TESTING THE WEAK FORM OF EFFICIENT MARKET HYPOTHESIS AT NAIROBI

STOCK EXCHANGE

BY

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DECLARATION

This research project is my original work and has not been presented for any other award in

any other institution of learning.

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APPROVAL

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

Supervisor

Signature _____   Date   _____

Dr. Philip Ngare

DEDICATION

I wish to dedicate this work to my dear mum and dad who made invaluable sacrifice to ensure I

achieve my dream, my sisters and brothers for their support.

ACKNOWLEDGEMENT

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ACRONYMS

NSE-Nairobi Securities Exchange

EMH-Efficient Market Hypothesis

RWH-Random Walk Hypothesis

K-S- Kolmogorov Smirnov

ABSTRACT

Understanding the market efficiency of a particular stock market is very important to assist existing and prospective investors to make well informed decisions. In a capital market where few players dominate the market, insider dealings are more likely to take place which has a significant impact of waning stock market confidence since the market will depict weak form of market efficiency.

This paper sought to test the weak form of efficient market hypothesis at NSE using daily data for stock prices for Kengen for the period of 17th may 2006 up to 31st December 2009, and Kenya power and lighting company for the period of 2nd January 2002 up to 31st December 2009. Secondary data was employed for this study and it was obtained from NSE. The data was subjected to Kolmogorov smirnov goodness of fit test, run tests and Autocorrelation tests. The daily returns in aspect to skewness and kurtosis was found to be non-normal. Same thing resulted from the Kolmogorov smirnov test. As a result null hypothesis of normality was rejected. Run tests and the Durbin Watson statistic rejected the randomness of the returns. Overall results from the analysis suggests that the Nairobi Stock Exchange is not efficient in weak form.

CHAPTER ONE

INTRODUCTION

1.1 BACKGROUND

Stock market efficiency is an important concept, both in terms of an understanding of the working of capital markets and in their performance and contribution of the development of a country's economy. During the past decades, the efficient market hypothesis (EMH) has been at the heart of debate in financial literature because of its important implications. Fama (1970) defined a market as being efficient if its prices fully reflect all available information. If the stock market is efficient, the prices will represent the intrinsic values of the stocks and in turn, the scarce savings will be automatically allocated to productive investments in a way that benefits both investors and the country economy (Copeland and Weston, 1988). Fama suggested three models for testing market efficiency: the fair game model, the sub martingale model and the random walk model.

1.1.1 Stock Market

Stock market is an organized market for buying and selling financial instruments known as securities which includes stocks, bonds, options and futures. Most stock markets have a specific locations where the trades are completed known as stock exchanges. For a company to be traded at these exchanges, it must be listed, and for it to be listed, it must satisfy certain requirements. Stock market plays a crucial role in cementing the relationship between investors and the corporate sector. In this process, they help mobilizing the savings of people and direct them to the growth of trade, commerce and industrial sectors of an economy.

The efficiency of the emerging markets assume a greater importance as the trend of investment is accelerating in these markets as a result of regulatory reforms and removal of other barriers for the internationally equity investments. The term market efficiency is used to explain the relationship between information and share in the capital market literature. . One way to measure the efficiency of the market is to ask what types of information, encompassed by the total set of all available information, are reflected in securities prices.

When we talk about market efficiency, we are interested not in the form of structural relationship between risk and expected return but rather in the precision with which the market securities in relation to its structure. If new information becomes known about a particular company, how quickly do the prices of securities adjust to reflect the new information? If prices respond to all relevant new information in a rapid fashion, we can say the market is relatively efficient. If, instead, the information disseminates rather slowly throughout the market, and if investors take time to analyzing the information and reacting, and possibly overreacting to it, values may deviate from values based on a careful analysis of all available relevant information. Such a market could be characterized as being relevantly inefficient.

1.1.2 Capital Market Efficiency

The characteristics of an efficient security market include:

- Security prices respond rapidly and accurately to new information.

- Trading rules fail to produce superior returns in simulation experiments.

- Professional investors fail to produce superior returns individually or as a group.

- Changes in expected returns are driven by time varying interest rates and risk premia. Changes in stock prices driven by other events should be random.

The combined effect of information coming in a random, independent fashion and numerous competing investors adjusting stock prices rapidly to reflect new information means that one would expect price changes to be independent and random. Since the current prices fully reflect all available information then they are consistent with the risk involved.

