Corporation Ltd Ord 2.50
5. Liberty Kenya Holdings Ltd Ord.1.00
6. Pan Africa Insurance Holdings Ltd Ord 5.00

INVESTMENT

1. Centum Investment Co Ltd Ord 0.50
2. Olympia Capital Holdings Ltd Ord 5.00
3. Trans-Century Ltd Ord 0.50 AIMS

INVESTMENT SERVICES

1. Nairobi Securities Exchange Ltd Ord 4.00

MANUFACTURING & ALLIED

1. A.Baumann & Co Ltd Ord 5.00 AIMS
2. B.O.C Kenya Ltd Ord 5.00
3. British American Tobacco Kenya Ltd Ord 10.00
4. Carbacid Investments Ltd Ord 1.00
5. East African Breweries Ltd Ord 2.00
6. Eveready East Africa Ltd Ord.1.00
7. Kenya Orchards Ltd Ord 5.00 AIMS
8. Mumias Sugar Co. Ltd Ord 2.00
9. Unga Group Ltd Ord 5.00

TELECOMMUNICATION & TECHNOLOGY

1. Safaricom Ltd Ord 0.05