TESTING THE WEAK-FORM EFFICIENCY OF THE NAIROBI SECURITIES EXCHANGE MARKET

BY

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DECLARATION

This project is my original work and has not been presented to any other examining body of any University. No part of this research shall be produced without my consent or that of the University of Nairobi.

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Supervisors' Declaration

The research project has been submitted with our consent and approval as the supervisors;

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DEDICATION

This research project is dedicated to my wife Lucy and children Samwel and Joseph for support and patience during the entire study period.

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ABBREVIATIONS AND ACRONYMS

ADF	Augmented-Duckey-Fuller
AMEX	American Express
AMH	Adaptive Market Hypothesis
BRIC	Brazil, Russia, India and China
DJIMI	Dow Jones Islamic Market Index
EMH	Efficient Market Hypothesis
EU	European Union
OIC	Organization of Islamic Cooperation
GARCH	Generalized Autoregressive Conditional Heteroskedasticity
GCC	Gulf Cooperation Council
KPLC	Kenya Power and Lighting Company
K-S	Kolmogorov–Smirnov
NACOSTI	National Council for Science, Technology and Innovation
NSE	Nairobi Securities Exchange
NYSE	New York Stock Exchange
RWH	Random Walk Hypothesis
SPSS	Statistical Packages for Social Science
WAN	Wide Area Network

ABSTRACT

In an efficient market, prices of securities always respond rapidly and accurately to new information because there are no delays in system facilitation of trading. The main purpose of the study was to test whether the Nairobi Securities Exchange market is efficient in the weak form. The specific objectives for the study were to determine: If traded stock prices movements on the floor of the Nairobi Securities Exchange market are random and if traded stock prices movements on the floor of the Nairobi Securities Exchange market are non-random. The study reviews four theories which were: efficient market hypothesis, random walk hypothesis, adaptive market hypothesis and behavioral biases theory. This study employed explanatory survey research design as it is concerned with the causal explanation of events. The target population for this study was all 68 listed firms in the NSE for the period 2002-2017. The study selected 20 firms out of current 68 stocks in the NSE representing a 29.4% of the target population. This study utilized secondary data from the NSE office on the daily price lists. The data collected were analyzed using both inferential and descriptive statistics with the help of Statistical Packages for Social Science (SPSS). In this regard, the Kolmogorov-Smirnov goodness of fit test was used together with the descriptive statistics obtained to test the distribution of the return series. In addition, parametric auto-correlation test and the non-parametric runs test were employed to test for serial independence in the daily prices. The research employed a panel type of study.Study results indicated that means for the sampled firms had varying values but all were positive. This strong positive mean return has an indication that the data didn't follow the random walk model which postulates a zero mean.Values of Skewness and kurtosis coefficients were all above 5% level of significance hence they are not approximately to zero indicating these data are not normally distributed. The study findings indicate that Shapiro-Wilk value was less than 0.05 (Sig. <0.05). This implies that data was considered not to come from a normal distribution because the significance values were less than 0.05 hence data were not normally distributed. The value of Durbin-Watson coefficient in this study was found to be 0.169 indicating non-independent observations because residuals get close to zero. Study findings indicated that all *Z* statistics value for all firms have negative signs, giving an indication that the run numbers observed were less than the expected numbers of runs for daily price data for NSE firms except for Sasini, Britam, Co-operative and Kengen. Therefore, the study rejected the null hypothesis and concluded that NSE firms' daily price data were non-random. From the findings of this study, the NSE daily prices do not follow a random walk, it is therefore apparent that the pricing mechanism in the NSE does not utilize all available information. Stock market prices are not informative and the market is inefficient in terms of resource allocation. The study therefore recommends innovative and superior modeling of past daily prices by security analysts or investors to earn superior profits. An evaluation of the factors that make the NSE weak-form inefficient so that specific aimed policies can be implemented to tackle the causes of inefficiency.

CHAPTER ONE

INTRODUCTION

1.1 Background of the Study

The place where buyers and sellers exchange money related to securities such as stocks and securities is called capital market (Sornette, 2017). Capital markets assist in channelizing surplus assets from savers to organizations hence utilizing them for gainful use (Ogunrinola and Motilewa, 2015). Capital market is made up of primary markets and secondary markets. The dealing of trade of issues of stocks which are new is primary markets while dealing with existing securities or those previously issued is secondary market. A little securities exchange might be less productive in the powerless sense than a substantial one, since usually less intricately sorted out in fact (Hamid et al., 2017). Henceforth, data about stock value development may spread just continuously through the monetary network. Thusly, stock costs may show more prominent level of no irregularity since brokers can't take out this.

In 1970 Fama came up with Efficient Market Hypothesis (EMH) where trading on existing information fails to provide abnormal profits (Hamid et al., 2017). This follows that with a revelation of all existing data related to underlying firm, the anticipated forthcoming money flows and the hazard associated with holding such a security can be assessed by investors. The consequent trading based on the estimated valuation of a firm’s stock should make current stock prices to be a fair impression of all the accessible data (Wendo, 2015). Basing on the latest information available market is able to correctly price securities in a timely manner because each stock is trading at its intrinsic value

According to Williams (2015) time to time change in price of stocks must be random movement because there is no motivation to anticipate the new data to be non-arbitrary in appearance. They should follow a random walk. According to Yang, Lee and Lee (2015) random walk is used to describe the price series at a point where all subsequent change in price is represented in random departures from preceding prices. Emenike (2017) distinguished three successively weaker versions of the Random Walk based on the distributional characteristics of the price (or return) increments: independently and identically distributed increments, independent increments and uncorrelated increments. A standout amongst the most essential standards utilized as a part of estimating the market's efficiency is the capacity of costs to mirror all right now accessible data (Cramton and Ockenfels, (2016). The Efficient Market Hypothesis (EMH) is the proposal that present stock expenses totally reflect every single open datum about the estimation of the firm and that there is no genuine method to acquire excess advantages by using this information. The EMH has gotten a plenitude of consideration since its initiation. Be that as it may, confirm against the EMH is developing, and various investigations have archived return consistency. Truth is told, notwithstanding its relative straightforwardness, this theory has additionally created extensive discussion (Rossi, 2015). All things considered, the EMH questions the capacity of financial specialists to reliably recognize mispriced securities. Thus, researchers have as of late been examining the schedule abnormalities that are one of the qualities of money related markets, and these inconsistencies are found to negate the EMH.

1.1.1 Weak Form Efficiency

Market proficiency is a standout amongst the most critical ideal models in current back (Whalen & Minsky, 2015). This is expected the way that a great part of the hypothetical reason for money related and budgetary hypothesis lays on the financial productivity of capital markets. Productive market is the degree to which stock costs consolidate all accessible data. Productive market is essential since it causes financial specialists to comprehend security conduct in order to settle on astute speculation choices (Frederiks, Stenner & Hobman, 2015). The market is said to be more proficient when it's speedier and more exact to value securities.

The three variants of market efficiency are the weak, semi strong and strong. The three vary as indicated by the data that is consolidated in the stock costs (Edmans, Heinle and Huang, 2016). The weak form of efficiency assumes that stock costs officially consolidate all past exchanging data. The semi-strong form efficiency stretches out the data set to all openly accessible data including past exchanging data as well as key information on firm prospects (Lys, Naughton & Wang, 2015). Strong form efficiency contrasts from the two in expressing that stock costs reflect freely accessible data as well as private inside data. Notwithstanding, this type of Market efficiency is constantly dismissed by experimental proof. The study will focus on the weak form efficiency.

The Weak form efficiency of securities exchanges suggests that security costs completely mirror all the data verifiable in the record of past costs (Gilson &Kraakman, 2014). At the end of the day, all data passed on in noteworthy market information of a stock's cost is appropriated into the present cost of the stock and financial specialists can't foresee future value changes by extrapolating costs or examples of costs from the past (Armour

& Cheffins, 2016). Such memorable market information which frames the feeble shape data set incorporates; past costs, exchanging volume, offer ask costs or short premium. Accordingly, in the feeble shape, the present piece of the overall industry cost includes some other conjecture concerning; basically, it mirrors the best, unprejudiced, gauge of the estimation of the stock (Degutis & Novickyte, 2014).

1.1.2 Implications of the Efficient Market Hypothesis in Stock Market

The capability of a stock marketplace to incorporate all existing data into prices establishes its level of efficiency. Information ally efficient markets imply security prices that at all times "fully reflect" all the data existing to the participants in the market regarding the return and peril of that security (Lehoczky & Schervish, 2018). Therefore, security prices in efficient markets should equivalent the security's investment cost, where investment value is the present value of all future cash flows expected from holding the stock.

On one hand, governments and market regulators will care about the extent to which a market is efficient. Since the essential job of capital markets is the portion of responsibility for economy's capital stock, the pricing mechanism will be a vital factor in effective allocation of such resources. A failure in the pricing mechanism and the consequent failure of stock prices to reflect information about a company's prospects will cause funds to be misdirected from their highest value users, therefore impeding on the economy's growth (Baporikar, Nambira & Gomxos, 2016).

In this regard, Hirota and Sunder (2016) noted that efficient markets promotes an economy's growth and development, posits informational efficiency as an essential basis for assessing financial frameworks and open approaches. Additionally, stock markets are

vehicles businesses use to raise financing and therefore the degree to which they are efficient is an important characteristic of a well-functioning financial system. Alsahlawi and Ammer (2017) contend that there is potential for efficiency improvement through regulatory, policy guidance and other measures where a trading system is characterized by inefficiencies. Indeed, market efficiency studies can be designed to gauge if improvements in a stock market's environment, for example; improvements in microstructure, regulatory or the macroeconomic environment, yield similar improvements in capital allocation.

1.1.3 Nairobi Securities Exchange

The history of Nairobi Stock Exchange (NSE) dates back to 1954 when it was an overseas stock exchange under the British rule (Murithi, 2013). Currently it has 68 listed companies (Chesire, 2014). In the past, the exchange has worked in close collaboration with other East African stock exchanges. This has seen some of the shares being cross-listed across the East African exchanges. Stocks at the exchange are broadly categorized into main investment segment and alternative investment segment. The firms are further categorized into economic sector (Njuguna, 2015). Until 2006, trading happened on the floor of the market with dealers shouting over each other. But an electronic trading system was later introduced in 2006 with the implementation of a Wide Area Network (WAN) happening in 2007. This enhanced the trading efficiency and reduced chaos that was the signature of the market. Thus, stock brokers did not have to send their dealers to the floor of the house anymore. However, in some circumstances, trading is conducted from the floor of the house NSE (Chesire, 2014).

The NSE performance is measured through two indices –NSE All Share Index and NSE 20 Share Index. The NSE 20 Share Index was introduced in 1964 and is based on 20 blue chip firms with strong fundamentals and from various sectors. (ARM Cement Limited, Bamburi Cement, Barclays Bank Kenya, Britam, British American Tobacco Kenya, Centum Invest, CFC Stanbic, Co-operative Bank, East African Breweries, Equity Group, KCB Group, KenolKobil, Kenya Airways, Kenya Electricity Generating, Kenya Power Lighting, Nation Media, Safaricom, Sasini, Standard Chartered Bank and WPP-Scangroup).

1.2 Research Problem

In ideal situation of market efficiency, prices of security always respond rapidly and accurately to new information because there are no delays in system facilitation of trading (Aitken et al., 2018). With joined impact of data's arriving in a random, autonomous and various contending investors altering stock costs quickly to reflect new data implies that one would anticipate that value changes will be independent and random. An efficient market should value the security, in order to completely mirror the organizations earning power (Cramton & Ockenfels, 2016). The vulnerability encompassing the stream of future salary clouds this issue and has debate among business analysts and financial experts in the matter of how the market esteems a given stock. As indicated by Gresse (2017) such enhancements in exchanging frameworks, market capitalization, participation and volume exchanged evidently prompt upgrades in liquidity and market efficiency. The mixed evidence and the witnessed improvements in the NSE elicit curiosity to reexamine the current efficiency status of the NSE using recent data.