According to Fama (1970), EMH can be categorized into three levels based on the definition of the available information set namely,

- Weak form EMH

- Semi strong form EMH

- Strong form EMH

1.1.3 Weak Form Efficient Market Hypothesis

Under the weak form of the EMH current stock prices are assumed to reflect any information that may be contained in the past history of the stock price itself including information on historical sequence of prices, rates of return, trading volume data, and the market generated information. This hypothesis implies that the past returns and any other market data has no relationship with future rates of return. Therefore one should gain little from any trading rule that decides whether to buy or sell a security based on the past rates of return or any other market data. For example, suppose there exists a seasonal pattern in stock prices such that stock prices fall on the last trading day of the year and then rise on the first trading day of the following year. Under the weak form of hypothesis, the market will come to recognize this and price the phenomenon away. Anticipating the rise in price on the first day of the year, traders will attempt

to get in at the very start of the trading on the first day. This will in turn lead to increase in price in the first minutes of the first day. Intelligent traders will then recognize that to beat the rest of the market, they will have to get in late on the last day of the previous year when stock prices have historically fallen. This attempt to buy late in the day will act to support prices and reduce the extent of the fall on the last trading day of the year. This process of attempting to get in earlier and earlier will continue until the entire year-end pattern is eliminated from the price series. Other more complex patterns in price series will be detected and eliminated in similar fashion until it becomes impossible to predict the future course of the series by analyzing its behavior. Once this state has been attained, the weaker form of the EMH will be satisfied.

1.1.4 Semi strong form of EMH

The semi strong form of EMH asserts that security prices adjust rapidly to release of all public information i.e all publicly available information is presumed to be reflected in securities prices. This includes information in the stock price series as well as information in the firms accounting reports, the reports of competing firms, announced information relating to the state of economy and any other publicly available information relevant to the valuation of the firm. This information might include annual reports, annual filings, earnings reports, announcements, and other relevant information that can be readily gathered. This hypothesis implies those investors who base their decisions on important new information after it is public should not derive above average profits from their transactions considering the cost of trading, because the security price already reflects all such new public information.

1.1.5 Strong form of the EMH

The strong form EMH asserts that stock prices fully reflect all information from public and private sources. This means that no group of investors has monopolistic access to information

relevant to the formation of prices. Therefore no group of investors should be able to consistently derive above average profits. The strong form encompasses both weak form EMH and semi strong form. Further the strong form extends the assumption of efficient market, in which prices adjusts rapidly to release of new public information, to assume perfect markets, in which all information is cost free and available to everyone at the same time. Under this form, those who acquire inside information act on it, buying or selling the stock. Their actions affect the price of the stock, and the price quickly adjusts to reflect the inside information.

1.2 Nairobi Stock Exchange

The Nairobi Stock Exchange (NSE) is the principal stock exchange in Kenya. It began in 1954 as an overseas stock exchange while Kenya was still a British colony with the permission of the London stock exchange. The NSE is a member of the African Stock Exchange Association. This came after Africans and Asians were not permitted to trade in securities until they attain independence. The administration of NSE limited is located on the 1st floor, Kimathi Street, Nairobi. As a capital market institution, the Stock Exchange plays an important role in the process of economic development. It helps mobilize domestic savings thereby bringing about the reallocation of financial resources from dormant to active agents. Long-term investments are made liquid, as transfer of securities between shareholders is facilitated.

In Kenya dealing in shares and stock started in 1920's. However there was no formal market no rules and no regulations to govern the stock broking activities. Trading took place on govern gentleman's agreements in which standard commissions were charged with clients being obligated to honor their contractual commitments of making good delivery and settling relevant costs it incurred at that time. In 1980s the Kenyan Government realized the need to design and implement policy reforms to foster sustainable economic development with an efficient and

stable financial system. In particular, it set out to enhance the role of private sector in the economy, reduce the demands of public enterprises on exchequer, rationalize the operations of the public enterprise sector to broaden the base of ownership and enhance capital market development.

Nairobi Stock Exchange is Africa's fourth largest stock exchange in terms of trading volume, and fifth in terms of market capitalization 4as a percentage of GDP (Source:milleniumit.com). The exchange works in cooperation with Uganda Securities Exchange and Dar es salaam Stock Exchange, including the cross listing of various equities. There are three active investment segments at the NSE namely: Main Market investment segment (MIMS), Alternative Market Investment segment (AMIS) and Fixed income Security Market segment (FISMS).

The first two are share listing segments while the fixed income securities market segment is where bonds, short term notes and conventional forms of debt securities are listed. Share listed on the NSE are further categorized by the sector in which the respective companies conduct their businesses: Agricultural sector, industry and allied, Finance and Investment and Commercial and Services. The exchange has a pre-market sessions from 09:00am to 09:30am and normal trading sessions from 09:30am to 03:00pm on all days of the week except Saturdays, Sundays and holidays declared by the Exchange in advance.

The NSE's offices and trading floor are located at the Nation Centre along Kimathi Street (Nairobi). Trading is done through the Electronic Trading Systems (ETS) which was commissioned in 2006. A Wide Area Network (WAN) platform was implemented in 2007nand this eradicated the need for brokers to send their staff (dealers) to the trading floor to conduct business. Trading is now mainly conducted from the broker's offices through the WAN.

However, brokers under certain circumstances can still conduct trading from the floor of the NSE.

