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**RELATIONSHIP BETWEEN VOLATILITY OF STOCK PRICES AND
THE LEVEL OF STOCK PRICES;
A CASE STUDY ON KENYA BOURSE.**

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DECLARATION

I declare that this work has not been previously submitted and approved for the award of a degree by this or any other University. To the best of my knowledge and belief, the Research Proposal contains no material previously published or written by another person except where due reference is made in the Research Proposal itself.

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Contents

Abstract.....	v
Acknowledgements.....	vi
List of Figures.....	vii
List of Tables.....	vii
List of Abbreviations.....	viii
1.0. INTRODUCTION.....	1
1.1. Background of Study.....	1
1.2. Research problem statement.....	3
1.3. Research objectives.....	4
1.4. Research Questions.....	4
1.5. Justifications.....	5
2.0. LITERATURE REVIEW.....	6
2.1. Introduction.....	6
2.2. Theoretical Literature.....	6
2.2.1. Non-Existence of the relationship between the variables.....	6
2.2.2. Existence of the Relationship between the Variables.....	9
2.3. Summary on NSE volatility.....	11
2.4. The Conclusions.....	12
3.0. METHODOLOGY.....	13
3.1. Introduction.....	13
3.2. Research Design.....	13
3.3. Population and Sampling.....	13
3.3.1. Population.....	13
3.3.2. Sampling.....	13
3.4. Data collection.....	14
3.5. Data Analysis.....	15
3.5.1. Introduction.....	15
3.5.2. Individual Stock Analysis.....	16
3.5.3. Group stock analysis.....	17
3.5.4. Returns analysis.....	17

3.5.5.	The Excel and R-software.....	18
3.6.	Presentation and Reporting	19
4.0.	RESULTS AND ANALYSIS.....	20
4.1.	Introduction	20
4.2.	Data availability and Reliability.	20
4.3.	Discussions	20
4.3.1.	Introduction and General market deviations.....	20
4.3.2.	Individual Stock analysis	21
4.3.3.	Group analysis	22
4.3.4.	Returns analysis	24
5.0.	CONCLUSION, LIMITATIONS AND RECOMMENDATION OF THE STUDY	26
5.1.	Conclusion	26
5.2.	Limitation of the Study	27
5.3.	Recommendations.....	28
References.....		30
Appendix.....		32

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Abstract

The study investigates the relationship between stock price level and the deviation of the stock prices of selected listed companies at the Nairobi Securities Exchange (NSE), Kenya. It seeks to understand given the stock level prices let say Kes. 5 and Kes. 100 which stock will an investor with ability willingly invest in. Does the two stocks provide a similar deviations?

The study therefore answer the following questions; is their relationship between the level of stock prices and variability of stock prices, how does low-priced and high-priced stocks deviate and finally given some stake which stock level will an able investor commit his funds that is, the study sought to identify the role of level of stock prices in making investment decisions whether it is better to invest in low stock prices or high priced stocks.

The literature showed that researchers have conflicting conclusions, in that some claimed there exist some relationship between the level of stock price and the volatility of the stock prices, while others concluded that there is no role of stock price level on stock prices deviations.

The study used standard deviations as a statistical metric to carry out the analysis. The data used are the average daily stock prices for the period January 1 2015 to December 31 2105. The conclusion of the study is that stock prices level has some role on the changes on stock prices, stocks with higher priced level has a higher variability and the low-priced stocks has lower variability and the Investor will invest based on its willingness to take risk. Risk averse will go for low priced stocks and risk seeking will invest in higher priced stocks.

List of Figures

Figure 1: NSE 20 performance over the period of study.	20
Figure 2: shows group analysis deviations.....	23
Figure 3: graphical state of returns in different groups.....	24
Figure 4: returns path over the period of study	25
Figure 5: Nairobi All Share Overview	32
Figure 8: Medium grouped levels	33
Figure 9: Higher grouped level.....	34
Figure 10: Low-priced grouped level	34

List of Tables

Table 1: shows the average stock price and the deviation of the analyzed companies.....	21
Table 2: shows the categories' standard deviations.....	22
Table 3: shows the selected sample and standard deviations.	23
Table 4: shows aggregate returns.....	24
Table 5: Group analysis sample table.....	32
Table 6: Returns analysis sample table	33

List of Abbreviations

NSE Nairobi Securities exchange.

CMA Capital Markets Authority.

ASP Average Stock Price.

CIC CIC Group Insurance Company

COOP Cooperative Bank.

HF Housing Finance Bank.

CFC CFC Stanbic Bank

NMG Nation Media Group.

DTB Diamond Trust Bank.

Key words: Volatility; level of stock prices; Nairobi Securities Exchange

1.0. INTRODUCTION

1.1. Background of Study

According to (Sen, 1974) in the study 'Stock Prices Level; A Predictive analysis' he asserts that the level of stock prices and their movements have always been of prime interest to people- as large investors intend on making a 'killing' on the market or small ones more concerned with finding a relatively safe depository for their saving. A rational investor therefore expects to add value (or make a 'killing') to his investment. In efficient markets, however, the actions of many market participants should cause the actual price of a security to wonder around about its intrinsic value (Fama, 1965), although the uncertainty concerning intrinsic values will remain, actual prices of securities will wonder randomly about their intrinsic value.

Stock prices fluctuate randomly around their intrinsic values and one would expect price changes to be independent and random, (MacKinlay, 1990). Random walk hypothesis (RWH) asserts that stock price returns movements are unpredictable and do not follow known direction or patterns, they are likely to go up as they are likely to go down regardless of past performance (Mutothya, 2013); which is consistent with (Heins & Allison, 1966) argument that one expects a \$40.00 worth of equity in a corporation to have a likelihood of becoming worth \$80 or \$20 that is independent of the number of shares into which that equity is divided. As a result of uncertainty in returns, many investors consider several factors in choosing what security to invest in among the factors is 'volatility of stock prices'. According to (Mutothya, 2013) many investors spend time and resources seeking out misplaced securities. In making decision to invest in stocks, investors tend to hold, sell or buy a security according to their specific risk appetite, analyst advice, Volatility and level of stock price plays a role.

Chartist and proponents of fundamental analysis attempt to predict the stock prices (Fama, 1965). Cowles commission raised a great deal of doubt on the ability of stock market forecasters to forecast (Renshaws, 1958), it is this that if it were perfect then the volatility will be zero. However, prices tend to have a random nature and using historical information to predict future value of a stock has negligible impact hence uncertainty in variability of expected returns.

These uncertainties of stock prices is evident in Kenyans bourse where market value of securities have kept on fluctuating in the recent past and in the process investors anticipation get ruined and some are lucky when the stock experience positive run-ups, however majority ends up with depressed value in the stocks held.