In real situation, the random condition of movements in the stock's price traded is unavoidable, it is impossible that one would locate a proficient market where there is accessibility of data, homogenous desires and zero trade exchange cost for instance where no speculator can beat the other and discretionary benefits are wiped out (Goodman, 2014). In the market efficienncy, market involves various investors who are always reading the updates on market and respond swiftly to any new notable information about a stock (Salonen, 2017). There are likewise numerous funds whose administrators are continually checking new reports and news searching for mispriced securities (Ndungu, 2014). Subsequently the ideal situation doesn't work.

From past studies there has been confirm that past information helps in anticipating future costs. Given the plain little decrease consequently unpredictability, it appears the strategy effect can be portrayed as unbiased. Malafeyev, Awasthi, & Kambekar (2017) studying China and India to test the effect of global money related emergency on the efficiency of stock markets revealed that both markets do not exhibit weak form efficiency and that the crisis did not affect the market efficiency. Righi & Ceretta (2013) studied the efficiency of European markets amid the monetary emergency using daily data and confirmed that the markets were efficient during the crisis. As per Phan and Zhou (2014) the economic health of a nation can be estimated by watching the productivity of its capital markets. In this way, the effective market speculation has been a noteworthy theme in finance and economic matters for as far back as forty years. Bamiatzi et al. (2016) contended that securities exchanges are redundant organizations for accomplishing elevated amounts of monetary improvement. Numerous viewed securities exchange as an operator that mischief economic advancement because of their weakness to showcase disappointment,

which is frequently show in the unstable idea of securities exchanges in numerous developing nations (Issahaku et al., 2017).

While numerous studies have been done in this area, very few have been done on the Nairobi Securities Exchange. For example Chesire (2014) study used only two stocks to conclude for the market and this might not be reflective of the entire market behavior hence a research gap to be filled by this study on 20 NSE firms. Njuguna (2015) tested EMH in Kenya by focusing on the role of technology. Kamau (2013) also found that NSE stocks were not weak form efficient. Murithi (2013) in his study examined the levels of weak-form efficiency in Kenya up to 2012 hence a research gap from 2012 to 2017. Furthermore all these studies have found mixed results.

However, most of them show evidence of inefficiency in the exchanges that have thinly traded stocks at high cost (Mayowa & Osayuwu, 2012). Given the mixed findings, this investigation looked to test the weak shape proficiency of the Nairobi Securities Exchange from 1st 2002 to 31st July 2017. Therefore, this study sought to test the movements of traded stock prices on the floor of the NSE market if they are random or non-random. This study therefore, sought to reject or neglect to dismiss the invalid theory that traded stock prices movements on the floor of the Nairobi Securities Exchange market are random.

1.3 Research Objectives

The general objective of this research was testing weak form efficiency in the Nairobi Securities Exchange market. Specific objectives were to determine:

i. If traded stock prices movements on the floor of the Nairobi Securities Exchange market are random
ii. If traded stock prices movements on the floor of the Nairobi Securities Exchange market are non-random

1.4 Research Hypotheses

i. **H_{01}:** Traded stock prices movements on the floor of the Nairobi Securities Exchange market are random
ii. **H_{02}:** Traded stock prices movements on the floor of the Nairobi Securities Exchange market are non-random

1.5 Value of the Study

This study is useful as it will add on to the growing body of literature on efficient market hypothesis and more so the weak form of EMH from the perspective of the Kenyan stock market a developing country perspective. Kenya being the fourth largest stock exchange market in Africa and one largely dominated by foreign capital provides important insights on the weak form of EMH.

The study will also be important in informing policy as far the development of the capital markets is concerned. The capital markets are important as financial intermediaries in the

economy and, therefore, development of the capital markets is paramount to economic growth through provision of credit.

Finally, this study is also important to students, academicians, and researchers who may find this document a useful resource material for reference in lectures and research. Further, the study will provide a recommendation on avenues for future research which will inform the basis for future researchers to focus on.

CHAPTER TWO

LITERATURE REVIEW

2.1 Introduction

Chapter two describes literature review of previous scholars done on the related research study. The following subsections are presented in the chapter; Theoretical review, Empirical studies, Conceptual framework and finally the summary of the literature review.

2.2 Theoretical Review

This section reviews four theories that explain efficient stock market. Two of these theories, the efficient market theory and the irregular walk speculation, are related as the RWH is used to test EMH. On the other hand, the AMH and Behavioral Biases Theory is recent theoretical framework that goes beyond EMH to explain stock behavior.

2.2.1 Efficient Market Hypothesis

Levy (1967) first advanced the idea of EMH before (Fama E. , 1970) popularized it. EMH suggests that prices of stocks reflect all information that is available in the market. What this means is that when prices reflect all available information, no investor can benefit from excess daily prices by using the information to his advantage as the prices change to reflect this information since everyone gets the same information. While Levy (1967) proposed two forms of EMH – weak and strong forms – Fama (1970) proposed three forms – weak, semi strong and strong. All these forms reflect a different set of information in the market.

In the weak type of EMH, the stock costs mirror all historical data of the stocks, daily prices, trading volume and the market (Nwachukwu & Shitta, 2015). Therefore, no investor can gain excessive profits in the market by predicting the stock prices based on past information about the stock as the current prices already reflect the historical information (Chesire, 2014). The semi strong form of EMH assumes that stock prices adjust rapidly to reflect all public information received (Nwachukwu & Shitta, 2015). This relates to information in the stock price series and that in accounting reports, those of competing firms, reports on the state of economy and any other information that is relevant to the firm that is publicly available (Chesire, 2014). Lastly, the solid frame EMH accepts that the stock costs completely reflect all data from open and private sources (Nwachukwu & Shitta, 2015). What this means is that there is no single group of investors that has a monopoly over information related to the formation of stock prices (Njuguna, 2015). Other than the assumption of stock prices reflecting both public and private information, the strong form also assumes that markets are efficient (Nwachukwu & Shitta, 2015). Thus, inside information that leads to investors buying or selling of stocks end up affecting the price of stocks and stock prices adjust accordingly to reflect the inside information (Chesire, 2014).

This theory forms the basis of this study. Since its introduction, scholars have tested the theory by focusing on the weak form of the theory. A rejection of weak form of EMH means that the strong form EMH is accepted (Hamid et al., 2017). Therefore, testing weak form EMH is also the same as testing strong form EMH hence the reason testing EMH in the weak form is always popular among scholars. In this study, we test the weak form of EMH by focusing on the Nairobi Securities Exchange market.

2.2.2 Random Walk Hypothesis

Random Walk theory was developed by Fama in 1965. The simple random walk theory suggests that given all past information about a stock, the future price is anticipated that would be equivalent to the present cost (Asiri, 2008). This also means that the change in price is zero.

Samuelson (1965) formalized the belief among economists that market prices are unbiased and are a reflection of fundamental factors in the market, which come because of an interaction between supply and demand. Samuelson (1965), therefore, proposed the Random Walk Hypothesis (RWH); arguments that stock market prices fluctuate randomly.

Precisely, the Random Walk model accept that progressive value changes (or daily prices) are independently and identically distributed random variables, ruling out predictability of future price changes from historical price changes (Fama, 1965). Therefore, in a weak form efficient market, i.e. where stock market prices fully reflect all past market data, the past price sequence cannot be used to obtain information about future prices. It will therefore be useless to choose stocks in view of data about late patterns in stock costs. Thus, technical analysis or investment strategies relying on stock price series with a specific end goal to gauge cost or decide when to purchase and offer the stock will not be able to earn excess profits (Cleary, et al., 2011).

Thus, researchers use RWH to study EMH by arguing that stocks that follow a random walk are efficient in the weak form. Indeed, studies that test EMH base the tests on the RWH. Therefore, this study also uses RWH as a basis for testing EMH for stocks listed on the Nairobi Securities Exchange

2.2.3 Adaptive Market Hypothesis

Adaptive Market Hypothesis was developed by Andrew Lo in 2004 in order to reconcile EMH and calendar anomalies (Lo, 2005). One of the criticisms of EMH is that it treats market efficiency as an all-or-nothing case. Market efficiencies evolve over time due to changes in market factors (for instance, regulations, institutions, and technology) and the behavior of market players. Adaptive Market Hypothesis (AMH) was born upon this deficiency.

Thus, under the AMH framework, return productivity vary now and again because of changes in economic situations (crises, bubble, and crashes) and institutional factors (Al-Khazali & Mirzaei, 2017). This means that market efficiency does not follow a secular trend as proposed in the EMH but rather varies in a cyclical fashion since it is dynamic and highly dependent on the context. Studies that follow this theory examine the influence of market conditions such as the Asian financial crisis (Charfeddine & Khediri, 2016) or the global financial crisis (Al-Khazali & Mirzaei, 2017) as well as the time-varying effects (Alvarez et al., 2012; Arshad et al., 2016; Urquhart & McGroarty, 2016; Charfeddine & Khediri, 2016).

In this study, this theory will not apply to examine market efficiency and its assumptions are beyond the scope of this paper. This paper emphasizes on testing whether the stock market is efficiency and not the influence of market factors on its efficient or the time varying effect.

2.2.4 Behavioral Biases Theory

The theory of behavioral finance was developed by Kahneman and Tversky in 1974. The theory states that speculators convey mental and social inclinations to their monetary

choices that make disparities between the reasonable estimation of money related resources and their real costs (Shiller, 2003). With a taught portfolio structure as an outline and an educated, objective monetary consultant as an accomplice, it's workable for speculators not exclusively to avoid these biases in their own portfolios, yet in addition to benefit from the occasionally nonsensical activities of their fellow investors.

According to behavioral finance, investors are not rational, as they are dared to be in standard money related hypothesis, but rather typical and along these lines subject to ordinary social inclinations that can cloud their venture judgment and prompt imperfect outcomes (Valsova, 2016). However recognizing and understanding these predispositions open the way to beating them. The best barrier against conduct inclinations is a trained portfolio structure that is constantly returned to guarantee its suitability for a financial specialist's long haul objectives.

2.3 Empirical Studies

This section presents empirical studies on testing efficiency of markets, especially the stock exchange market. While this review attempts to focus purely on the stock exchange market, some of the studies reviewed on EMH or RWH are from other markets other than the stock markets but are useful in providing a basis for testing market efficiency, as the methods are the same. Table 2.1 summarizes these studies.

Eugene Fama developed the Efficient Market Hypothesis (EMH) in 1970. The definition is one in which exchanging on accessible data neglects to give irregular benefits. In its original form, it states that, a productive market is one in which costs dependably 'completely reflect' accessible data (Fama, 1970). This follows that with a revelation of all accessible data concerning the hidden organization, the normal future money streams

and the hazard associated with holding such a security can be assessed by competent investigators or financial specialists. The consequent trading based on the estimated valuation of a company's stock should make current stock prices to be an unbiased reflection of all the available information.

Fama (1970) elaborates that the weak form efficiency requires that price changes follow a random walk such that successive price changes are independent of prior changes. In other words, stock prices cannot be predicted.

In the real world, the non-random state of movements in the prices of stocks traded is un avoidable, it is impossible that one would locate an effective market where there is accessibility of data, homogenous desires and zero exchange cost i.e. where no financial specialist can beat the other and subjective benefits are wiped out. There are advertise flaws and these prompt stock daily prices abnormalities. It is hence critical to comprehend securities exchange arbitrary oddities to have the capacity to exploit them. One of the fundamental worries of venture examiners is the consistency of stock daily prices. The more unsurprising the profits are, the lower the hazard. This worry offers an incentive to the investigation of securities exchange conduct. Learning of securities exchange inconsistencies is crucial to speculators. Through this learning financial specialists will apply the rule of purchase low and pitch high to make high benefits, in flawlessly productive markets; anyway these arbitrage benefits are impractical. In spite of solid proof that securities exchange is exceedingly effective there have been scores of concentrates that has archived long haul chronicled oddities in the share trading system that appear to repudiate the EMH.