Two indices are popularly used to measure performance. The NSE 20-share index has been in use since 1964 and measures the performance of 20 blue-chip companies with strong fundamentals and which have consistently returned positive financial results. Included in the Index are Mumias Sugar, Express Kenya, Rea Vipingo, Sasini Tea, CMC Holdings, Kenya Commercial Bank, Standard Chartered Bank, Bamburi Cement, British American Tobacco, Kengen, Centum Investment Company, East African Breweries, EA Cables, Kenya power & Lighting Company Ltd. and Athi River Mining. This index primarily focuses on price changes for these 20 companies.

In 2008, the Nairobi Stock Exchange All Share Index was introduced as an alternative index. Its measure is an overall indicator of the market performance. The index incorporates all the traded shares of the day. Its attention is therefore on the overall market capitalization rather than the price movements of the selected counters.   The stock market is measured using three methods namely: NSE-20 Index, NSE All Share Index and MCSE Share Index. NSE-20 Index is the most commonly used since it incorporates 20 companies cutting across all sectors in the economy.

This index has always been a great importance in the world markets NSE being one of these growing markets. The index has helped the world market in the analysis and portfolio management. Therefore the index value is used to measure the performance of a stock market and the institutions and individuals can get to know how the market is performing and their investments in general.

The brochure of NSE do explains the roles that the stock market has to the general economy as:

Firstly, the stock exchange has played, and continues to play in many economies is that it promotes a culture of thrift, or saving. Secondly, the stock exchange assists in the transfer of savings to investment in productive enterprises as an alternative to keeping the savings idle. It should be appreciated that in as much as an economy can have savings, the lack of established mechanisms for channeling those savings into activities that create wealth would lead to misallocation or waste of those savings.

Thirdly, a robust stock market assists in the rational and efficient allocation of capital, which is a scarce resource. Fourthly, stock markets promote higher standards of accounting, resource management and transparency in the management of business.

Fifthly, the stock exchange improves the access to finance of different types of users by providing the flexibility for customization. Sixthly which is very important is that the stock exchange provides investors with an efficient mechanism to liquidate their investments in securities.

1.3 PROBLEM STATEMENT

A few years ago investors could buy shares and sell them in the same day. This posed a serious threat since investors could evaluate the trend of the stock prices and predict the future price creating chances of arbitrage profits. This would be countered by the policy that after buying a security an investor would be able to sell it after a fortnight

This study seeks to evaluate the weak form of market efficiency on the NSE by evaluating whether one can predict the price of the stocks after the two weeks.

1.4 OBJECTIVES OF THE STUDY

The main objective of this study is to test the weak form of market hypothesis of Nairobi Securities Exchange.

1.5 SIGNIFICANCE OF THE STUDY

NSE was formed so that investors can be able to earn proceeds from preferred company without necessarily buying the whole company. The investor will buy as little as 100 shares from a given company and will enjoy the rights of a shareholder.

In developing economies stock markets are getting momentum as reliable and profitable opportunity for investors. For the investors of stock market there's only win or lose position as far as trading is concerned. Therefore the necessity of efficient stock market is important because in an inefficient market some investors might generate abnormal profits but on the other hand these investors are source of abnormal losses to the rest of market participants.

Testing the weak form of efficient market hypothesis helps investors in portfolio selection and also ensures that all investors have same chance of profit taking.

CHAPTER TWO

LITERATURE REVIEW

There are numerous researchers over the past few decades that have tested the weak form efficiency. Fama has defined market efficiency, as a place where there are large numbers of rational investors competing actively, where each investor is trying to forecast future market values of stocks and where current information about stocks is almost freely available to all participants. Dickinson and Muragu (1994) provide evidence of market efficiency in Nairobi stock exchange. They used the serial correlation tests and run tests to testing the market efficiency. They concluded that small markets such as NSE provides empirical results consistent with weak form.

Other recent studies, testing the random walk hypothesis (in effect testing the weak form efficiency in the markets) are: Korea (Ryoo and Smith, 2002, this study uses a variance ratio test and find the market to follow a random walk process if the price limits are relaxed during the period March 1988 to Dec 1988), China (Mahmood et al, 2011, apply ADF, DF-GLS, PP(Phillips-Perron) and KPSS (Kwiatkowski, Phillips, Schmidt, and Shin)tests on stock market returns on both Shenzhen and Shanghai Stock Exchanges separately. The results of the study shows that Chinese Stock Market is weak form efficient and past data of stock market movements may not be very useable in order to make excess returns; Liu, 2010, employs unit root test, autocorrelation function, BDSL, Engle-LM and AR (p)-EGARCH and AR (p)-TARCH to test the market efficiency of Chinese stock market over 2001 to 2008. The results show that the Chinese stock markets are not weak-form efficient), Hong Kong (Jarett 2008; Cheung and Coutts 2001), Slovenia (Dezlen, 2000), Spain (Regulez and Zarraga, 2002), Czech Republic

(Hajek, 2002), Turkey (Buguk and Brorsen, 2003), Africa(Smith et al. 2002; Appiah-kusi and Menyah, 2003) and the Middle East (Abraham et al. 2002; this study uses variance ratio test and runs the test to test for random walk for the period 1992 to 1998 and finds that the markets are not efficient).