Much of previous work has attempted to explain the relationship of the common factors and new information relationship with stock prices. (Brennan & Jagadeesh, 1993) In this context new market information include stock splits, dividends, profit warning, release of development agendas, mergers and acquisitions, economic macro factors such as interest rates, resignation of management etc. with regard to this variables studied it is good enough to examine whether the level of stock prices plays a role in stock prices movements at Kenyan Bourse. (Shiller, 1981) has shown evidences that variability of stock price indices cannot be accounted for by information regarding future dividends, just dividends do not seem to vary enough to justify the price movements. This means variability of stock prices cannot be explained in wholesome by new information and as (Heins & Allison, 1966) puts that much research ought to be carried out to clarify these causes of volatility.

However factors such as level of stock prices playing a role has not been studied in Kenya Bourse, it is therefore relevant to find out whether the study is consistent with (Clendenin, 1951)) and (Heins & Allison, 1966) conclusion that the level of stock prices doesn't explained variability in the same price or it upholds (Fritzemeier, 1936) study that there is relationship between price level and its volatility such that it is better to invest in low-priced stocks.

Knowledge that a stock was selling high or low in relation to its price range in the preceding year would not have helped in forecasting whether it would fall into the gaining or losing group, (Latane, 1954). He explained more that there is slight tendency for stocks to reverse their direction of movement over the years. The variations from year to year are so wide that it seems doubtful if past price performance, alone, is a valuable guide in selecting securities.

SSA has come to play an increasingly important role in international investments. However, the growing interest in SSA markets has been associated with increasing concern about the high levels of volatility characterizing these markets (Nouyrigat, 2008).

Nairobi securities exchange (NSE) is therefore at a strategic position to tap these investments and expand its capital markets, which is also outlined in achievement of vision 2013 as capital markets development is inevitable and thus vital. These investors (both domestic and international) try to maximize their return in the capital markets which is dynamic and subject to stock variability (Vimala, 2015).

1.2. Research problem statement

It is untrue that ‘low-priced stocks “moves faster and farther” than high-priced ones, yet the facts are widely accepted and are unproven’ (Clendenin, 1951). His study further explain that it is said that low prices per share are conducive to volatility, that the percentage price fluctuation is commonly greater than would have been in a higher-priced stock of similar quality and prospects. John Clendenin study concluded that the percentage price fluctuations in most low-priced stocks are about the same as those in high-priced stocks of same quality. This is reinforced by (Heins & Allison, 1966) study that stocks prices plays no role in explaining variances in the stock prices.

However, (Fritzemeier, 1936) claims the contrary of (Clendenin, 1951) and like-minded scholars such that (1) low-price industrial stocks offer greater opportunities for speculative profits than high-price industrial stocks and (2) in case two or more issues of industrial stocks seem to offer equal prospective profits, the speculator should purchase the shares selling at the lowest price. These studies show conflicts in the past reviews such that there is no clear cut between the relationship between level of stock prices and volatility of stock prices.

In Kenya bourse securities’ price have surge or dwindle each other trading day. The behavior is random in nature such that the fluctuations influence investors’ strategies. The capital markets’ investors therefore lack clear decisive strategy when new market information is released or anticipated causing stocks run-ups, downward trend or dormancy (Demodaran, 1995). This has led to depreciation of investments’ value as a result of changes in the stock prices movements.

According to (Clendenin, 1951) he disputed the obvious implication held by then that low-priced stocks provide the ideal hunting area for profit-minded investor-speculation that was widely accepted yet unproven. The question we need to ask ourselves therefore is, is it safer to invest in

low or high level stock prices? It is therefore important to identify stocks that have higher anticipated returns and whose risk is Minimize. It is not clear whether high level stock price or low level stock is worthwhile to invest in the Nairobi Securities exchange.

Several studies that have examine the influence of price level on volatility have derived conflicting results (Drzycimski, 1978)The study will help to identify whether there is a relationship and thus the correlation amongst the variables and hence outline appropriate strategy whether it is safer to invest in low (Fritzemeier, 1936) or high level stock or whether there is no significant differences in investing in either high-priced or low-priced stocks as suggested by (Clendenin, 1951) and thus no need to put level of stock prices into consideration when making investments.

1.3. Research objectives

- 1) To investigate the relationship between stock price volatility and level of the stock prices.
- 2) To find out whether volatility in low-priced stocks is the same as with the high-priced stocks.
- 3) To identify whether it is profitable to invest in low priced or high priced stocks in the NSE.

1.4. Research Questions

- 1) Is there relationship between stock price volatility and level of the stock prices?
- 2) Do the low-priced stocks have the same volatility with high-priced stocks?
- 3) Are low-priced stocks more profitable than high stock price in the NSE?

1.5. Justifications

Several studies that have examined the influence of price level on volatility have derived conflicting results (Drzycimski, 1978). In these past reviews on the market stock prices volatility and whether there is association with level of stock prices has not been set straight. There are those scholars who think there is no association at all such as (Graham & Dodd, 2009) , (Clendenin, 1951), (Renshaws, 1958) and (Heins & Allison, 1966) and others who disputed this presumed fact such as (Fritzemeier, 1936).

However much of the study has been carried out in New York stock exchange, American railroad stocks, but in Africa and more specifically developing countries such Kenya little has been done on this area. The study therefore aims to exploit this field.

This study seeks to examine whether such claims hold in Kenya Bourse and whose facts among the scholars are upheld and reinforced. It will seek to understand if there is advantage of investment in various stocks prices levels. It is also; in line with the spirit of various scholars who recommend need to establish a clear-cut line with regard to notion of existence or non-existence of the relationship between these two variables, stock price level and volatility of the stock prices.

2.0. LITERATURE REVIEW

2.1. Introduction

The literature review section will be covered under three subtopics; (1) the theoretical, (which is in two aspects (a) literature the scholars who are against the claim relationship between volatility and level of stock prices, (b) those that support the existence of the relationship), (2) summary on NSE Volatility and (3) the conclusion.

2.2. Theoretical Literature

2.2.1. Non-Existence of the relationship between the variables.

According to (Clendenin, 1951) in the paper 'Quality versus Price as factors influencing common stock price fluctuations he concluded that, the truth of the matter is that the percentage price fluctuations in most low-priced stocks are about the same as those in high-priced stocks of the same quality. He attributed the price changes which characterizes many low-priced stocks to their speculative quality and not as a result of being low-priced stocks. These observations were derived by (MacKinlay, 1990) where he stated that there is a strong tendency for small firm portfolio to have higher variance ratio than the large firm portfolio, although he did not explain the association to the level of stock prices.

The argument above is consistent with (Heins & Allison, 1966) that the Investment grade of the stock is highly correlated with the average price. According to the duo it is this high correlation that has probably led to the commonplace that low-priced stocks are more volatile; yet the volatility is due to the low grade or high risk of the stock and not the low price. (Clendenin, 1951), conclusions disputed the commonly accepted and unproven facts that 'low-priced stocks "moves faster and farther" than high-priced ones which had led to obvious implication that low-priced stock provide the ideal hunting area for profit-minded investor-speculation. It has been a residual activity that market speculators invest mush of their wealth in the low-priced stocks with this mentality of higher return. They also hinted that more active stocks experience greater price variability than less active stocks; however, low-priced stocks exhibit no tendency to experience relatively wider price fluctuations than high-price stocks with similar characteristics

"Everyone knows" that low-quality stocks fluctuate more widely than high-quality ones, but few people know how much more, nor mush in absolute terms (Clendenin, 1951). In securities

analysis (Graham & Dodd, 2009) articulates that “it is a commonplace of securities market that an issue will rise more steadily from 10 to 40 than from 100 to 400”. According to (Heins & Allison, 1966) in the paper ‘Some factors affecting stock prices’ they disagree with the claims as inaccurate or at least inadequate. They further say that it is only by appealing to some sort of irrational investor can one justify the notion that low-priced stocks, *Ceteris paribus*, will behave differently than high-priced stocks. However the problem is whether indeed the stocks investors are irrational. Graham and Dodd in 1952 study derive that ‘low-priced stocks have a probability of advancing or declining more than higher-priced stocks.