There are studies on European markets that reject the EMH. For instance, Al-Loughani & Chappell (1997) studied the validity of weak form EMH for London stocks and found no evidence that the series followed RWH hence no weak-form efficiency of the market. Khan & Vieito (2012) examined the impact of random stock exchange mergers on the efficiency of Portuguese stock market. The outcomes demonstrated that the Portuguese market was wasteful in the feeble shape amid the period before stock exchange merger. Narayan et al., (2015) tested whether EMH is day-of-the-week-dependent using stocks from banks listed in NYSE. The study found no evidence of EMH for individual bank stocks. Further, Al-Khazali & Mirzaei (2017) using Dow Jones Islamic Market Index (DJIMI) used both AMH and EMH frameworks and found that AMH better explained calendar anomalies affecting market efficiency of Islamic stocks than the EMH.

Some studies on Asian and Middle Eastern stock markets reveal that the markets are not efficient in the weak form. For instance, Omran & Farrar (2006) investigated the RWH in Middle Eastern countries and rejected the RWH for all the markets examined. Jarrett (2010) studied the Asian market in a bid to test EMH and revealed that the weak form EMH does not hold for the four markets (Singapore, Malaysia, Korea and Indonesia) examined. Mishra et al. (2015) showed that Indian stocks were means reverting thus no evidence of weak form efficiency. Malafeyev et al. (2017) studying China and India to test the effect of global financial crisis on the efficiency of stock markets revealed that both markets do not exhibit weak form efficiency and that the crisis did not affect the market efficiency.

Besides the stock markets, some studies also reject RWH for other markets. For instance, Lean & Smyth (2015) tested the weak form efficiency of crude palm oil spot and future

markets using GARCH unit root test and found no evidence of weak form efficiency especially when the test allowed for heteroscedasticity of price series. Further, some studies combine both developed and developing markets in their analysis and find evidence of EMH. For example, Lee et al. (2010) studied whether EMH holds under different levels of economic development by focusing on 32 developed countries and 26 developing countries (including Kenya). The study revealed that there was no evidence of EMH for all the markets studied. Nwachukwu & Shitta (2015) also studied the weak-form efficiency of emerging and industrial stocks using monthly data and found no evidence of weak form EMH for 17 of the 24 emerging stocks.

A study in Bangladesh by Feige (2016) investigated the Independent movements in the prices of stocks. The recurrence developments with which income declarations create differential cost and volume responses demonstrate diverse responses are related with declaration particular attributes. That researched differential cost and volume responses related with profit declarations demonstrate that an example of 8180 declarations was considered by 1079 firms recorded with NYSE/AMEX. They utilized day by day costs for the time of 1986-89. They presumed that cost and volume responses are autonomous and firmly related. Besides, exchanging volume is probably going to be high in respect to value response when a profit declaration produces differential conviction corrections among financial specialists. The examination inferred that income declarations that produce a high exchanging volume response in respect to cost response are related with more unique money related investigators (pre disclosure) profit estimates; a vast expert after; higher irregular – walk-based unforeseen profit in respect to investigators based surprising income; and cost increments. Aftereffects of their investigation are extensively

reliable with the thought that exchanging volume response is probably going to be high (in respect to value response) when a declaration produces differential conviction updates among individual financial specialists.

In the United States the Independent movements in the prices of stocks traded for a securities market to function smoothly, several institutions are involved. The institutions include brokers, dealers, investment banks and an organized exchange. The institutions act on behalf of clients, and also take positions of their own, more commonly referred to as proprietary trading that creates conflict of interest. Brokerage firms have membership on stock exchanges, which allow them to vote on exchange policy, giving them opportunities to fulfill self-interest. Technological advances create new products that expand the scope of investment banking to include other activities that create potential for unethical trading. Collaboration in merging financial services leads to collusion to undercut the stock market (Sornette, 2017).

Some studies on market efficiency support EMH in the European market. Righi & Ceretta (2013) studied the efficiency of European markets during the financial crisis using daily data and confirmed that the markets were efficient during the crisis. Camelia, Cristina, & Amelia (2017) examining both EU and BRIC, and using a new technique, revealed that Hungary had the most efficient market while Greece had the least efficient market. Because of data asymmetry, financial specialists may not know as much about securities offered available to be purchased by firms as firm insiders such as brokers and dealers. When price-setting, mechanics settle on average prices for all securities based on lack of information, good securities disappear from the market and only poor and overpriced securities will be available for sale.

A number of studies also find the Asian stock markets efficient in the weak form. For instance, (Asiri, 2008) tested the weak-form efficiency of Bahrain stock market using cross-sectional time series data and revealed that the market was efficient in the weak form. This was the same case in Indonesia (Andrianto & Mirza, 2016), Indian capital markets during the global financial crisis (Jain, Vyas, & Roy, 2013), Istanbul stock market (Ozdemir, 2008), GCC countries to test the effect of the Arab spring (Charfeddine & Khediri, 2016) and OIC countries to test the effects of business cycles (Arshad, Rizvi, Ghani, & Duasa, 2016).

In Africa, a few studies also confirm the EMH for the stock markets. For instance, Opoku (2016) studied the weak form efficiency of African stock markets (which included Kenya) by selecting 24 stocks indexes and 8 individual national stocks and found that the stocks were weak form efficient with the continent-wide indexes being more weak-form efficient than the national stocks. Using 30 stocks from Kenya, Kelikume (2016) found that the stocks were efficient in the weak form.

Also in Ethiopia the Independent movements in the prices of stocks traded is influenced by malpractices where an investment bank oversees an issue while a business department of the same bank trades in those shares prior to an issue of the company. There are circumstances where analyst compensation for research work and investment banking businesses are connected. Engdawork and Ababa (2015), argue that share recommendations what's more, look into reports by securities investigators in real venture managing an account firms are normally excessively optimistic. Very few analysts recommend that investors sell a share. The reasons for such advice emanate from unwillingness to say anything bad. If broker-dealers fail to identify, prevent and manage

conflict of interest between brokerage and dealing business of the firm, there is the possibility of prejudicing the execution of client orders in favour of proprietary interests (Engdawork & Ababa, 2015).

In Kenya Murithi (2013) studied the weak-form efficiency of NSE and found that the stocks did not follow a random walk. Kamau (2013) also found that NSE stocks were not weak form efficient.Chesire (2014) also found no evidence for weak form EMH when she examined weak form EMH for KenGen and KPLC shares prices. Another study by Njuguna (2015) tested the weak form EMH for NSE using daily and weekly index and found no evidence of weak form EMH.

2.4 Conceptual Framework

Conceptual framework consists of independent variables and dependent variables. This study adopted a conceptual framework of strategic importance to determine the efficiency of the NSE market. Specifically this study investigated the randomness or independence of daily prices in the NSE using the Random Walk model.

Independent variables **Dependent variables**

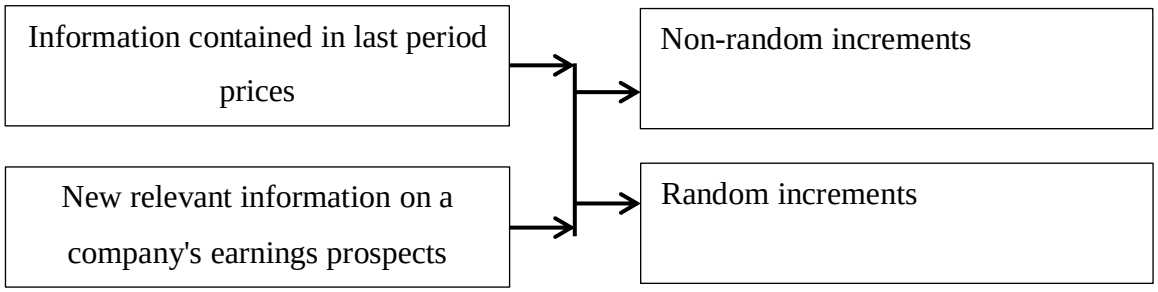

Figure 2.1 Conceptual Framework

2.5 Summary of the Literature Review

This chapter presented a review of literature. From reviewed literature it was found out that those independent movements in the prices of stocks traded demonstrate that, exchanging volume is probably going to be high with respect to value response when a profit declaration produces differential conviction amendments among financial specialists. From the survey ponders it was reasoned that profit declarations that create a high exchanging volume response in respect to cost response are related with more disparate budgetary investigator's income estimates; a huge expert after; higher arbitrary walk-based startling income in respect to examiners based unforeseen income; and cost increments.

Also the random state of developments in the costs of stocks exchanged demonstrates that the more unsurprising the profits are, the lower the hazard. This worry offers an incentive to the investigation of securities exchange conduct. Information of securities exchange inconsistencies is fundamental to financial specialists. Through this information financial specialists will apply the standard of purchase low and pitch high to make high benefits, in splendidly effective markets; anyway these arbitrage benefits are unrealistic. Investors make systematic errors in processing information, a fact that makes them susceptible to exploitation by others (Feige, 2016). Investors, more so individual investors buy shares that recently caught their attention. Research on testing the weak form of the efficient market hypothesis in the Nairobi Securities Exchange market is necessary.

Table 2.1: Summary of Empirical Studies Reviewed On EMH

Author of Study	Focus of study	Methodology	Findings	Knowledge Gaps	Focus of Current study
Fama (1970)	developed the Efficient Market Hypothesis (EMH)		Elaborates that the weak form efficiency requires that price changes follow a random walk such that successive price changes are independent of prior changes.	Elaborated the requirement for weak form efficient but didn't test weak form efficiency	Testing the weak-form efficiency at NSE
Bulla (2015)	Examined weak from EMH for NSE	Weekly data covered the period 2000 to 2009 for 39 stocks was used; serial correlations and runs tests used to test RWH.	Found evidence for RWH suggesting market is weak form efficient.	Weekly data did not take cognizance of the day of the week effects and for individual stocks.	Using daily data for the 20stocks.15 Years
Chesire (2014)	Examined weak form EMH at NSE	Used daily prices for KenGen from 2006 to 2009 and KPLC from 2002 to 2009; K-S normality test, runs test and autocorrelation used to test EMH	No evidence for weak form EMH found for NSE	Used two stocks to conclude for the market and this may not be reflective of the entire market behavior	Using NSE daily prices for 20 firms. Period from 2002-2017
Murithi (2013)	Examined the weak form	Daily, weekly and monthly daily prices for the NSE 20 index used from	NSE 20 daily prices series do not follow a random	Weekly index does not take note of the	Using daily data covering the period

	efficiency of NSE	2003 to 2012; parametric (auto correction) and nonparametric (K-S normality and runs test) tests used.	walk (no evidence of weak from efficiency); approaching random walk since 2006	day-of-the-week effect	beyond 2012 to present a more current study
Mutothya (2012)	Tested RWH for the NSE	Using daily stocks for 18 companies that comprise the NSE 20 share index; period ranged from 2008 to 2011 (4Years); serial to test RWH.	NSE stocks do not follow RWH	Selected 18 stocks and used daily data which reflects a panel data yet panel techniques not used in the analysis.	Using the daily price lists for a long period of time (15 Years) hence time series data.
Njuguna (2015)	Tested weak form EMH of NSE.	The techniques that were utilized to break down the everyday and week by week record information are the serial relationship test, unit root tests and the runs test. Jan 2001-Jan2015 and Feb 2008-Jan 2015	No evidence of week-form EMH at the NSE.	Weekly index does not take note of the day-of-the-week effect	Using daily data2002-2017 which is more current study

CHAPTER THREE

RESEARCH METHODOLOGY

3.1 Introduction

Chapter three describes design of the research design, population of the study, census survey, research instruments, data collection procedure and data processing and analysis.

3.2 Research Design

Research design refers to the general system that you coordinate the diverse parts of the investigation in a cognizant and consistent way, along these lines, guaranteeing you will adequately address the exploration issue; it comprises the diagram for the gathering, estimation, and examination of data (Kothari, 2004).The choice of a research design is informed by the nature of the research problem (Orodho, 2003). This study employed explanatory survey research design as it is concerned with the causal explanation of events.