In southern part of Asia, Sharma and Kennedy (1977) and Alam et al. (1999) report that random walk hypothesis cannot be rejected for stock price changes on the Bombay (India) and Dhaka Stock Exchange (Bangladesh) respectively. However, Abeysekera (2001) and Abraham (2002) show evidence to reject the hypothesis of weak form efficiency for stock markets in Srilanka, Kuwait, Saudi Arabia and Bahrain, while Sanda (2009) used stock prices of 24 companies showing evidence to reject the hypothesis of weak form efficiency in the case of Nigerian Stock Market.

However, some recent studies on the EMH on the Nigerian Stock Market shows that the hypothesis on the market efficiency was not rejected; study by Bashir (2009) using weekly returns for the 69 most actively traded shares over the period 1995-2005. His paper tests the weak form of the EMH using tests of autocorrelation and technical trading strategies. Overall, the analysis indicates that the Nigerian market may be weak-form efficient for ordinary investors who operate in a costly trading.

Cooper (1982) included the NSE as one of his sample exchanges. He studied the NSE weekly indices using serial correlation, runs and spectral analysis. He found eight cases of serial correlation. The standardized value of the runs test was -5.58. Spectra analysis revealed 39 readings out with the 95% confidence band. This evidence may be considered to indicate that the RWH was not a good description of the successive changes of the NSE-Index. Because index

data may introduce autocorrelations not present in the original series [Working (1960)]. He did not have adequate basis for rejecting RWH when transaction cost was included.

Parkinson (1984) carried out various tests of the EMH. These tests covered 50 stocks which were listed on the exchange. He performed serial correlation tests and the results showed that the signs was predominantly negative for 80% of the shares. He found first order serial correlation of 0.3 for eleven shares out of the fifty shares. This would violate the extreme Random Walk Hypothesis. He further carried out run tests whereby he used both one tailed and two tailed tests of significance at 50% level of significance. He found that forty nine of the fifty exhibited fewer runs than would be expected from randomly distributed randomness. He was forced to reject hypothesis of randomness. He concluded that Random Walk Hypothesis was not a valid description of share price changes of the NSE hence the study was therefore not conclusive on whether there is evidence consistent with weak form efficient.

Cheung, Wong and Ho (1993) report inefficiency of stock markets of Korea and Taiwan on the basis of weak theoretical form of Capital Asset Pricing Model in both markets. Groenewold and Kang (1993) have conducted weak and semi-strong efficiency tests of Australian Stock Market by using aggregate share price indexes and find the data consistent with the weak form efficiency. Barnes (1986) tests the weak form market efficiency of the Kuala Lumpur Stock Market Exchange and concludes that the stock exchange exhibited a surprisingly high degree efficiency, in spite of thinness of the market.

In this study we are going to use stocks for Kengen and Kenya power and lighting company. The graphs for the trend of their prices is shown in the appendix.

HYPOTHESIS

The first hypothesis is

H_o: The stock prices in the Nairobi Stock market follow a normal distribution

H1: The stock prices in the Nairobi Stock market do not follow a normal distribution.

The second hypothesis

H_o: the stock prices are random during the study period

H_1: the stock prices are not random during the study period

CHAPTER THREE

METHODOLOGY

Shares listed on the Nairobi Stock Exchange are categorized according to the business operation of the company listed. The shares that formed the basis of the study are as shown below, categorized according to the sector in which they are listed on the NSE.

- Industry and allied-Kenya power and lighting company

                    -Kengen

The study uses daily prices of Kenya power and lighting company from 2nd January 2002 up to 31st December 2009 and the daily prices for Kengen from 17th may 2006 up to 31st December 2009. The data was subjected to test for randomness and serial correlation tests. Normality tests for the share returns were also tested.

The descriptive statistics of the stock returns include mean, variance, standard deviation, skewness and kurtosis.

One of the basic assumption underlying the Random Walk theory and therefore Efficient Market Hypothesis is that if the stock prices are random then its distribution should be normal. Any normal distribution is an advantage because we need only two measures, mean and variance, to describe the entire distribution. The normal distribution is also one of the basic assumptions underlying the capital asset pricing model. The histogram of the prices is computed and the curve for normal distributions have been fitted in order to ascertain whether the distribution of price values fits the normal distribution. A distribution that is not symmetric but has more cases, or more of a tail toward one end of the distribution than the other is called skewed. If the tail is

towards larger values, the distribution is skewed to the right. If the tail is towards smaller values, the distribution is skewed to the left. Kurtosis indicates the extent to which, for a given standard deviation, observations cluster around a central point. If cases within a distribution cluster more than those in the normal distribution, the distribution is called leptokurtic. If cases cluster less than in the normal distribution, the distribution is termed platokurtic. Values for skewness and kurtosis are zero if the observed distribution is exactly normal.