The duo continued explained the arithmetic advantage of low-priced stocks, that investors tend to invest much in low-priced stock with the aim to take advantage of high volatility, this is further elaborated by (Heins & Allison, 1966) that in an orderly market one would not expect that the price of a stock affects the variability in that prices. The authors argued that since price of a stock is determined by the market valuation of stockholders equity in corporate assets divided by the number of stock outstanding hence no direct link to volatility of stocks. Graham and Dodd argument on the arithmetic advantage was further illustrated by (Heins & Allison, 1966) using a mere expression that it is factual and obvious if one buys one share of a \$4.00 stock he can lose less than if he buys one share of a \$40 stock. However they disputed the Graham and Dodd study by bringing an arithmetic scenario where if one buys ten shares of a \$4.00 stock he can lose as much as if he buys one share of a \$40 stock.

‘Price variability is not a function of highness or lowness of prices; of course, persistent skeptics could argue that our tables deal with small numbers of stocks, that our stocks are not classified by industries, and that we have no adequate data on stocks selling below \$5.00 per share.’ (Clendenin, 1951). An investor expects a \$40.00 worth of equity in a corporation to have a likelihood of becoming worth \$80 or \$20 that is independent of the number of shares into which that equity is divided (Heins & Allison, 1966). This means a share prices is expected to increase as it is to decrease in value. This shows presence of stock prices volatility. In their Hypothesis, they stated as: the relative price variability of a common stock is not related to the average price of the stock, other factors constant. In their conclusion, they formalize and reinforced their results with (Clendenin, 1951) study that stock prices variability bears no relationship to the average price of stocks, holding other factors constant.

Over the years a great deal of attention has been focused upon the investments merits of low price common stocks and stock repurchase warrants (Renshaws, 1958). He further explained this using a study made by New York Stock Exchange which showed, for instance, that out of 74 listed stocks which advanced 60% or over the first nine months of 1944, approximately 80% were in the price group under \$10 per share. This shows that only 20% of the stocks that advanced constituted the other groups such as high priced or medium priced stocks.

The above argument is disputed by (Renshaws, 1958) such that he cited (Graham & Dodd, 2009) that the pronounced liking of the public for cheap stocks would therefore seem to have a sound logic. Yet it is undoubtedly true that most people who buy low-priced stocks lose money on purchases. They further explained the reason behind losing money due to the public who buys issues that are sold to it, and the sales effort is put forward to benefit the seller and not the buyer. (Renshaws, 1958), reinforced the argument above, such that most buyers of low priced issues lose money.

The issues about low-priced and high-priced stocks is also elaborated by (Renshaws, 1958), study in the paper 'A Note of Behavior in the Stock Market' where he raised a question whether an enlightened individual could or would have been able to behave in such a way as to take advantage of the implication that low priced stocks have "better" market action than high priced stocks. He argued that increase in expected appreciation in the stocks can only be purchased with the assumption of a greater degree of risk and uncertainty however low priced stocks and warrants can on the basis of average past experience be expected to out-perform high priced stocks, proportionally more individual low priced stocks will perish.

In (Renshaws, 1958) conclusion he upholds (Clendenin, 1951), (Graham & Dodd, 2009), such that the volatility of stock prices and their prices level have no relations. He says that the idea of general level of stock prices being explained in part by a derivative of relative price changes within the security itself is quite disturbing. A study made by the New York stock Exchange showed for instance, that out of 74 listed common stocks which advanced 60% or over in the first nine months of 1944, approximately 80% were in the price group under \$10 per share (Renshaws, 1958). He claims the shift from low priced to high priced stocks to escape poorer market or to vice versa from high to low take advantage for better market action will have an effect on stock prices that will appear more warranted yet it is just a psychological reaction and

would make the market oscillate without reason in relation to real factors governing fortunes and future income streams of the companies represented.

Stocks with historic earnings in relation to price, i.e., those having a low-price earnings ratio, tended to show greater price appreciation than high-priced –earnings stocks (Latane, 1954). This articulates as well what the proponents who disputes the relation between volatility and level of stocks. He asserts that knowledge of dividend payments in the preceding year would not help in determining whether a stock was in the gaining or losing group, dividends receipt in the year after the investment date would be a significant indication.

However, earnings and dividends changes during the year under consideration tended to have major effects on prices during the same year (Latane, 1954). Earnings especially, seem to be a major factor separating the stocks showing major appreciation from those losing ground. He thus disputed that level of stock prices has no association with its volatility and hence his conclusion consistent with (Clendenin, 1951) and the author claimed that low-priced stocks are much more opt to show major percentage price changes than high-priced stocks and that price alone gives no indication as to which way stocks will move. He added that accurate earnings estimates for the coming period may well be one key to successful investment and speculation.

2.2.2. Existence of the Relationship between the Variables

According to (Fritzemeier, 1936) in the paper “Relative price fluctuations of industrial stocks in different price groups, the author seeks to answer whether price level of industrial stocks has effect on the price fluctuations. His study showed that there is tendency for low-priced stocks to fluctuate more than the high-priced stocks; as the results from his analysis showed stocks opening between \$10 and \$25 reached the highest and those consisting stocks under \$10 were second highest, however, those with high-priced declined most.

The low-priced stocks tended rose definitely more than the high-price stocks during the “bull” markets of 1927 and 1928 and did not tend to make a proportional recession in 1929 is significant. This means low-priced stocks tended to go up considerably more in the “boom” than the high priced stocks, but in the downward movement of the market they did not go down much more than the high-priced stocks (Fritzemeier, 1936).

However in his study he asserts that to reach final conclusions in regard to the relative price fluctuations of industrial stocks in the different price groups, it seemed necessary to examine in a general way the major movements which took place throughout the nine-year period covered by this study. After putting other necessary factors into consideration he says 'It must be admitted that low-priced stocks show some tendency to change price or make "market fluctuations" more frequently than high-priced stocks'.

In (Fritzemeier, 1936) conclusions he puts it such that "unless there are serious uncompensated errors in the statistical work here presented, this investigation would seem to establish the existence of certain relationships between price level and price fluctuations which have hitherto gone unreported by students of stock-market phenomena". Hence

- 1) Low-priced stocks tend to fluctuate relatively more than high-priced stocks.
- 2) In a 'bull' market the low-priced stocks tend to go up relatively more than high-price stocks, and they do not lose these superior gains in the recessions which follow.