Mackey and Gass (2015) recognize the need of informative outline especially when the purpose is to accomplish a more far reaching thought of the setting of the exploration and techniques being looked for. Further, they contend that the plan has generous capacity to deliver answers to the inquiries of 'why?' and 'how?' questions. In a general sense, logical research is utilized to answer cause-impact inquire about inquiries that are displayed as how is that thing occurring? For what reason is the thing occurring? Informative outline likewise utilize auxiliary sources, for example, distributed writing or information consequently space for consideration to be taken to pick an extent of honest sources to give a wide and adjusted cognizance of the subject.

The research employed a panel type of study. Panel data is a dataset in which the data of firm is seen over time (Hsiao, 2014). It was utilized in this study since it was a specific

design of longitudinal study in which the unit of examination is taken after at indicated interim over a long time, frequently many years and since the study looked at data from companies for the last 15 years, then the aforementioned research design is relevant.

3.3 Target Population

The target population refers to the group of individuals or study subjects who are comparative in at least one different ways and which frames the subject of the investigation in a specific review (Orodho, 2003). The target population for this study will be all 68 listed firms in the NSE for the period 2002-2017 (NSE handbook, 2017). Therefore, the target population above was chosen since it provided research information in respect to the study.

3.4 Sampling and Sample Size

Sample size refers to the quantity of perceptions or repeats to incorporate into a factual example (Orodho, 2003). The sample size is a vital element of any experimental investigation in which the objective is to make inductions about a population from a Sample. Sampling technique refers to a technique of choosing a piece of population on which research can be directed, which guarantees that ends from the examination can be summed up to the whole population. The study selected 20 firms out of current 68 stocks in the NSE representing a 29.4% of the target population. According to Mugenda and Mugenda(2003) a sufficient sample size should be in the range between 10 to 30 percent of a target population, therefore a sample of 20 stocks was considered a fair representation of the whole market because the companies drawn from every sector of the economy.

3.5 Data Collection

This study utilized secondary data from the NSE office on the market index. For the researcher to get systematic information he used a designed documentary analysis guide in form of data collection sheet in order to capture the relevant data was used. This documentary guide was used to find out the information concerning study variables (Appendix I). Daily index data were collected from 1st January 2002 to 31st July 2017. The fifteen-year data gave 3825 daily observations.

3.6 Data Collection Procedure

The researcher obtained a duly signed and stamped introductory letter from the University of Nairobi and then permission from National Council for Science, Technology and Innovation (NACOSTI) was sought. The data were obtained through the use of data collection sheets attached (Appendix I) which was filled in with the relevant data from all the 20 firms that the study was targeting.

3.7 Data Processing and Analysis

The quantitative data were gathered from the NSE offices in Nairobi. The data collected were analyzed using both inferential and descriptive with help of Statistical Packages for Social Science (SPSS). Descriptive statistics employed observations number as well as their respective, means, median, standard deviation, minimum, and maximum values. In order to test for the weak form efficient market hypothesis of the NSE, the researcher established whether the daily price dynamic could be defined as a random walk process. The researcher therefore used inferential statistics to try to infer from the daily price data how the population of stocks in the NSE behaves. In this regard, the Kolmogorov-Smirnov goodness of fit test was used together with the descriptive statistics obtained to

test the distribution of the return series. In addition, parametric auto-correlation test and the non-parametric runs test were employed to test for serial independence in the daily prices. The research employed a panel type of study. It was employed in this study because it was a specific outline of longitudinal study in which the unit of examination is pursued at indicated interims over a significant lot, frequently numerous years and since the study looked at data from companies for the last 15 years panel data was relevant.

The Random Walk Model

According to Campbell et al., (1997) random walk hypothesis is almost approximately true. They indicated that, if stock daily prices are partially predictable, the degree of predictability is generally low comparative with the high volatility of these daily prices. The following are random walk with drift process:

$P_t = P_{t-1} + \mu + \varepsilon_t$ ……Equation 3.1

or,

$R_t = \Delta P_t = \mu + \varepsilon_t$ ……Equation 3.2

Where, 〖(P〗_(,t)) is the cost of the record saw at time t, (μ)is a self-assertive float parameter or the normal value change, R_tis the relative change in the list and ε_t is an irregular unsettling influence term free and indistinguishably conveyed with zero (0) mean and consistent fluctuation. The autonomy of augmentations (ε_t) implies not just that ε_ (t) is uncorrelated, i.e. 〖Cov (ε〗_t, ε_ (t+k)) =0 for all k and k≠0, however any non-straight elements of the additions are additionally uncorrelated. Under the irregular walk speculation, a market is (powerless shape) productive if the latest cost contains all

accessible data. The offer cost is subsequently similarly prone to ascend as it is to fall; thus the best indicator of future costs is the most current value (Campbell et al., 1997).

According to Emenike (2008) the important part of Random Walk Model is that price changes during period *t* are independent of the sequence of price changes during previous time periods. The stock's price behaviour is therefore said to be consistent with the notion of a random walk when successive price movements move randomly, thereby showing no discernible pattern(s) and thus eliminating predictability.This model indicates that the daily prices of the index at time (month) *t* is equal to the return of the index at time (month) *t-1* plus a given value that depends on new and unpredictable information arriving between time *t-1* and *t*.

Kolmogorov-Smirnov Goodness of Fit Test

According to Mobarek, Mollah & Keasey (2014) Kolmogorov-Smirnov (K-S) goodness of fit test is a non-parametric test which is used to determine whether a sample comes from a population with a specific continuous distribution (uniform, normal or Poisson). The one-sample K-S test compares the observed cumulative distributional function of the data sample with a hypothesized distribution (in this case the normal distribution) to determine if they are identical.

The test computed the p-value which can then be directly compared to the desired significance value for the same purpose of determining whether to reject or accept the test hypothesis. The p-values are calculated based on critical values of the Kolmogorov distribution to which *D* converges in distribution and denote the threshold value of the significance level in sense that the $H_o$was accepted for all values of less than the p-value.

Auto-Correlation Test

The parametric test which is used to test the independence of auto-correlations between a time series variable and lagged values of it is called Auto-correlation test is a (Elbarghouthi, Qasim & Yassin, 2012). The term 'parametric' means that the test is based on the assumption of normal distribution in the data. In cases where strong deviations from normality are observed, Mlambo, Smit and Biekpe (2003) suggested the use of non-parametric testing methods, such as the runs test, which ignores the distribution pattern to conduct correlation analysis. However, despite the leptokurtosis and Skewness observed in financial data Nicholls and Quinn (2012) held the view that for the sake of statistical analysis, the assumption of near normality was acceptable as long as the number of observations is large.

Runs Test

Data series must be primarily tested for stationarity in all econometric studies (Gujarati, 2009).Stationarity condition is the integration orders of data series. Unit root test is conducted for the variables using the Augmented-Duckey-Fuller unit root test. If p-value of ADF is less than the theoretical value of 0.05 it show that the variable is suitable for modeling. To correct non-Stationarity of a variable, the first difference of the variable [D (var)] is used in the regression.

A run is checked each time the value arrangement transcends or falls underneath a cut point measure which might be the mean, middle, mode, or some other picked esteem. Every perception at that point is characterized with either a + or - to demonstrate whether the arrival falls above or beneath the cut point. This exploration grouped each arrival as indicated by its situation as for the mean return saw in the example under examination; a

positive return (+)is defined as any return equal or above the mean return while negative daily prices (-) are defined as any return falling below the mean return. According to Borges (2007), the runs above and below mean approach has the advantage of allowing for and correcting the effect of an eventual time drift in the series of daily prices as opposed to the runs up and down approach which counts a run every time the price (return) series changes its sign.

The runs test is centered on the idea that if price changes (daily prices) are random, the actual number of runs(R)will be consistent with the independence hypothesis as depicted by the expected number of runs(m)under the Random Walk Hypothesis.

CHAPTER FOUR

DATA ANALYSIS, RESULTS AND DISCUSSION

4.1 Introduction

In this chapter data analysis and presentation of the findings on testing the weak-form efficiency of the Nairobi securities exchange market was done. The guiding objectives were to determine, if traded stock prices movements on the floor of the Nairobi Securities Exchange market are random and if traded stock prices movements on the floor of the Nairobi Securities Exchange market are non-random. The study uses daily secondary data collected from firms in NSE. The study started with descriptive statistics followed by testing of Kolmogorov-Smirnov Goodness of Fit Test, Auto-Correlation Tests and Runs Test.

4.2 Descriptive Statistics

Descriptive statistics for the 20 sampled firms are presented in Table 4.1(a and b). The table summaries start and end period of each firm, observations number as well as their respective means, median, standard deviation, minimum, and maximum values.

Table 4.1(a) Descriptive Statistics of the NSE Firms

	ARM	BAMBURI	BBK	BAT	ICDCI	CFC	EABL	KCB	KENOL	KQ	KPLC
Observation	3811	3321	3818	3311	3818	3825	3815	3818	3818	3818	3818
Mean	75.1	147.2	85.3	284.6	43.5	68.7	219.0	47.3	67.5	29.8	79.37
Median	72.5	158	57.25	205	32	65.5	194	32.5	49	14	25
Mode	91	200	17	200	60	9	145	23	100	6	9
Std. Dev	56.24	54.64	93.37	207.4	49.64	36.84	98.07	43.14	80.47	30.87	80.43
Min	0	0	7	0	9	0	74	8	0	3	6
Max	235	240	602	999	553	368	552	271	423	146	335

Table 4.1(b) Descriptive Statistics of the NSE Firms

	NMG	SASINI	SCBK	BRITAM	COOP	EQTY	KENGEN	SAFCOM	SCAN
Observation	3813	3803	3815	1363	2144	2711	2766	2279	2685
Missing	0	0	0	97	3628	3628	3628	3628	3640
Mean	187.5	19.02	192.7	12.93	15.18	62.22	14.68	9.16	38.09
Median	178	15.55	189	10.40	15.70	33.75	12.30	5.85	32.75
Mode	180	20	140	10	20	24	7	4	26
Std. Dev	78.39	17.169	72.75	7.461	4.058	65.83	7.651	6.008	15.63
Min	0	3	46	4	6	12	5	3	10
Max	398	177	355	37	24	324	40	25	76

From table 4.1(a and b) the study results indicated that daily price's mean for the 20 sampled firms were positive. These positive means for daily prices had an indication that the data from the sampled firms didn't follow the random walk model indicated by zero mean. According to Emenike (2008), in weak form efficient stock market daily prices is Zero when positive daily prices cancel out the negative daily prices causing their average effect on investment daily prices to be zero. However, in this study all means were positive and above Zero. Furthermore mean and median had different values for all sampled firms where majority of firms had greater mean than median values for all the

daily samples. These study findings didn't concur with study results of Spiegel and Stephens, (2008), who indicated that the mean, median and modal values in a symmetrical distribution are alike; instead, it indicates that the daily return series are not symmetrically distributed.

Table 4.2(a) Skewness and Kurtosis

Category	ARM	BAMBURI	BBK	BAT	ICDCI	CFC	EABL	KCB	KENOL	KQ
Skewness	0.574	-0.901	1.445	1.47	4.91	1.15	1.169	2.534	2.057	1.36
Kurtosis	-0.383	0.019	2.127	1.49	28.711	5.79	0.778	6.732	4.611	0.98

Table 4.2(b) Skewness and Kurtosis

Category	KPLC	NMG	SASINI	SCBK	BRITAM	COOP	EQTY	KENGEN	SAFCOM	SCAN
Skewness	0.672	0.116	5.202	0.211	0.943	-0.245	1.976	1.152	0.637	0.49
Kurtosis	-0.819	-0.721	30.403	-0.629	-0.069	-0.817	3.305	0.603	-1.041	-0.95

From table 4.2 (a and b) the study findings also indicated that values of Skewness and kurtosis coefficients were all above 5% level of significance hence they are not approximately to zero indicating that these data are not normally distributed. The study finding also indicated that majority of data were positively skewed. These study findings of positive skewness for the daily data in NSE concur with study findings of Vitali and Mollah (2010), in Tunisia, Kenya (N20I) and Mauritius. However didn't agree with the findings of Borges (2007), who noted negative values for all the daily samples in the Pakistan market. As per Elbarghouthi, et al. (2012), skewness is a measure of asymmetry of the distribution of the series around its mean. A symmetric distribution, with a skewness coefficient near zero (like the normal distribution) looks the same to the left as

it does to the right of the centre point. Positive skewness means that the distribution has a long right tail (skewed right) relative to normal and negative skewness implies that the distribution has a long left tail (skewed left) relative to normal. The significant positive skewness in NSE firm daily prices give an implication that large positive daily prices tend to be larger than the higher negative daily prices hence data are not symmetrical distribution.