3.1 NON PARAMETRIC TESTS

3.1.1 KOLMOGOROV SMIRNOIV GOODNESS OF FIT TEST

Kolmogorov-smirnov test (K-S test) is a nonparametric test that can be used to compare a sample with a reference probability distribution (one sample K-S test), or to compare two samples (two-sample K-S test). This test compares the observed cumulative distribution function for a variable with a specified theoretical distribution, which may be normal, uniform, Poisson or exponential. This goodness of fit test, tests whether the observations could reasonably have come from the specified distribution. We use both normal and uniform parameters to test the distribution.

3.1.2 TEST FOR SERIAL INDEPENDENCE

3.1.3 Run tests

The test is independent of normality and constant variance of data. We use the Wald Wolfowitz runs test for the randomness of the series. This is a non-parametric statistical test that checks a randomness hypothesis for a two valued data sequence. More precisely it can be used to test the hypothesis that the elements of the sequence are mutually independent. Runs testing is a strong test for randomness in investigating serial dependence in share price movements and compares the expected number of runs from a random process with the observed number of process. A run is defined as a series of identical signs that are preceded or followed by a different sign or no

sign at all. Thus, + - - - + + + 0 has four runs, a run of one +, a run of three −s, followed by a run of three +s, followed by a run of one no change. That is given a sequence of observations, the run tests observes that the value of one observation influences the value taken by the later observations. If there is no influence (the observation is independent), the sequence is considered random.

Under the null hypothesis, the number of runs in a sequence of length N is a random variable whose conditional distribution given the observation of N_+ positive value and N_- negative values ($N=N_+ +N_-$) is approximately normal with;

- **Mean**

$$\mu = \frac{2\,N_+\,N_-}{N} + 1$$

- **Variance**

$$\sigma^2 = \frac{2\,N_+\,N_-\,(2\,N_+\,N_- - N)}{N^2\,(N-1)} = \frac{(\mu-1)(\mu-2)}{N-1}.$$

These parameters do not depend on the fairness of the process generating elements of the sequence, i.e. +'s and −'s have equal probabilities and the assumption that the elements are independently and identically distributed. If the number of runs is significantly higher or lower than expected, the null hypothesis of statistical independence of the elements may be rejected.

The run test was used to test the randomness of the distribution, by taking the data in a given order and marking with + the data greater than median and with – the data less than the median.

3.1.4 Serial correlation coefficient tests

Autocorrelation refers to the phenomenon where a given variable is correlated with itself over successive time periods. Within the context of efficient market hypothesis, if stock market exhibit evidence of autocorrelation, then past prices can be used as predictors of future returns and the weak form of the efficient market hypothesis is violated.

For testing the Efficient Market Hypothesis in the weak form, serial correlation coefficient test is widely used. The serial correlation coefficient measures the relationship between the values of a random variable at time t and its value in a precious period. The population serial correlation coefficient Pa is estimated using sample serial correlation coefficient Ra. For complete independence Pa=0, a significant test may be performed on the variation of Ra from 0. Here confidence intervals of two and three standard errors are used. Autocorrelations are reliable measures for testing dependence/independence of random variables in a series. If no autocorrelations are found in a series then the series is considered random.

Autocorrelation is also a symptom of systematic lack of fit. DW option provides the Durbin Watson d statistic to test that the autocorrelation is zero. The DW test is based on the following statistic.

$$d = \frac{\sum_{i=2}^{n}(e_i - e_{i-1})^2}{\sum_{i=1}^{n} e_i^2}$$

Where e_i are Ordinary Least Squares (OLS) residuals and d is close to 2 if the errors are uncorrelated.

The sample autocorrelation estimate is displayed after the Durbin-Watson statistic. The sample will be computed as

$$r = \frac{\sum\limits_{i=2}^{n} e_i e_{i-1}}{\sum\limits_{i=1}^{n} e_i^2}$$

Any missing observation in the regression is treated as though the missing observation did not exist, when computing these measures. The DW test is a test for H_0: $\rho = 0$ (no first order autocorrelation) versus $H_A = \rho \neq 0$ (positive autocorrelation).