He further concluded that assuming (1) that the behavior of the various price groups will be similar to their past behavior and (2) that the selection of stocks on the basis of the activity for the current year does not account completely if at all, for superior performance of the stocks in the low-price groups, it seems logical to conclude the following;

- a) Low-price industrial stocks offer greater opportunities for speculative profits than high-price industrial stocks.
- b) In case two or more issues of industrial stocks seem to offer equal prospective profits, the speculator should purchase the shares selling at the lowest price.

2.3. Summary on NSE volatility

In Kenya, however the asymmetric volatility coefficient is significant and positive, suggesting that positive shocks increase volatility more than negative shocks of equal magnitude (Nouyrigat, 2008). High volatility means high risk and hence uncertainty of the returns.

Over the recent past the NSE has experienced some surge and downward trend. The volatility can be negative or positive. For instance, according to the figure 5 shown in the appendix was obtained from (Fusion Media Limited, 2007-2016) January 2009, 2012 and 2016 experience some downtrend while mid-2010 & 2011, 2014 to 2015 there were some positive aspect. This is a good example in all share indexes that there exists some variability in stock prices.

Financial markets exhibit dramatic movements, and stock prices may appear too volatile to be justified by the changes in fundamentals. As such these observations have been under scrutiny over the years and are still being studied vigorously (Vimala, 2015). It is therefore, in this spirit that we aim to examine if the volatility in NSE, Kenya has relationship with the stock prices levels. This is also explained by (Nation Media Group, 2015) that over the period July 2015 the exchange lost some values explaining some changes and volatility involved.

It is therefore essential to understand the volatility associated with the stock prices. Fredrick Macaulay study 1856 derived that there is a mathematical drift, which is the opposite tendency, whereby in periods of advancing prices in the market there is a pronounced tendency for individual stocks to be abnormally active when they are advancing in price more rapidly than the general market. (Gifford, 1939). It is this drift that stock prices fluctuate randomly and hence can be a win for one investor and a ruin on the other. To make NSE more attractive it means cases of massive ruin ought to be minimized and hedging against such to enhanced portfolio growth. This hedging is suggested by (Gifford, 1939) that if possible a mixture of low-priced stocks and high-priced stocks be invested in, such the when the market is bullish, the low-priced stocks hedges the high stock price and vice versa when the market is at the bear.

2.4. The Conclusions

In summary the scholars carried out the studies in the similar if not the same fields (price level and volatility of the price) but their conclusion disputed the earlier study, criticized or reinforced. For instance (Heins & Allison, 1966) criticized (Fritzemeier, 1936) on grounds that he used group rather than individual companies and not controlling the quality of stocks selected, and at the same time reinforced (Clendenin, 1951) for catering for the shortcoming; while selected stocks were limited to lower grades, no attempt was made to control the quality variable within the grades allowed and that the findings were based upon variability of groups of low-price and high-price stocks rather than individual stocks.

Moreover the analysis was done in let say developed markets such as New York Stock exchange (Brunnermeier, 2005) and little has been done in developing market in comparing the variables. The study therefore will help to compare the analysis and results of the market and the previous studies carried out.

3.0. METHODOLOGY

3.1. Introduction

‘Interested in examining the differences in price behavior to find causes and relationship’; to implement this approach it is necessary to decide on the method of selection and size of the groups of stocks, the investment periods to use and the data to compare (Latane, 1954). According to the above author the methodology part outlines the Research design, Target population and Sampling, Data collection and analysis, Presentation and reporting approach.

3.2. Research Design

This study used quantitative approach. This approach focused on the stock prices from listed companies in NSE, Kenya; this data is collected from the NSE and CMA websites as from January 2, 2015 to 31 December 31, 2015.

The reason for using the quantitative approach is that the research questions and the data or target population are measurable or quantifiable in nature that is stock prices.

3.3. Population and Sampling

3.3.1. Population

The target population was the listed companies in the Nairobi Securities Exchange (NSE), Kenya.

3.3.2. Sampling

The sample size was then selected from the population according to;

- the industrial sector the listed company is, then
- the level of stock price of the company in that given sector.
- Volumes traded over the entire period

The criteria above was used due to convenience since it was ease to analyze. The sample of a sector is robust and consistent with the other companies in a given industrial sector. Also the companies in a given sector has a high correlation amongst themselves since the factors affecting them are similar.

The representative sample was then analyzed as shown in the data analysis section.

The NSE20 will be used as the benchmark. This is because it is presumed to be optimally created portfolio and gives the best estimate of the overall market, this will show the market nature and overall performance of the market.

3.4. Data collection

The data obtained was the secondary data mined from the NSE and CMA websites. The data used is the daily stock prices due to the following factors;

- To cater for intraday changes.
- To have a good number of data points.
- Plausibility of information.

The industrial sectors considered are Manufacturing, Investment services, investment, Insurance, Energy and Petroleum, Construction and Allied, Banking, Automobiles and Accessories and Agricultural.

As (Fritzemeier, 1936) did, those companies under study should meet some conditions, which is consistent with (Heins & Allison, 1966) study where stocks that incurred splits or substantial stock dividends during 1959 were rejected from the samples. The conditions include;

- No splits issued or declared dividends within the period.
- Have no major developments projects, Mergers and acquisitions etc.
- Information was available for the period of study.

Using individual companies for analysis is consistent with (Heins & Allison, 1966) criticism on (Fritzemeier, 1936) study, where they stated that one of the weaknesses is that the findings were based upon variability of groups of low price and high-price stocks rather than individual stocks and no attempt was made to control the quality of stock prices.

3.5. Data Analysis

3.5.1. Introduction

Recent approaches to the study of the unpredictability of stock market returns in developing markets have included variance ratios models, (MacKinlay, 1990), data analysis involved carrying out variance (deviation) and Standard deviation analysis using the Excel and R-software.

Standard deviation is a statistical term that measures the amount of variability or dispersion around the average. Standard deviation is a measure of volatility. Dispersion is the difference between the actual value and the average value. The higher the dispersion the higher the standard deviation and vice versa. Chartists can use the standard deviation to measure expected risk and determine the significance of certain price movements, (StockCharts.com Inc, 2016). This price movements in this context is the stock variability.

Steps in Calculating Standard deviation.

- Calculate the average (mean) price for the number of periods or observations.
- Determine each period's deviation.
- Square each period's deviation.
- Sum the squared deviations.
- Divide this sum by the number of observations less one because this is a sample.
- The standard deviation is then equal the square root of that number.

Variance is the presume measure for volatility. It measures how much the value deviates from the given or anticipated mean. However this study will focus on the standard deviation as opposed to variance since the former is a superior measure than the later.

3.5.2. Individual Stock Analysis

The average priced denoted by \hat{u} for each day is obtained by finding the average of opening and closing price. This caters for intraday analysis.