4.3 The Kolmogorov-Smirnov Goodness of Fit Tests

To test if the data come from normally distributed population or not Kolmogorov-Smirnov goodness of fit test was also done. The study results for Kolmogorov-Smirnov Goodness of Fit Tests were presented in table 4.3.

Table 4.3 Kolmogorov-Smirnov Goodness of Fit Tests

	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	Df	Sig.	Statistic	df	Sig.
ARM	0.124	3311	0.000	0.929	3311	0.000
BAMBURI	0.111	3311	0.000	0.912	3311	0.000
BBK	0.239	3311	0.000	0.801	3311	0.000
BAT	0.235	3311	0.000	0.816	3311	0.000
ICDCI	0.256	3311	0.000	0.494	3311	0.000
CFC	0.079	3311	0.000	0.917	3311	0.000
EABL	0.16	3311	0.000	0.882	3311	0.000
KCB	0.198	3311	0.000	0.684	3311	0.000
KENOL	0.206	3311	0.000	0.746	3311	0.000
KQ	0.188	3311	0.000	0.807	3311	0.000
KPLC	0.22	3311	0.000	0.852	3311	0.000
NMG	0.098	3311	0.000	0.966	3311	0.000
SASINI	0.279	3311	0.000	0.454	3311	0.000
SCBK	0.067	3311	0.000	0.966	3311	0.000
BRITAM	0.147	1363	0.000	0.894	1363	0.000
COOP	0.073	2144	0.000	0.975	2144	0.000
EQTY	0.315	2711	0.000	0.689	2711	0.000
KENGEN	0.131	2766	0.000	0.879	2766	0.000
SAFCOM	0.214	2279	0.000	0.858	2279	0.000
SCAN	0.151	2685	0.000	0.929	2685	0.000

From table 4.3 Kolmogorov-Smirnov value less than 0.05 is considered not normal and the study results value was less than 0.05 (Sig. <0.05). Also value for Shapiro-Wilk less than 0.05 indicate non-normality. The study findings indicate that Shapiro-Wilk value was less than 0.05 (Sig. <0.05). This implies that data was considered not to come from a normal distribution because the significance values were less than 0.05 hence data were not normally distributed. These study findings confirm the results from descriptive statistics that the frequency distribution of the NSE firms daily prices are not coming from normally distributed population. The study findings concur with study finding of

Elbarghouthi, et al., (2012); Mlambo and Biekpe (2003); Mollah (2007); Simons and Laryea (2005); Vitali and Mollah (2010) who found out that return from emerging markets are not normally distributed. The study further test for normality using the histogram and the results were presented as followed.