DATA ANALYSIS AND RESULTS

This study uses the daily stock prices for Kengen and KPLC. The price trend for both companies are shown in the figure below
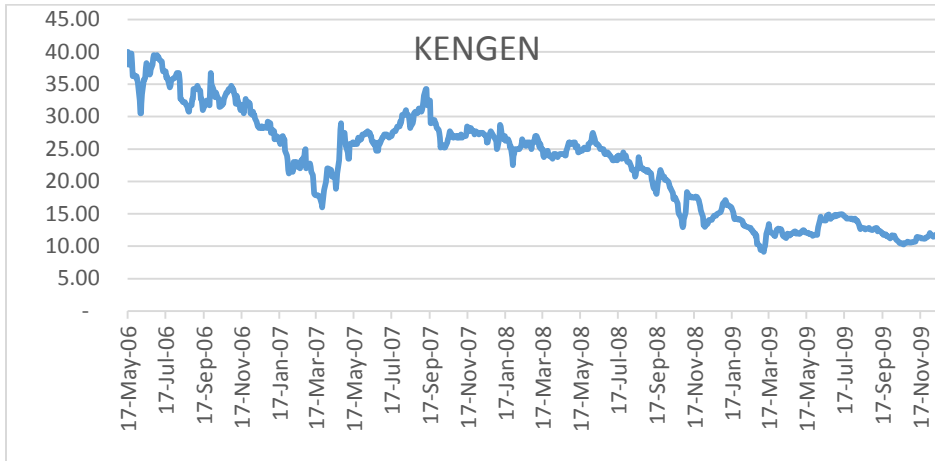
Fig 1
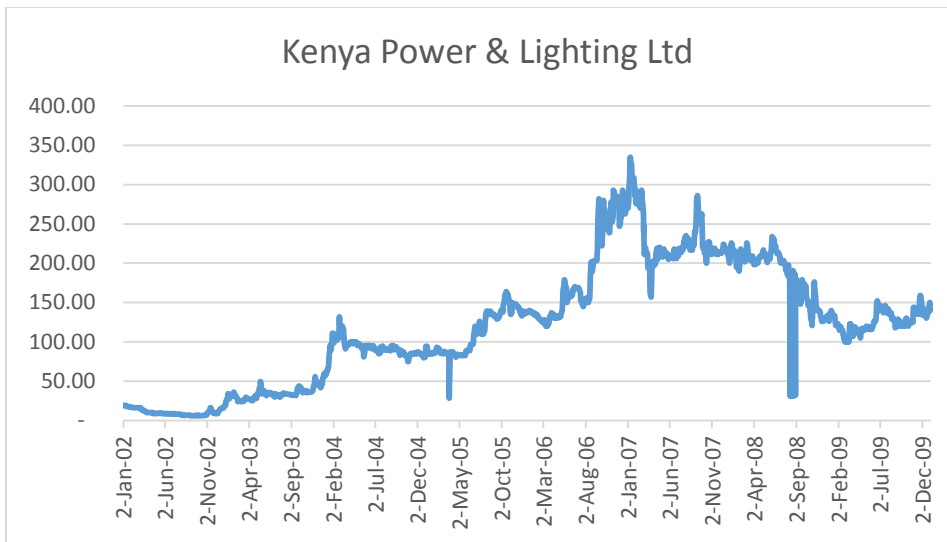
Fig 2

4.1 Test for normality

Frequency distribution histogram

KPLC share prices.

Probability Density Function

Fig 3

From the figure above it is observed that the frequency distribution is not normal. The distribution is positively skewed and with a value of -0.7267 kurtosis. The descriptive statistics are given in the table below.

Table 1

KPLC Descriptive Statistics

Statistic	Value
Sample Size	2008
Range	329
Mean	121.63
Variance	5868.0
Std. Deviation	76.603
Coef. of Variation	0.62983
Std. Error	1.7095
Skewness	0.25174
Excess Kurtosis	-0.7267

Percentile	Value
Min	6
5%	8.7
10%	15.685
25% (Q1)	56.625
50% (Median)	121.5
75% (Q3)	181
90%	219
95%	258.55
Max	335