This can be illustrated arithmetically as shown;

Let;

X_1 = opening price

X_2 = closing price

$$\hat{u} = \frac{X_1 + X_2}{2}$$

The volatility (deviation), σ , is obtained by finding the variance of the stock prices,

That is, Deviation, $\sigma^2 = (\hat{u} - \mu)^2$

$$\text{Standard Deviation } \sigma = \sqrt{\frac{\sum(\hat{u} - \mu)^2}{n-1}}$$

The individual stock standard deviation is then compared against the stock level price. The sample table is provided in the appendix as table 5 arranged according to level of stock price from least to highest.

In determining the relationship between stock prices deviation and stock price level sought to find the correlation of determination or simply correlation. Correlation of determination, r^2 explains how much a dependent variable explains the independent variable. For this case how much the stock price level explains the variation in the stock prices

The following formula will be used;

$$r = \frac{n \sum xy - \sum x \sum y}{\sqrt{n \sum x^2 - (\sum x)^2} \times \sqrt{n \sum y^2 - (\sum y)^2}} \quad r^2 = (r)^2$$

The variables x and y will presume the average stock price and the standard deviation respectively.

The average stock price will be the mean of the various selected companies over the period of study.

The higher the r^2 means more of the deviation or changes of standard deviation can be explained by the level of stock prices.

3.5.3. Group stock analysis

In 'individual stock analysis' companies' stocks prices are analyzed as individual, however in the group analysis the selected samples are grouped into strata according to price levels i.e. those deemed high and low priced stocks.

This is aimed at establishing movement of prices at different levels and establish the relationship between level of stock price and volatility. Security analysis, (Graham & Dodd, 2009) defined "low-priced" must, of course, be somewhat arbitrary. Prices below \$10per share belong to this category beyond question; those above \$20 are ordinarily excluded; so that the dividing line would be set somewhere between \$10 and \$20.

The different levels of stock prices will be arranged into different groups as suggested by the table in the appendix as table 6. The standard deviation for the different grouped stock price levels is carried out and compared against each other.

3.5.4. Returns analysis

The returns for each group is obtained from the formula shown below. The aggregate returns is the accumulated daily average return obtained over the period. The aggregated return is then multiplied by the presumed investment stake.

$$R = \frac{p_1}{p_0} \quad \text{where } p_1 \text{ is the price at time } t=1 \text{ and } p_0 \text{ is the price at time } t=0.$$

The resulting amount is compared against different levels and the benchmark. The results (returns and standard deviations) is presented in the table format shown in the appendix as Table 6. The group category that provided the highest return is ranked first followed by the other categories according to the returns obtained.

3.5.5. The Excel and R-software

3.5.5.1. Introduction

The data analysis stated above will be carried out in R-software and Microsoft Excel. Microsoft spreadsheet that performs a wide variety of activities ranging from graphical design, pivot tables, regression analysis etc.) R-software is an integrated suite software facilities for data manipulation, calculation and graphical (the core team, 2016). Among other things it has;

- An effective data handling and storage facilities
- A suite of operators for calculations on array, in particular matrices
- A large, coherent, integrated collection of intermediate tools for data analysis
- Graphical facilities for data analysis and display either directly at the computer or on hard copy.

3.5.5.2. Why Excel and R

- a) Convenience, good command in functions of the stated software.
- b) Availability and cost-free, MS- Excel comes with Microsoft office installation into the computer. R can be downloaded and installed freely as well.
- c) R handles huge amounts of data and hence simplifies.
- d) Easy to interpretation and understand the results.

3.6 Presentation and Reporting

The aftermath of all the procedures in quantitative approach data analysis is to interpret the results and hence communicate (represent). This is where graphs, tables and explanation was used.

To explain objective 1, where it aim to seek whether there is relationship between volatility of stock prices and the level of stock prices, correlation between the level of stock prices (ASP) and standard deviation was carried out and the value presented and explanation based on the value obtained as correlation of determination.

The second objective is to investigate if the volatility in low and high-priced stocks is the same. This is presented using the plot line graphs and stating the differences in variability as represented by standard deviation for the individual and group categories in a tabular form showing the differences.

The third objective seeks to state the profitability of investing in different stock categories price levels. This is shown by arithmetic calculation let's say an investor invest Kes. 1000 in either level of the categories provided at this given period of study how much would the eventual aggregate return be. The one with the highest return is presumed the best. It is represented by the table as suggested in Table 6. In the appendix arranging the level from the highest to the least and a line graph showing the pattern that the stake amount will follow over the period of study.

4.0. RESULTS AND ANALYSIS

4.1. Introduction

This chapter seeks to discuss;

- Data availability and reliability, data analysis and presentation.
- Discussions on the results which involves interpretation, answering the research questions, conclusions on the study, recommendations and limitations of the study.

4.2. Data availability and Reliability.

The data obtained from the NSE and CMA websites were readily available online in excel sheets. However the missing data was least, I did filled it by calculating the average per month and others by maintain the previous day price. Data analysis and presentation were done correctly as prescribed by the methodology.

4.3. Discussions

4.3.1. Introduction and General market deviations

During the period of study (Jan-Dec 2015) the market shown a general downward trend which is attributed to adverse economic conditions in the country during the period. The NSE 20 which is used as a benchmark shows the trend as shown below.

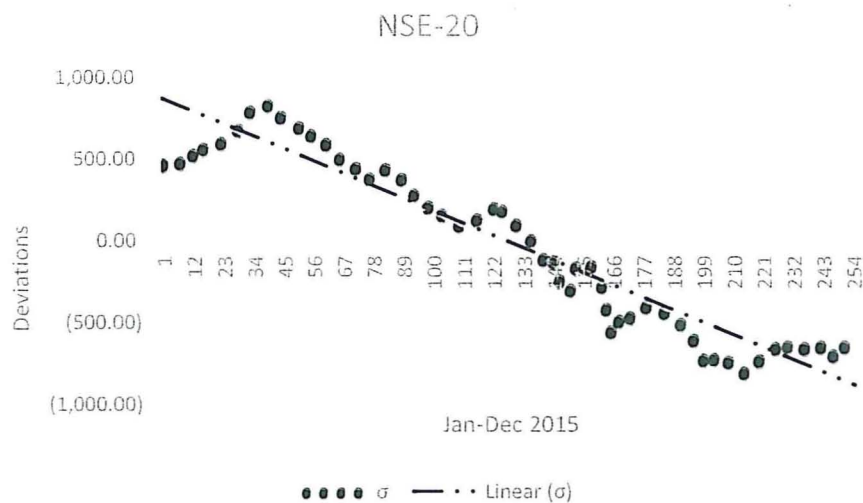


Figure 1: NSE 20 performance over the period of study.

As a result of this decline the companies analyzed are expected to show the same line of downward trend.

4.3.2. Individual Stock analysis

All the companies shows the decline over the period of study except Crown paints which had a gentle surge in the market.

Kenol Kobil had the least deviation of 0.61 and Nation Media Group (NMG) had the highest deviation of 44.80. The mean standard deviation for the 21 companies is 7.40 and out of the 21 listed companies analyzed, only 8 had a standard deviation greater than the mean.

The average stock price (ASP) is the mean of the stock's price for the period of study the figure below shows the standard deviation (σ) and average stock prices for all the companies.