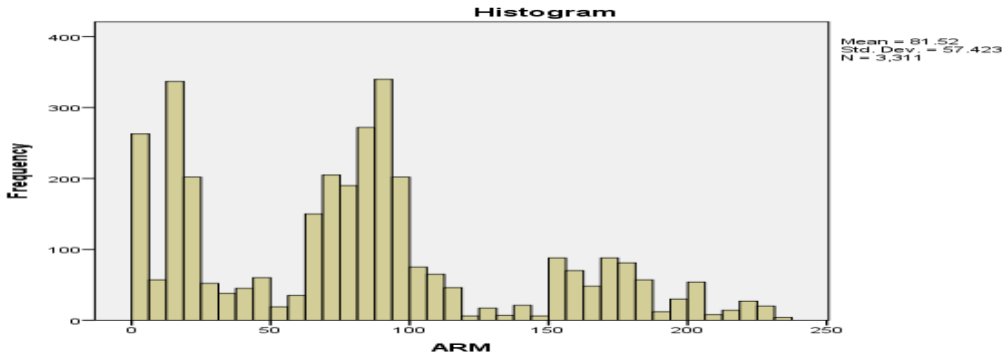

Figure 4.1 ARM Histogram

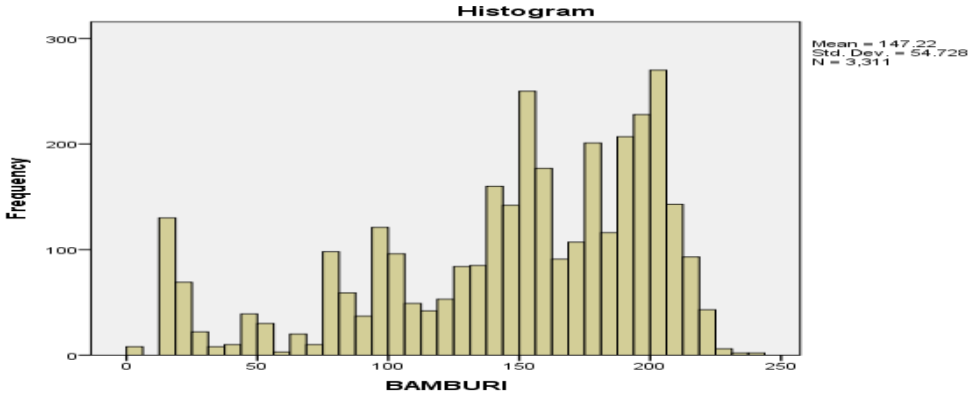

Figure 4.2 Bamburi Histogram

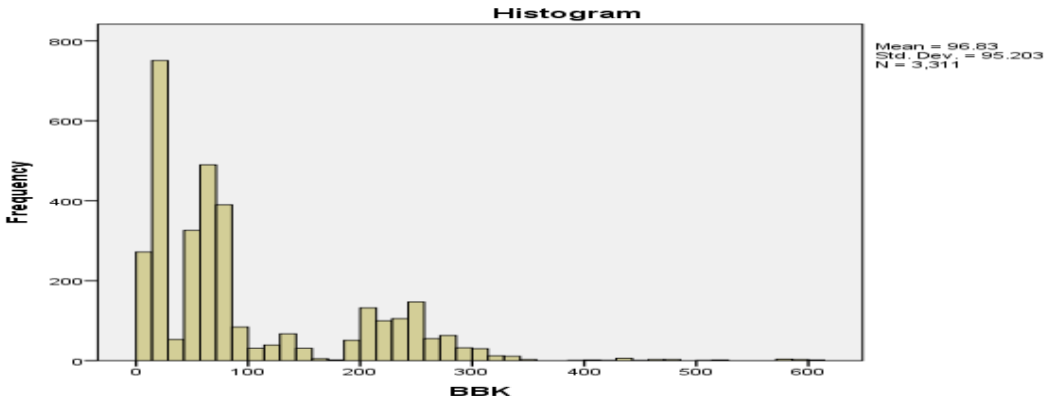

Figure 4.3 BBK Histogram

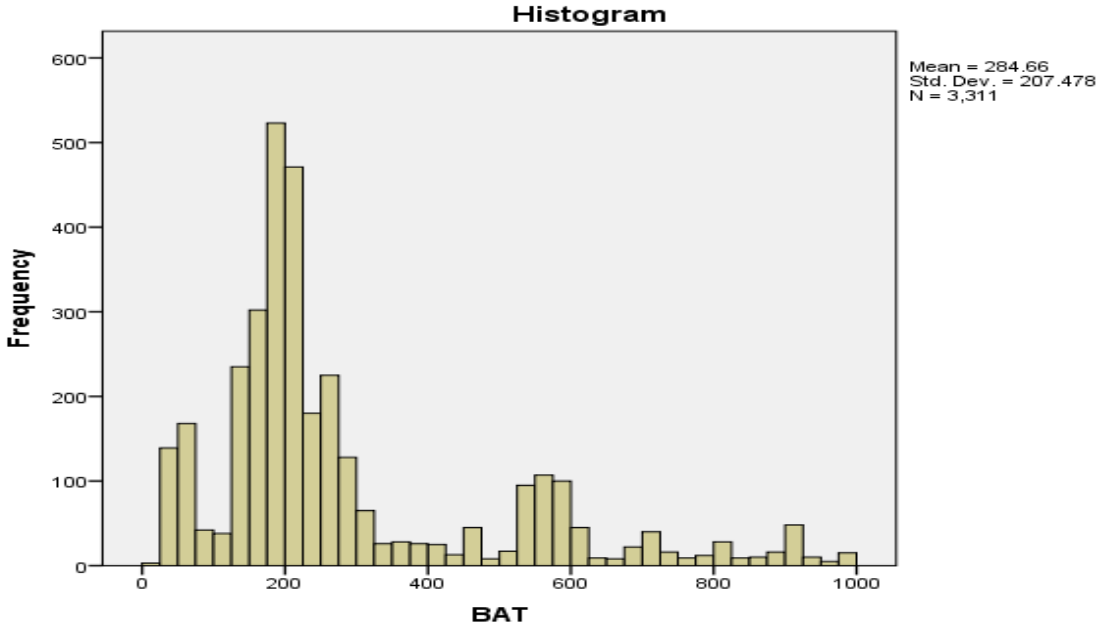

Figure 4.4 BAT Histogram

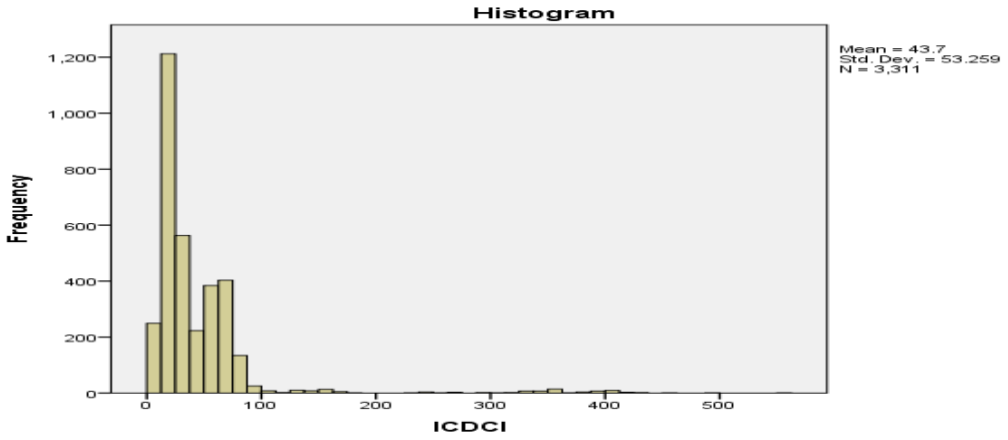

Figure 4.5 ICDCI Histogram

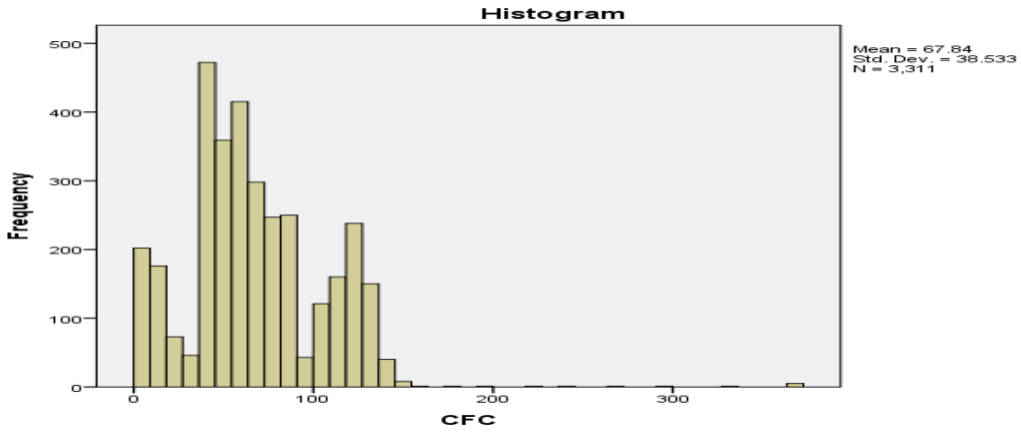

Figure 4.6 CFC Histogram

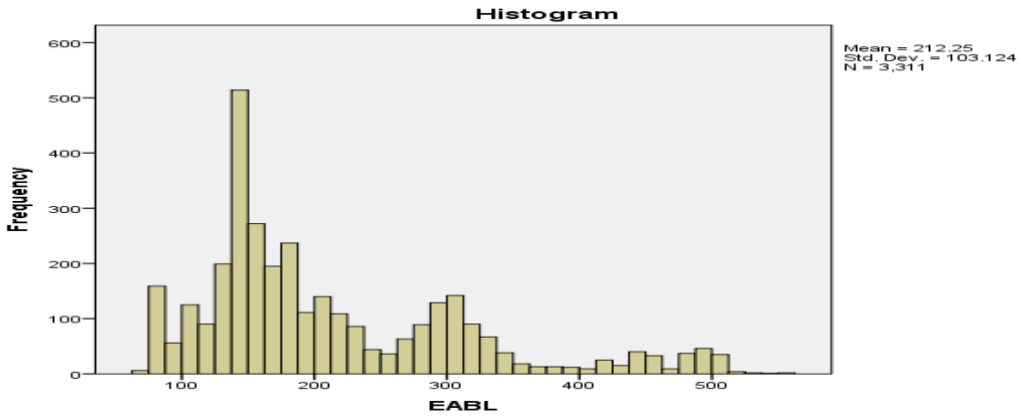

Figure 4.7 EABL Histogram

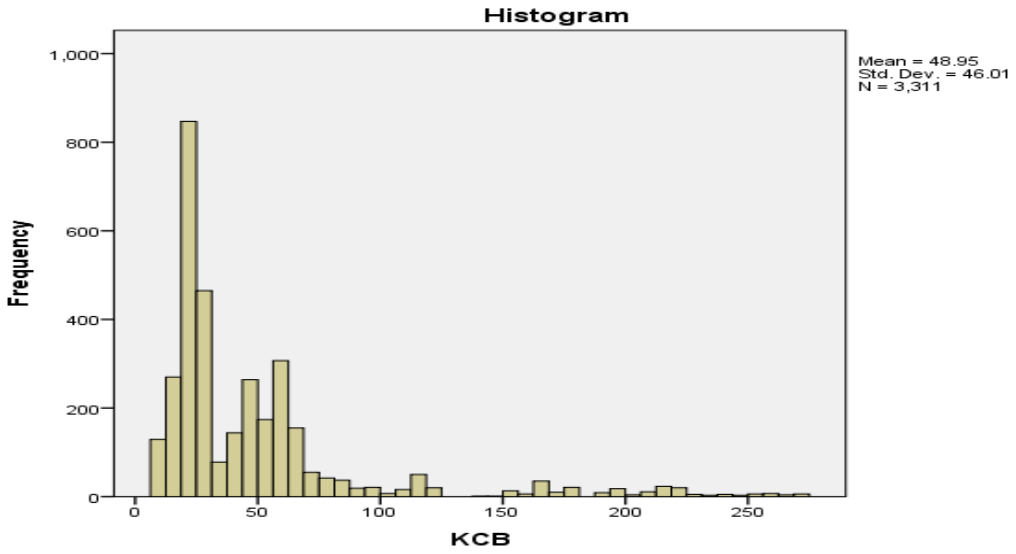

Figure 4.8 KCB Histogram

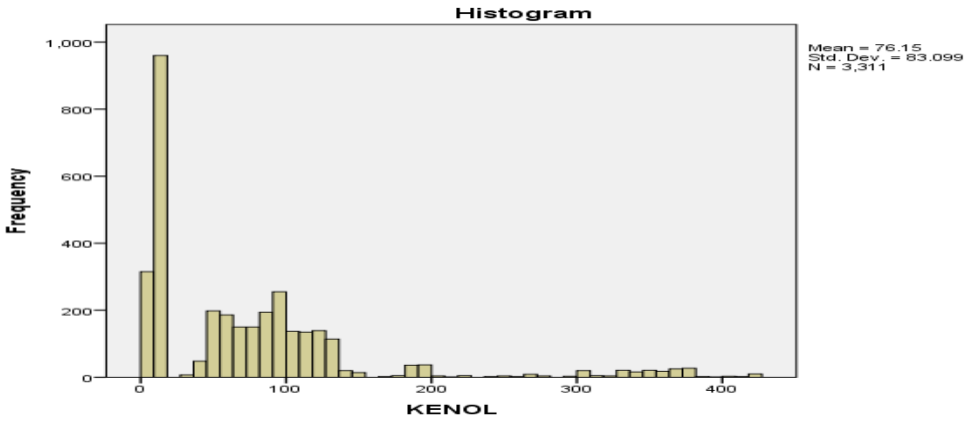

Figure 4.9 KENOL Histogram

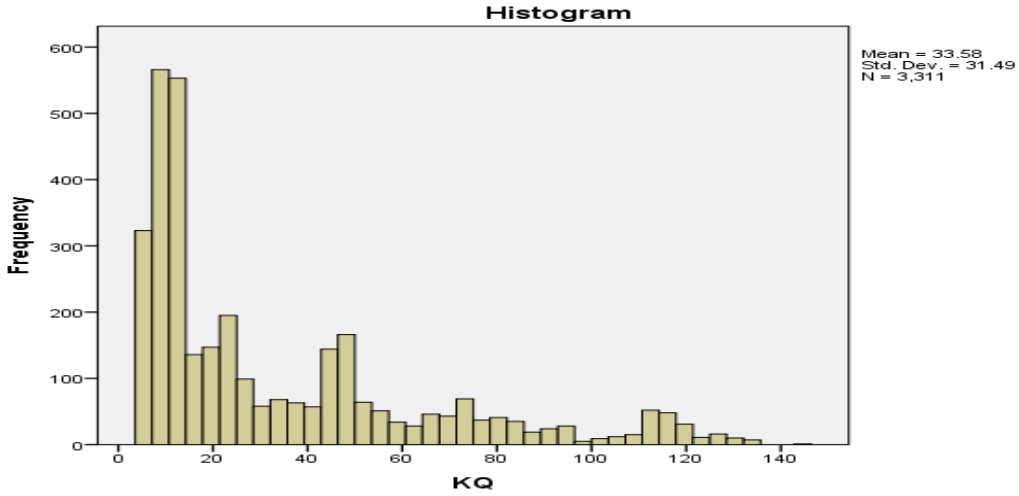

Figure 4.10 KQ Histogram

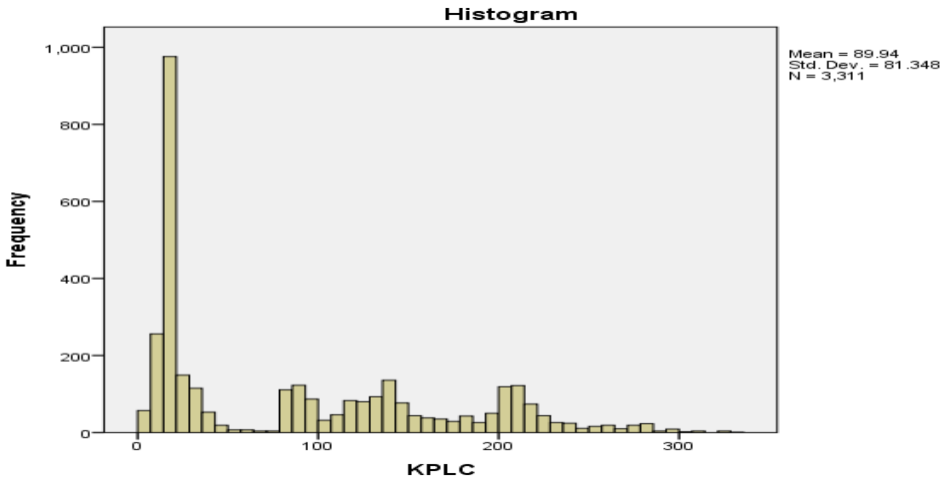

Figure 4.11 KPLC Histogram

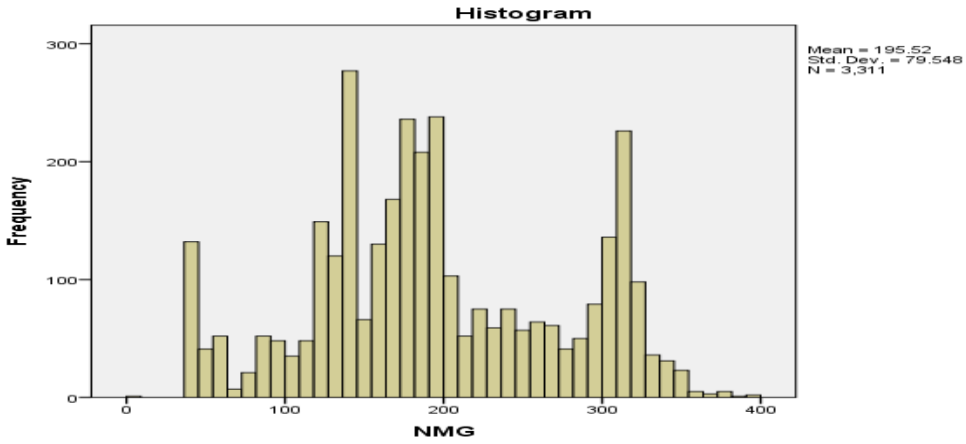

Figure 4.12 NMG Histogram

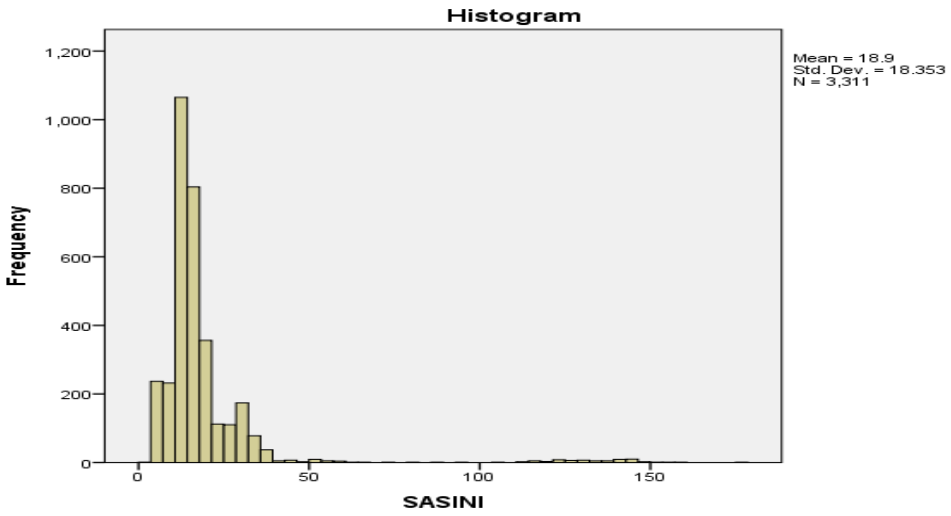

Figure 4.13 SASINI Histogram

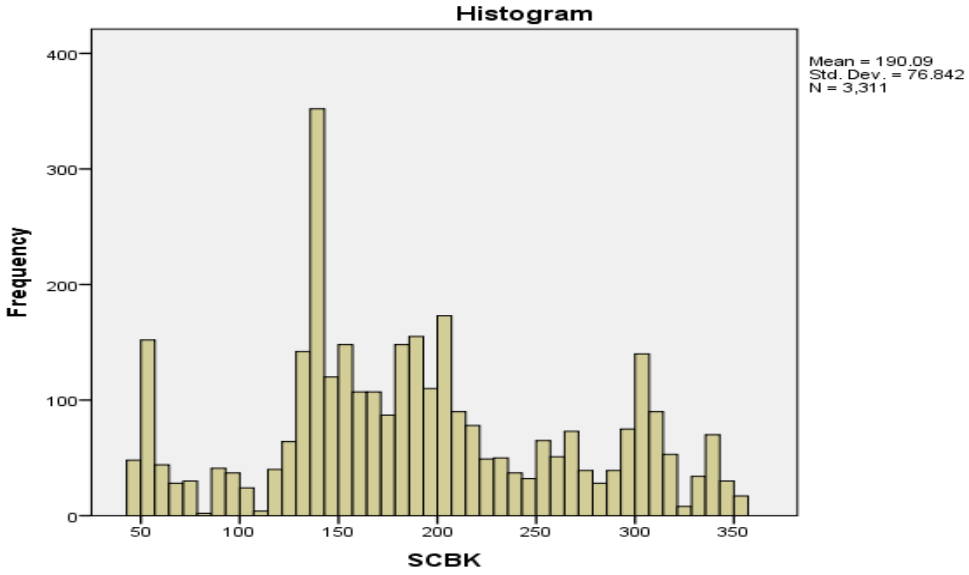

Figure 4.14 SCBK Histogram

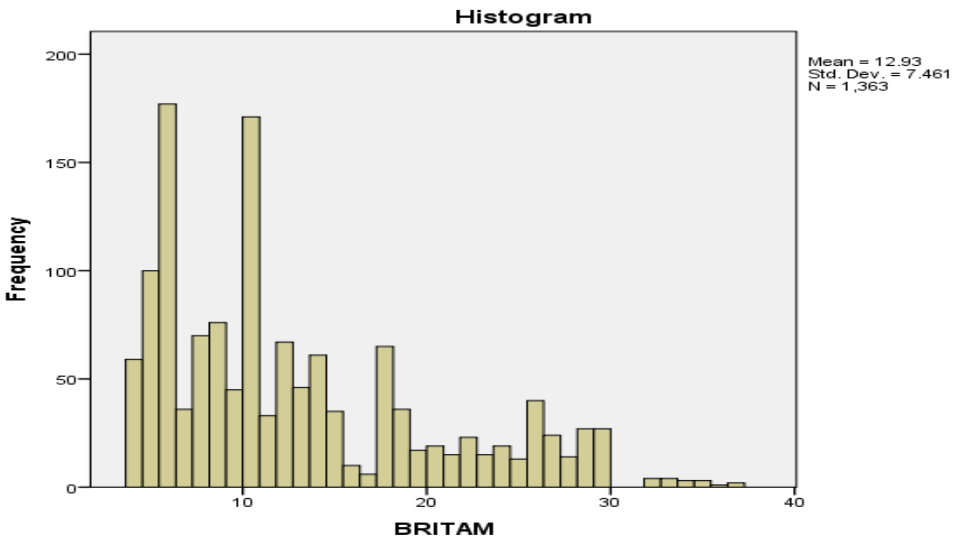

Figure 4.15 Britam Histogram

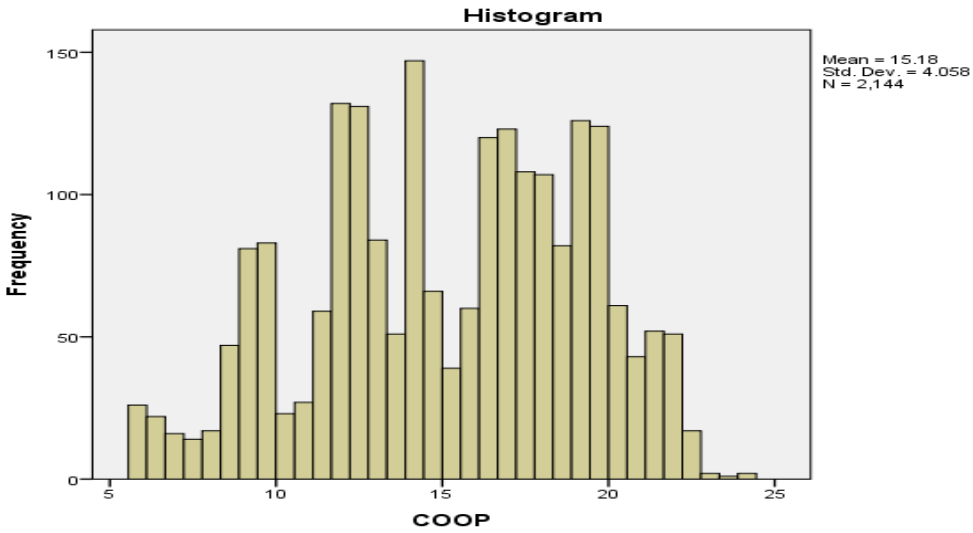

Figure 4.16 Co-operative Histogram

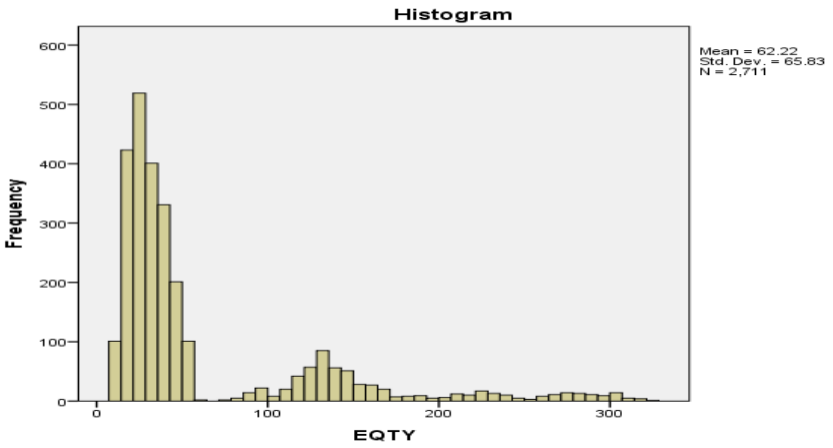

Figure 4.17 Equity Histogram

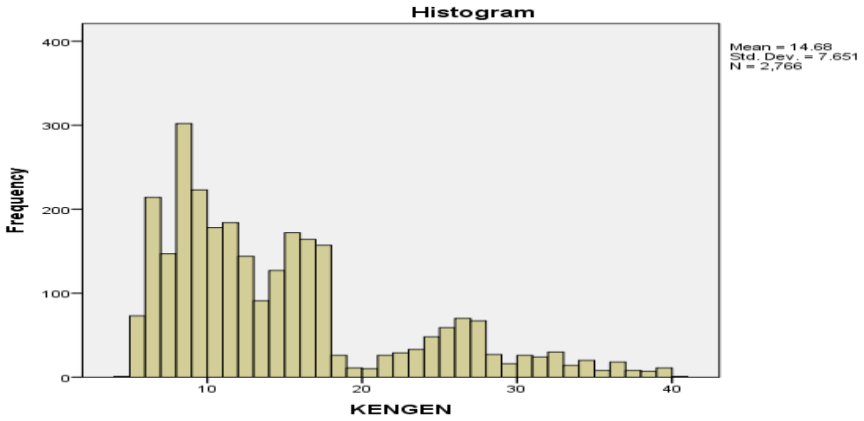

Figure 4.18 KENGEN Histogram

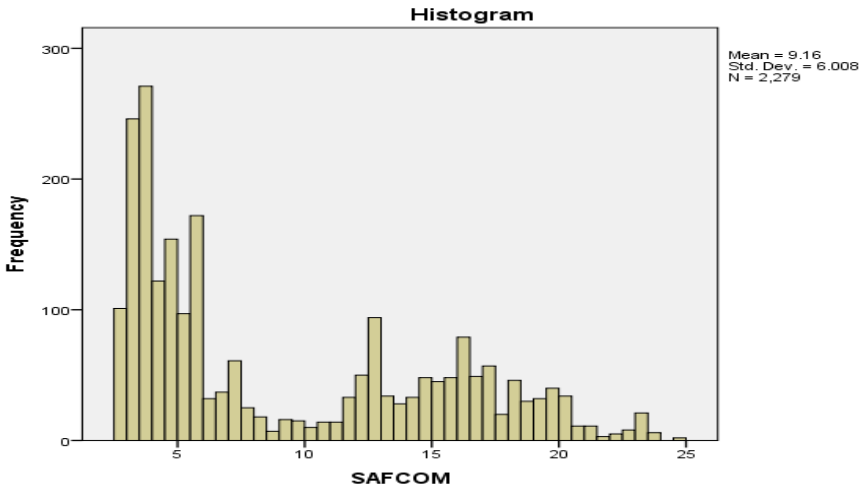

Figure 4.19 Safaricom Histogram

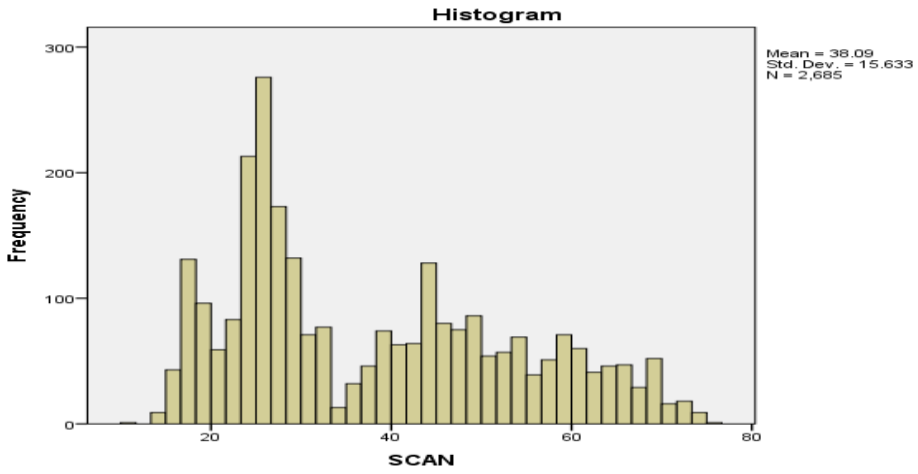

Figure 4.20 SCAN Histogram

From the study results it was revealed that all the histogram for all sampled firms doesn't represent the bell-shape normal curve showing the data are not normally distributed. None of them displays the classical bell-shaped, symmetric histogram with most of the frequency counts bunched in the middle and with the counts dying off out in the tails. The