Frequency distribution histogram for Kengen's share prices
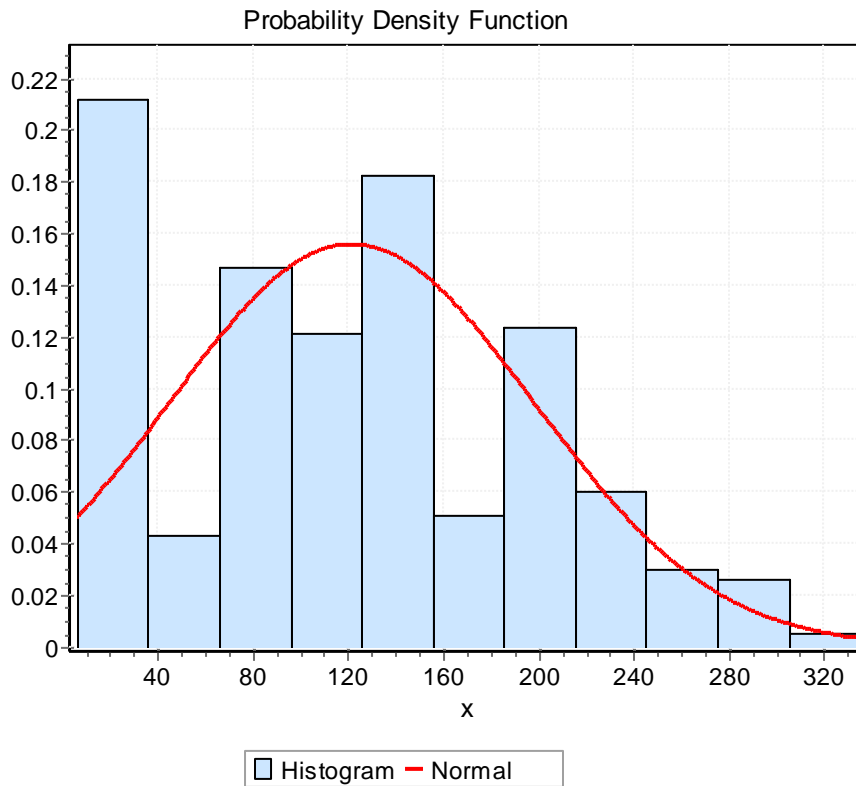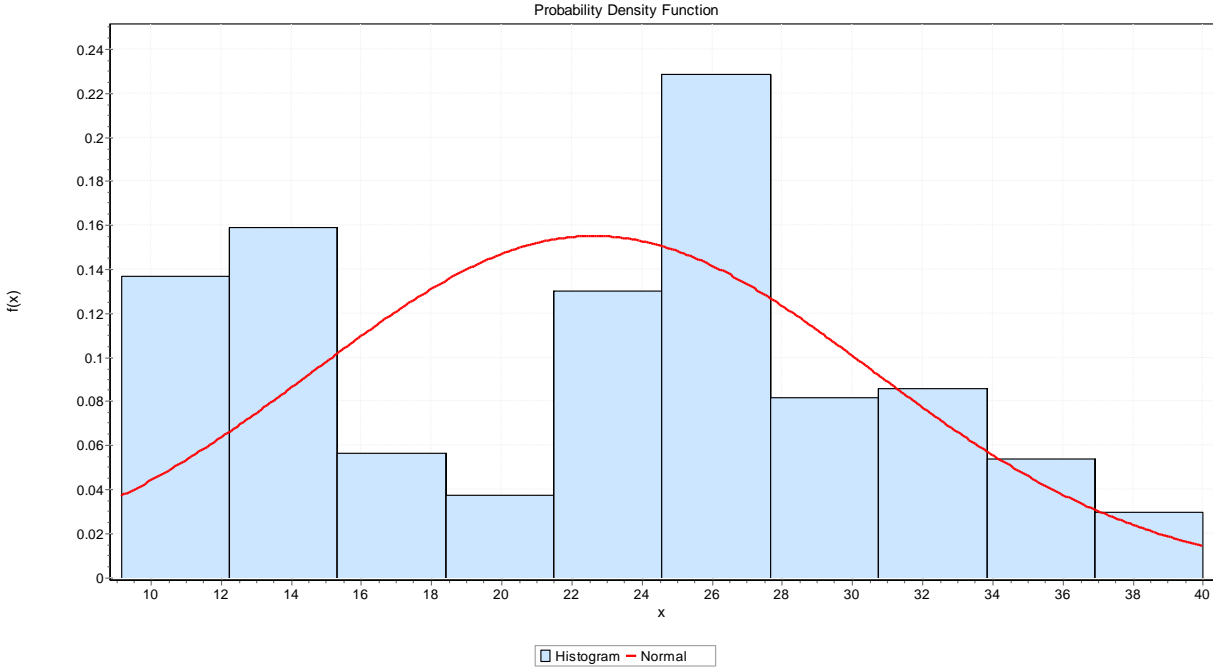
kur

Probability Density Function

Fig 4

Clearly it is also observed from the figure above that the frequency distribution is not normal. The distribution is positively skewed with a value of -1.0588 kurtosis. The descriptive statistic are given out in the table below

Table 2

Kengen Descriptive Statistics

Statistic	Value		Percentile	Value
Sample Size	906		Min	9.15
Range	30.85		5%	11.35
Mean	22.625		10%	11.9
Variance	63.058		25% (Q1)	14.25
Std. Deviation	7.9409		50% (Median)	24.25
Coef. of Variation	0.35097		75% (Q3)	27.75
Std. Error	0.26382		90%	32.75
Skewness	0.02594		95%	35.912
Excess Kurtosis	-1.0588		Max	40

Due to the fact that the data exhibits strong evidence to non-normality we have employed non parametric tests in our investigation of the weak form efficiency as well that do not require the assumption of a normal distribution to make our results more robust.

4.2 KOLMOGOROV SMIRNOV TEST

The Kolmogorov Smirnov Goodness of fit test (KS) shows a 0.0000 probability for the Z at the 5 percent level of significance, in case of normal as well as uniform distribution. The results clearly indicates that the frequency distribution of the daily values of both Kengen and KPLC does not fit either normal or uniform distribution. Therefore null hypothesis of normal distribution of the prices is rejected.

 The K-S results for both companies are shown in the tables below

Table 3: KPLC KS Results

	Kolmogorov Smirnov Goodness of fit test				
	Absolute	Positive	Negative	K-S Z	Z-Tailed P
Normal	0.185	0.185	-0.12	8.289	0.000
Uniform	0.396	0.396	-0.303	17.754	0.000

Table 4: KENGEN KS results

Kolmogorov Smirnov Goodness of fit test

	Absolute	Positive	Negative	K-S Z	Z-Tailed P
Normal	0.117	0.117	-0.107	3.521	0.000
Uniform	0.361	0.217	-0.361	10.865	0.000

4.3 Test for independence in price changes

In test for hypothesis

H_o: the successive price changes in the stock market are independent.