Company	ASP	σ	Company	ASP	σ
1 Home Africa	2.72	0.92	12 HF	28.95	7.57
2 Sameer	5.00	1.01	13 Eaagrad	33.76	5.57
3 CIC	8.23	1.59	14 Scangroup	37.92	7.45
4 Kenol kobil	8.83	0.61	15 Equity	46.06	4.55
5 EA Cables	13.89	2.30	16 Crown Paints	53.14	11.69
6 Barclays	14.80	1.54	17 Centum	55.92	7.34
7 NSE	15.80	1.42	18 CFC	107.25	17.39
8 Sasini	15.93	1.83	19 Bamburi	157.48	9.65
9 Kplc	15.93	1.53	20 NMG	199.76	44.80
10 COOP	19.70	1.67	21 DTB	219.06	19.52
11 Britam	21.05	5.47			

Table 1: shows the average stock price and the deviation of the analyzed companies

The hypothesis one seeks to identify whether there is a relationship between the stock price levels and variability of stock prices. The information about the ASP and their respective standard deviation is regressed to obtain the correlation.

The correlation of determination is 0.7 which means during this period of study 70% of the deviation in the stock prices could be explained by the level of stock prices. The rest 30% is the unexplained aspect which could be due to other factors apart from the level of stock prices.

Based on the literature review it shows that the stock prices level plays a role in the stock prices variability.

4.3.3. Group analysis

The group analysis covered 5 levels of groups. Stock with below ASP 15, between 15 and 29, between 30 and 49, 50 and 100 and those above 100. The 4 category with above 100 has the highest standard deviation of 18.18 and the category below 15 had the least standard deviation of 1.22. The standard deviation is found by calculating the average of stock price per day for the companies in each group.

The diagram below shows the categories and the respective standard deviation.

Group	Std Dev
1 < 15	1.22
2 15-29	2.38
3 30-49	5.34
4 50-100	4.24
5 > 100	18.18

Table 2: shows the categories' standard deviations.

The graph below shows a further clarity on the deviation during the period of study and the nature of the trend, which is declining for all groups except category '50 – 100' where the Crown paints had a different outlook in the market.

The deviation per level groups is further explained as shown by the diagrams in appendix as figure 4, 5 and 6. Where the line graphs plots shows the deviation of the different selected companies to illustrate the role of level of stock prices to the volatility of stock prices.

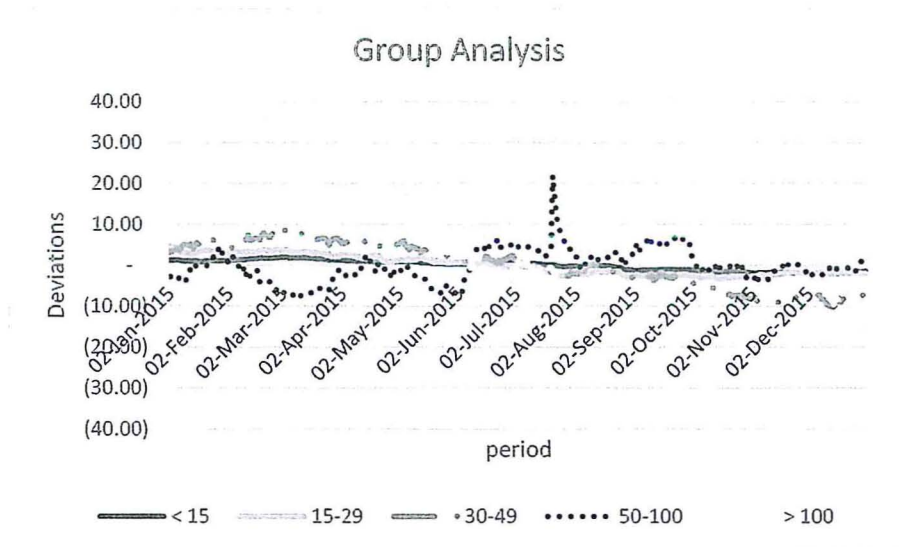


Figure 2: shows group analysis deviations

The second objective aimed to identify whether variation of stock prices is the same for low and high level. The results shows that there is a difference in the variation with different levels.

The table below shows the companies, average stock prices (ASP) and the standard deviation. The companies is the sample of the analyzed companies that shows consistency.

Company	Average Stock Price	Standard Deviation
Home Africa	2.72	0.92
CIC	8.23	1.59
COOP	19.70	1.67
Britam	21.05	5.47
Eaagrads	33.76	5.57
Scangroup	37.92	7.45
Crown Paints	53.14	11.69
CFC	107.25	17.39
DTB	219.06	19.52

Table 3: shows the selected sample and standard deviations.

From the above table it is visible that stock prices varies differently according to the level. This is further reinforced by the group analysis where the group with a higher stock prices deviates more than other level. It therefore means objective two which compares the stock prices level and there variation concludes that deviation is not the same. It also reinforces the first results that the level of stock prices has some relationship to prices deviation.

4.3.4. Returns analysis

The cumulative returns is obtained for each category and the value is calculated given an investor had committed Kes 1000 on January 2, 2015 in each category. What would be his value at the end of the year? The table below shows the summary of aggregate returns,

Level of stock price	No. of Companies	Average Aggregate Returns	Average Standard Deviation
1 50-100	2	1.16	0.11
2 Above 100	4	0.88	0.09
3 15-29	5	0.85	0.07
4 30-49	3	0.82	0.12
6 Below 15	7	0.75	0.12

Table 4: shows aggregate returns

When the KES 1000 is applied to each category the returns is shown by the graph below;

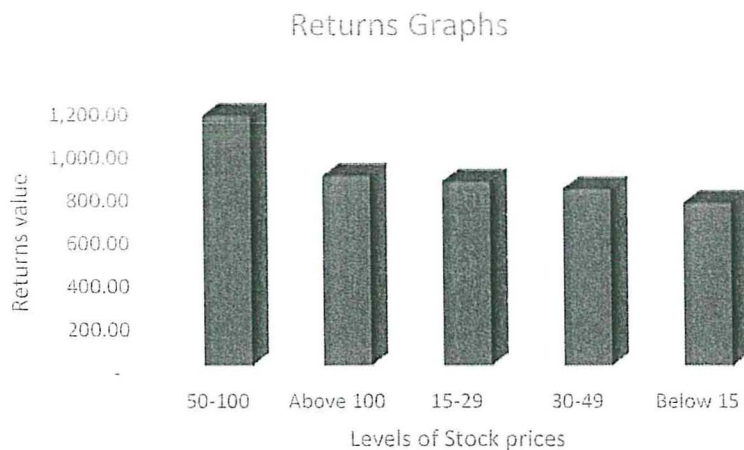


Figure 3: graphical state of returns in different groups.

The category '50-100' showed a higher returns followed by above 100 category. The below 15 had the least returns. The returns is associated with the volatility of share prices and thus the lower the volatility the lower the returns.

The flow chart below shows the path that the Kes. 1000 investment would follow to the end of the year.