firms data were skewed either to left or right skew and some had data values that were far away from other data values. This implies that data for the all firms were not normally distributed.

4.4 Auto-Correlation Tests

Auto-Correlation Tests were done in order to know if correlation coefficients of the NSE return series and their lagged values were significantly different from zero. According to Borges (2007), if a variable follows a random walk, it will be uncorrelated at all leads and lags.

Table 4.4 Auto-Correlation Coefficients

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.978[a]	.956	.955	.589	.169

Autocorrelation occurs when residuals are not independent from each other. The assumption of independence of residuals implies that successive observations of the dependent variable are not correlated. This means that successive residuals have no pattern and are not highly correlated and that there are no long runs of positive or negative residuals. Durbin-Watson statistic was used to test for autocorrelation. The value of the Durbin-Watson statistic can range from 0 to 4. The value of Durbin-Watson statistic is 2.0 when there is no autocorrelation among the residuals. It gets close to 0 when there is positive autocorrelation and is beyond 2 when there is negative autocorrelation (Lind, Marchal & Wathen, 2012). The value of Durbin-Watson coefficient in this study was found to be 0.169 indicating non independent observations.

4.5 Runs Tests Results

Run test was done in order to test independence of data. According to Elbarghouthi, et al. (2012) when running run test, Z statistics shows the probability of the difference between the actual and expected number of runs for large samples. According to Vitali and Mollah (2010) the null hypothesis is rejected when the Z-statistic is greater than or equal to the critical value ±1.96 at the 5% level of significance or ±2.576 at the 1% level.