H_1: the successive price changes in the stock market are dependent.

Test for randomness for the successive price changes was done using Wald-Wolfowitz test. The null hypothesis of the series is that the observed series is random variable. When the expected number of runs is significantly different from the observed number of runs, the test rejects the null hypothesis.

Kengen and KPLC stock prices were selected at random for the test and the results are as follows:

4.4 Results for Wald-Wolfowitz test

1. **Kengen**

   Table 5

Cases	Test value (Median)	Runs	Z	2-Tailed P
Case < test value	451	24.25	20	-28.853	0.000
Case >= test value	455				
Total	906				

2. **KPLC**

   Table 6

	Cases	Test Value (Median)	Runs	Z	2Tailed P
Case < test value	1004	121.50	30	-43.527	0.000
Case >= test value	1004				
Total	2008				

As can be seen for both cases the total number of runs are just 20 and 30 with a zero observed significance level. Therefore the hypothesis of randomness for the series rejected.

4.5 Test for Autocorrelation

Durbin Watson test results

- **Kengen**

Table 7

Model Summary[b]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.903[a]	.816	.816	3.40738	.030

a. Predictors: (Constant), Kengen share dates

b. Dependent Variable: share prices

Table 8

- **KPLC**

Model Summary[b]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.717[a]	.514	.514	53.42518	.012

a. Predictors: (Constant), kplc dates

b. Dependent Variable: kplc share prices

From the sample above tested for autocorrelation, H$_o$: ρ =0 was rejected, i.e. there was a positive autocorrelation since 0<d<2. It is evident that the price changes of the stock are dependent.

CHAPTER FIVE

CONCLUSION AND RECOMMENDATION.

From the test carried out, the results strongly indicate that the NSE is not efficient in the weak form. The price changes of the securities are not independent and therefore technical analysis is very much viable. This will help the investor to prepare in advance for the activities in NSE. The important of the fore knowledge of likely unfolding in stock market is that by the time all available information on a given stock is fully absorbed and reflected in the prices, the investor will have bought the securities and has the advantage of favorable price.

From the sample selected, the test proved that the price changes of the two stocks was not random, thus, H_o was rejected. In the second test of autocorrelation i.e. Ho: $\rho = 0$, Durbin-Watson test was done to test for autocorrelation. From the sample tested Ho was rejected i.e. there was positive autocorrelation since 0<d<2. Therefore it is evident that the price changes of the stocks are dependent therefore Nairobi Stock Exchange is not efficient in the weak form.

Nairobi stock exchange is not efficient stock in the weak form and therefore I wish to recommend further research on the topic especially the application of the Variance root test, unit root test, Augmented Dickey Fuller tests.

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Companies Listed in the Nairobi Stock Exchange

No.	Category	Companies
1	**Agriculture**	1. Unilever Tea (K) Ltd. 2. Rea Vipingo Ltd. 3. Sasini Tea & Coffee Ltd. 4. Kakuzi Ltd.
2	**Commercial and Services**	1. Access Kenya Group 2. Marshalls E.A. Ltd. 3. Car & General Ltd. 4. Hutchings Biemer Ltd. 5. Kenya Airways Ltd. 6. CMC Holdings Ltd. 7. Uchumi Supermarkets Ltd. 8. Nation Media Group

3	**Finance and Investment**	Ltd.
		9. TPS (Serena) Ltd.
		10. ScanGroup Ltd.
		11. Standard Group Ltd.
		1. Barclays Bank of Kenya Ltd.
		2. CFC Bank Ltd.
		3. Housing Finance Company of Kenya Ltd.
		4. Centum Investment Company Ltd.
		5. Kenya Commercial Bank Ltd.
		6. Kenya Re-Insurance Corporation Ltd
		7. National Bank of Kenya Ltd.
		8. Pan Africa Insurance Holdings Co. Ltd
		9. Diamond Trust Bank of Kenya Ltd.

		10. Jubilee Insurance Co. Ltd
		11. Standard Chartered Bank Ltd.
		12. National Industrial Credit Bank Ltd.
		13. Equity Bank Ltd.
4	**Industrial and Allied**	1. Athi River Mining Ltd.
		2. BOC Kenya Ltd.
		3. British American Tobacco Kenya Ltd.
		4. Carbacid Investments Ltd.
		5. Olympia Capital Holdings Ltd.
		6. E.A. Cables Ltd.
		7. E.A. Breweries Ltd.
		8. Sameer Africa Ltd.
		9. Kenya Oil Ltd.
		10. Mumias Sugar Company Ltd.

		11. Unga Group Ltd.
		12. Bamburi Cement Ltd.
		13. Crown berger (K) Ltd.
		14. E.A Portland Cement Co. Ltd.
		15. Kenya Power & Lighting Co. Ltd.
		16. Total Kenya Ltd.
		17. Eveready East Africa Ltd.
		18. Kengen Ltd.

Source: Nairobi Stock Exchange Website