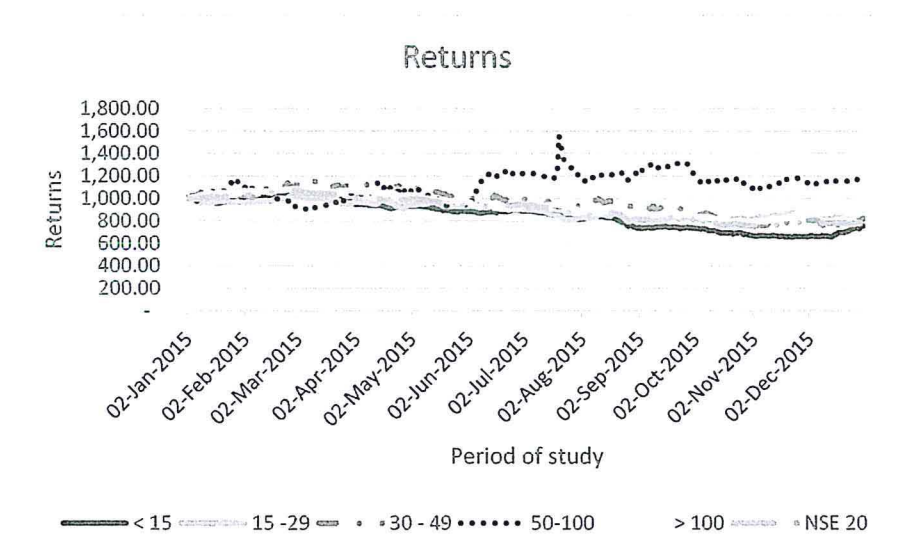


Figure 4: returns path over the period of study

The objective three was to compare returns if an investor committed KES 1000 to either levels of stock prices. In the table below it shows that returns from the ‘50-100’ category had the highest value followed by the ‘above 100’ category. The least level had the lowest returns. The deviation leads to returns and thus the categories with lowest deviation characterizes least returns.

However the ‘50-100’ category might not have topped the categories, and this is because they are only two companies sampled and one of the company deviation did not reflect the exact market trend at this time of study. Its deviation towards the year end was upward trending and maintained a positive deviations.

5.0. CONCLUSION, LIMITATIONS AND RECOMMENDATION OF THE STUDY

5.1. Conclusion

The study examines the relationship between level of stock prices and the variability of the stock prices in the NSE, Kenya. The NSE shows that variability of stock prices varies with the level of stock prices, that is, as the stock prices increase, its variation increases and the lower stock price levels have a lower deviations. Its results are consistent with the 'belief' that the higher the risky the higher the returns.

The study carried out, used a statistical metric standard deviation. Standard deviation as a measure of dispersion is used to facilitate a comparability of the various samples selected for the study. The Individual stock prices with a lower stock price level provided the least deviation, and deviation increases as the stock prices level increases. It therefore means the higher the stock price level the higher the variability and vice versa.

The study also analyzed the stock prices in categories. This is where the groups were created based on the level of stock prices. There were 5 categories and in this categories the deviation was consistent with the individual stock analysis such that deviation was higher for a group with a higher mean of stock prices. The group with lower average stock price level had the least deviation and provided a reinforcement to the individual stock analysis where the results is consistent with each other.

Finally the study analyzed the advantage of investing based on a level of stock prices. This is where the presumed groups were invested based on stake worth Kes1000. The pattern is identified for the stake until its maturity which is the presumed date of study. The study showed that the higher stock price levels provides a better return provided one is willing to take the risk of deviation. Deviations and returns are in a way similar such that the higher the positive deviation the higher the return and vice versa

The summary of the study then can be captured in the following statements, which is consistent with Fritzeimer study where the level of stock prices plays some role in the deviation of the stock prices;

- The companies with higher stock prices experiences a higher variability in its share prices, while those with lower stock prices have a lower variations.

- The stock prices levels plays some role in the deviation of stock prices. The higher the variability the higher the returns.
- If investors are risk seeking they should consider higher stock price level for investment as it would lead to higher returns and is accompanied by high risk whereas the risk averse one should go for the low level stock prices.

5.2. Limitation of the Study

The study had the following limitation.

The study period was limited to 1 year. From the literature review the studies' span a period of two years to 10 years and the data used was annually. This study considers a one year period with daily data. The data points are adequate however the study might not have captured the entire impact of stock prices level and its changes. Some factors might have occurred during this period of study and caused the deviation and not necessarily by virtue of being low stocks or high priced stocks. As a result, a longer period of study is recommended to ensure a wider span of analysis.

The period of study had a downward trend whose impact varied to different companies or sectors and hence deviation might not have a natural pattern. The deviation or reaction of different companies to bad economic situation varies and thus some sectors might have been hit hard by the economic situation and hence have different magnitude of variations.

Incompleteness of the data. Some companies had no data on the last date 31 December 2015. The data was filled using statistical approach where the average value per month was used as a value for the specific date. As a result of this the value presumed might be low or higher than the actual values. The values used therefore might not reflect the actual market value and hence a drawback to the study. Moreover the data availability from Capital Markets Authority (CMA) and Nairobi Securities Exchange (NSE) were not readily available and meant some companies which might have given a better reflection of the market might have been eliminated at data analysis stage due to missing data.

Market inefficiencies. The stock markets in developing countries are presumed to be weak form type of markets. Weak-form means the information that are reflected by the market are purely

historical and information pertaining future and current state might not be reflected at all. As a result the market prices are lagged in some way such that the prices used might have reflected a historical value of another day and not the specific day of study.

Moreover, due to market inefficiencies the NSE might not be reflecting the actual pattern of demand and supply of stock prices but instead is controlled by psychological trap and may be insider trading. Insider trading in the manner that NSE has information asymmetry. Information do not reach all investors at the same time. Others benefit due to first-hand information than others. The market is not yet sophisticated to facilitate a uniform information reach.

5.3. Recommendations

The following are recommendations of the study;

The analysis of stock prices levels and its variability should be done on a continuous basis. Due to inefficiencies of the market it is possible that every other trading day the market improves. The more the analysis done the results obtained could in some way reflect the NSE market better.

The period of study need to be increased. The companies should be study over a longer period than a year. The wider the study period the more the information and as such the analysis will in best way be a better representative or the conclusions will be much comprehensive.

The market participants, (specifically the NSE and CMA) should provide a better platform to ease analysis and data collection. The data could be provided for free for academic purposes and if not free should be relatively cheap to facilitate research. In the course of study CMA was identified to be working well on its Resource Center (where data for all listed companies and licensed members such as stock brokers will be available) and this is a better way to ease and facilitate research in the capital markets.

A comparable analysis amongst the stock price level and other factors ought to be studied. Other factors that are deemed to affect stock price variations such as dividends issues, major development projects, management changes etc. to be studied alongside the level of stock prices. In doing this the deviation in stock prices will be captured in nearly total way.

And finally there is need to identify how much the behavioral finance influences the investment pattern of investors in NSE. And this will help to identify whether the information symmetry is achieved such that investors are reached by information at a uniform rate. As a result of uniformity of information the stock prices will follow a natural pattern where the stock prices variation are triggered by factors of demand and supply.