Table 4.5 Runs Test Results

	Test Value	Total Cases	Number of Runs	Z	Asymp. Sig. (2-tailed)
ARM	75.1	3811	45	-60.314	0.000
BAMBURI	147	3321	54	-55.715	0.000
BBK	85.37	3818	19	-61.066	0.000
BAT	284.66	3311	10	-57.159	0.000
ICDCI	43.58	3818	33	-60.66	0.000
CFC	69.35	3794	50	-60.007	0.000
EABL	219.09	3815	26	-60.947	0.000
KCB	47.3	3818	35	-60.548	0.000
KENOL	67.52	3818	14	-61.36	0.000
KQ	29.81	3818	11	-61.435	0.000
KPLC	79.37	3818	5	-61.667	0.000
NMG	187.56	3813	49	-60.168	0.000
SASINI	19.02	3803	80	-58.466	0.000
SCBK	192.17	3815	64	-59.727	0.000
SCAN	38.09	2685	25	-50.895	0.000
SAFCOM	9.16	2279	4	-47.62	0.000
KENGEN	14.68	2766	30	-51.46	0.000
EQTY	62.22	2711	2	-52.031	0.000
COOP	15.18	2144	22	-45.406	0.000
BRITAM	12.93	1363	18	-35.957	0.000

From table 4.5 the study findings indicated that all *Z* statistics value for all firms have negative signs, giving an indication that the run numbers observed were less than the expected numbers of runs for daily price data for NSE firms data except for Sasini, Kengen, Co-operative and Britam which had observed number of runs more than expected numbers of runs. As per Elbarghouthi,et al. (2012), negative Z values are an indication of positive serial correlation in the return series. The observed differences between the actual and the expected number of runs, expressed as a two-tailed ($p<0.05$) is significant hence the study rejected the null hypothesis that the traded stock prices movements in NSE firms market is random for the daily data and concluded that NSE firms daily price data were non-random. Rejecting the null hyphothesis implies that the successive return changes are not independent, hence traded stock prices movements in NSE firms market is not weak form efficient. This implies that the daily prices of the NSE do not follow a random walk as the probabilities associated with expected number of runs are all greater than the observed number of runs except for Sasini, Kengen, Co-operative and Britam which had observed number of runs more than expected numbers of runs.

The study findings agreed with the study results of; Waweru, Munyoki and Uliana (2008) on the NSE; Emenike (2008) on the Nigeria Stock Exchange and Elbarghouthi, et al. (2012), on the Amman Stock Exchange, where all the above researchers found out that the expected number of runs were significantly higher than observed number of runs in the respective markets.

The study findings also agreed with study findings of Vitali and Mollah (2010) who rejected the null hypothesis of the return series being a random at 5% significance level

for Kenya, Mauritius, Morocco, Nigeria and South Africa for the whole sample period (1999-2009). However, the study findings fails to agree with study findings of Dickinson and Muragu(1994) who failed to reject the null hypothesis of independence at the 5% level for the NSE daily prices.

CHAPTER FIVE

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

5.1 Introduction

This chapter presented the summary, conclusion and recommendation of the study. This was done according to study objectives. Recommendations were done according to overall results of the research study. The chapter also presented suggestions for further research.

5.2 Summary of the Study

From table 4.1 the study results indicated that means of daily prices for the 20 sampled firms had varying values but all were positive. This strong positive mean return has an indication that the data didn't follow the random walk model which postulates a zero mean. As per Emenike (2008), in a weak form efficient stock market return is Zero because the daily prices which are positive cancel out the daily prices which are negative causing their average effect on investment daily prices to be zero. However, in this study the results of all means were positive.

The study findings also indicated that values of Skewness and kurtosis coefficients were all above 5% level of significance hence they are not approximately to zero indicating that these data are not normally distributed. The study finding also indicated that majority of data were positively skewed.

Kolmogorov- less than 0.05 is considered not normal and the study results value was less than 0.05 (Sig. <0.05). Also value for Shapiro-Wilk less than 0.05 indicate non-normality. The study findings indicate that Shapiro-Wilk value was less than 0.05 (Sig. <0.05). This implies that data was considered not to come from a normal

distribution because the significance values were less than 0.05 hence data were not normally distributed. These study findings confirm the results from descriptive statistics that the frequency distribution of the NSE firms daily prices are not coming from normally distributed population.

Durbin-Watson statistic was used to test for autocorrelation. The value of the Durbin-Watson statistic can range from 0 to 4. The value of Durbin-Watson statistic is 2.0 when there is no autocorrelation among the residuals. It gets close to 0 when there is positive autocorrelation and is beyond 2 when there is negative autocorrelation (Lind, Marchal & Wathen, 2012). The value of Durbin-Watson coefficient in this study was found to be 0.169 indicating independent observations.

From table 4.5 the study findings indicated that all *Z* statistics value for all firms have negative signs, giving an indication that the run numbers observed were less than the expected numbers of runs for daily price data for NSE firms data except for Sasini, Kengen, Co-operative and Britam which had observed number of runs more than expected numbers of runs. As per Elbarghouthi,et al. (2012), negative Z values are an indication of positive serial correlation in the return series. The observed differences between the actual and the expected number of runs, expressed as a two-tailed ($p<0.05$) is significant hence the study rejected the null hypothesis that the traded stock prices movements in NSE firms market is random for the daily data and concluded that NSE firms daily price data were non-random. Rejecting the null hyphothesis implies that the successive return changes are not independent, hence traded stock prices movements in NSE firms market is not weak form efficient.

5.3 Conclusions

The study concluded that in 16 out of the 20 firms sampled, the run numbers observed were less than the expected numbers of runs for daily price data for NSE firm. Therefore, the study rejected the null hypothesis and concluded that NSE firm's daily price data were non-random. This implies that the successive return changes are not independent, hence traded stock prices movements in NSE firms market is not weak form efficient. This implies that investors and technical analysits are in a position to make use of historical data and be able to predict the future prices.

The study findings agreed with the study results of; Parkinson(1987), on the NSE; Emenike (2008) on the Nigeria Stock Exchange and Elbarghouthi, et al. (2012), on the Amman Stock Exchange, where all the above researchers found out that the expected number of runs were significantly higher than observed number of runs in the respective markets.

5.4 Recommendations

From the findings of this study, that the NSE daily prices do not follow a random walk, it is therefore apparent that the pricing mechanism in the NSE does not utilize all available information. Stock market prices are not informative and the market is inefficient in terms of resource allocation.

The market regulatory body should revise the markets information services and come up with innovative ways to increase free fair and equal dissemination of stock market information to all participants.

The study therefore recommends innovative and superior modeling of past daily prices by security analysts or investors to earn superior profits.

The Kenyan government should formulate and implement tax and other policy incentives aimed at encouraging capital market participation by both the local and foreign investors.

5.5 Recommendations for Further Research

1. An evaluation of the factors that make the NSE weak form inefficient so that specific aimed policies can be implemented to tackle the causes of inefficiency.
2. Research should be done on the remaining 48 firms in the NSE while taking thin-trading adjustment into account before testing for the weak form efficiency.
3. There should be a focus on influence of historic data in generating abnormal returns considering time lag of settlement procedures.
4. Policies should be put in place at the NSE to ensure that traded stock prices movements in NSE are in efficient form.
5. Research should be carried out to cover the most current period
6. Further run tests should be carried out on Britam, Cooperative Bank, Kengen and Sasini stocks.

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APPENDICES

Appendix 1: Daily Price List for Individual Company

NAME OF THE LISTED COMPANY:……		
DATE	**Volume**	**Close**
2/1/2002		
31/7/2017		

Appendix II: Listed Companies

AGRICULTURAL
1. Eaagads Ltd Ord 1.25 AIM
2. KakuziPlc Ord.5.00
3. Kapchorua Tea Co. Ltd OrdOrd00 AIM
4. The Limuru Tea Co. Ltd Ord 20.00 **AIMS**
5. Sasini Ltd Ord 1.00
6. Williamson Tea Kenya Ltd Ord 5.00 AIM
AUTOMOBILES & ACCESSORIES
7. Car & General (K) Ltd Ord 5.00
8. Sameer Africa Ltd Ord 5.00
BANKING
9. Barclays Bank of Kenya Ltd Ord 0.50
10. Diamond Trust Bank Kenya Ltd Ord 4.00
11. Equity Group Holdings Ltd Ord 0.50
12. Housing Finance Group Plc Ord 5.00
13. I&M Holdings Ltd Ord 1.00
14. KCB Group Ltd Ord 1.00
15. National Bank of Kenya Ltd Ord 5.00
16. NIC Bank Ltd Ord 5.00
17. Stanbic Holdings Plc ord.5.00
18. Standard Chartered Bank Kenya Ltd Ord 5.00
19. The Co-operative Bank of Kenya Ltd Ord 1.00
COMMERCIAL AND SERVICES
20. Atlas African Industries Ltd ***GEMS***
21. Deacons (East Africa) Plc Ord 2.50**AIMS**
22. Eveready East Africa Ltd Ord.1.00
23. Express Kenya Ltd Ord 5.00 **AIMS**
24. Hutchings Biemer Ltd Ord 5.00
25. Kenya Airways Ltd Ord 5.00
26. Longhorn Publishers Ltd Ord 1.00 **AIMS**
27. Nairobi Business Ventures Ltd Ord. 1.00 ***GEMS***
28. Nation Media Group Ltd Ord. 2.50
29. Standard Group Ltd Ord 5.00
30. TPS Eastern Africa Ltd Ord 1.00
31. Uchumi Supermarket Plc Ord 5.00
32. WPP Scangroup Ltd Ord 1.00
CONSTRUCTION & ALLIED
33. ARM Cement Plc Ord 1.00
34. Bamburi Cement Ltd Ord 5.00
35. Crown Paints Kenya Ltd Ord 5.00
36. E.A.Cables Ltd Ord 0.50
37. E.A.Portland Cement Co. Ltd Ord 5.00

ENERGY & PETROLEUM
38. KenGen Co. Ltd Ord. 2.50
39. KenolKobil Ltd Ord 0.05
40. Kenya Power & Lighting Co Ltd Ord 2.50
41. Kenya Power & Lighting Co Ltd 4%
42. Kenya Power & Lighting Co Ltd 7%
43. Total Kenya Ltd Ord 5.00
44. Umeme Ltd Ord 0.50
INSURANCE
45. Britam Holdings Plc Ord 0.10
46. CIC Insurance Group Ltd ord.1.00
47. Jubilee Holdings Ltd Ord 5.00
48. Kenya Re Insurance Corporation Ltd Ord 2.50
49. Liberty Kenya Holdings Ltd Ord.1.00
50. Sanlam Kenya Plc Ord 5.00
INVESTMENT
51. Centum Investment Co Plc Ord 0.50
52. Home Afrika Ltd Ord 1.00
53. Kurwitu Ventures Ltd Ord 100.00
54. Olympia Capital Holdings ltd Ord 5.00
55. Trans-Century Ltd Ord 0.50 AIM
INVESTMENT SERVICES
56. Nairobi Securities Exchange Plc Ord 4.00
MANUFACTURING & ALLIED
57. A. Baumann& Co Ltd Ord 5.00 AIM
58. B.O.C Kenya Ltd Ord 5.00
59. British American Tobacco Kenya Ltd Ord 10.00
60. Carbacid Investments Ltd Ord 1.00
61. East African Breweries Ltd Ord 2.00
62. Flame Tree Group Holdings Ltd Ord 0.825
63. Kenya Orchards Ltd Ord 5.00 AIM
64. Mumias Sugar Co. Ltd Ord 2.00
65. Unga Group Ltd Ord 5.00
TELECOMMUNICATION
66. Safaricom Ltd Ord 0.05
REAL ESTATE INVESTMENT TRUST
67. STANLIB FAHARI I-REIT
EXCHANGE TRADED FUNDS
68. NEW GOLD ETF