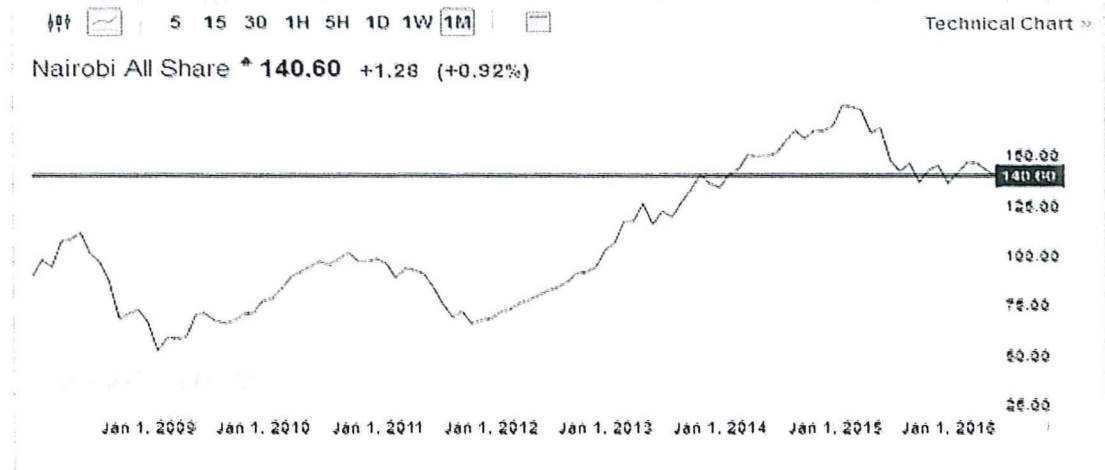
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Appendix

Nairobi All Share Overview



Prev. Close	139.32	Volume	-	Day's Range	139.32 - 139.32
Open	139.32	Average Vol. (3m)	-	52 wk Range	135.71 - 164.41
1-Year Return	-10.23%				

Figure 5: Nairobi All Share Overview

Group	Category	Number
1	Below 15	7
2	15 – 29.9	5
3	30 – 49.9	3
5	50 – 100	2
6	Above 100	4
Total		21

Table 5: Group analysis sample table

	Group Share Prices	Aggregate Return
Benchmark	NSE20	
Levels	Below 15	
	15-29	
	30-49	
	50-100	
	Above 100	

Table 1: Returns analysis sample table

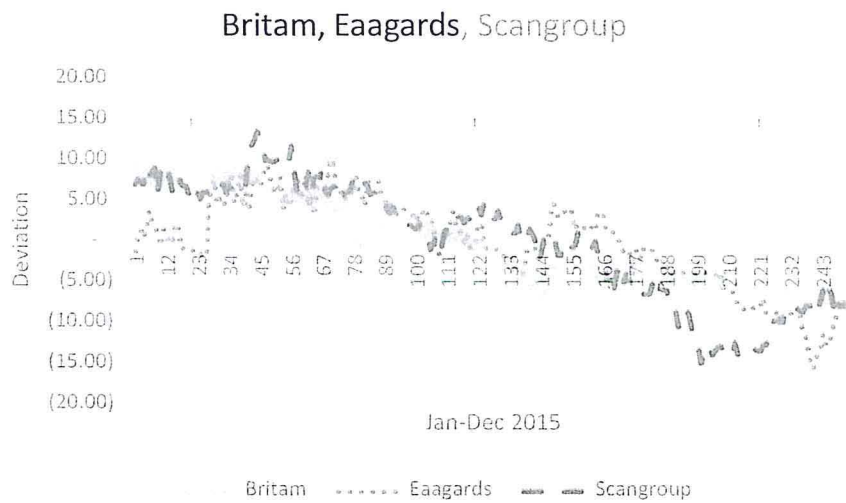


Figure 6: Medium grouped levels

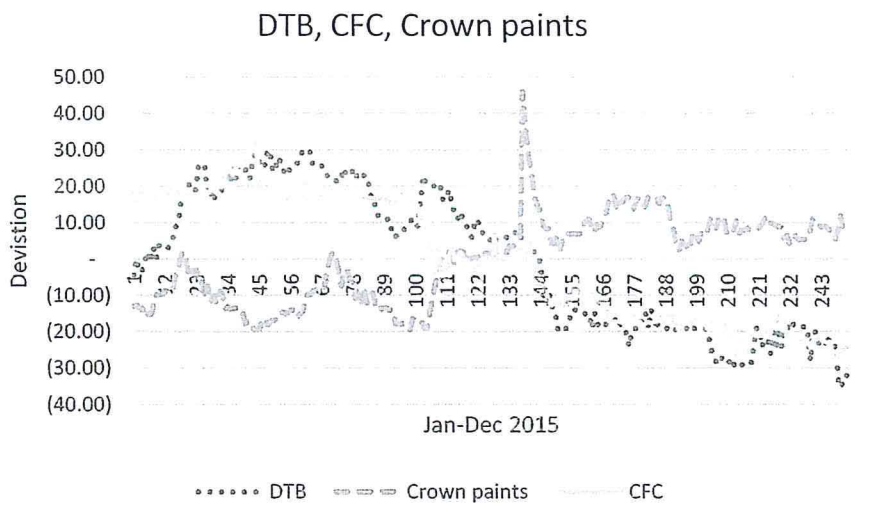


Figure 7: Higher grouped level

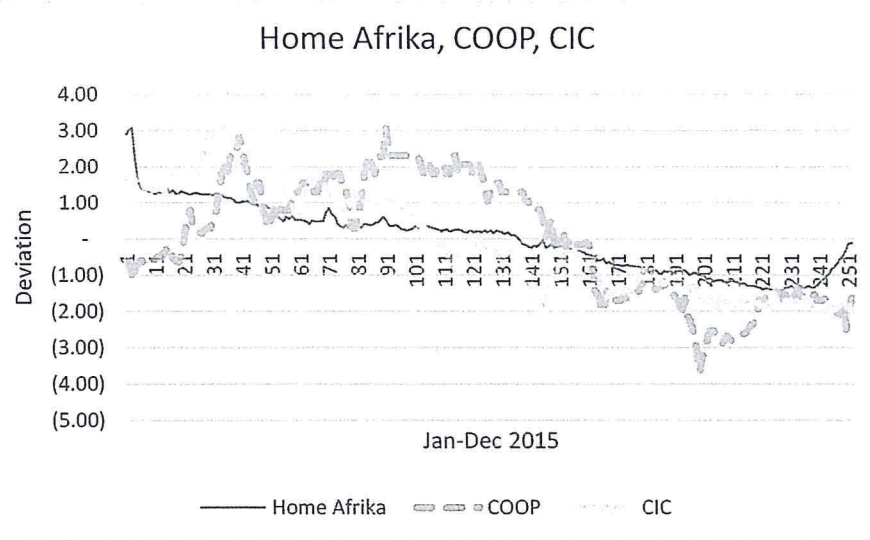


Figure 8: Low-priced grouped level