UNIVERSITY OF NAIROBI

SCHOOL OF MATHEMATICS

NAIROBI SECURITIES EXCHANGE:

IS IT A RELIABLE FORM OF INVESTMENT?

This Dissertation is submitted in partial satisfaction of the requirements for

POSTGRADUATE DIPLOMA

in

ACTUARIAL SCIENCE

By

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Reg. No: I46/65536/2010

School Mathematics

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DECLARATION

Declaration: By the candidate

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Phyllis Kerubo Ondari

Signature

Date

Declaration: By the lecturer

This research was conducted and has been submitted for examination with my approval as the supervisor.

Prof. Patrick Weke

Signature

Date
ABSTRACT

The big question remains "......... Is Nairobi securities exchange a reliable form of investment? ........." Following the market confidence, that was generated in the first three year of independence due to stable economic development and the Kengen initial public offer which did some acceleration in the recent years, the stock market operated several highly oversubscribe issues. Some people investing in NSE have become super rich while others stagnate in abject poverty. The disparity between the gainers and losers in the market is disquieting and thus the question.

This research was inquest to establish whether the Nairobi stock market is an efficient capital market and find out to what extent is it efficient. Further, analysis was carried out to determine the survival of newly listed counter to continually register impressive which in turn accelerates the prices of respective securities. This research was paramount and it will help investors in future to cautious evaluate the investment option to avoid pit falls that were encountered by their predecessors.

Data was collected from Nairobi Stock exchange for the year 2009 from i.e. from Jan 2009 to December 31st. Data collected was subjected to Wald walfowiz test, serial correlation test and survival analysis. Survival analysis was important since most of listings done in the recent past have failed to record impressive returns soon after listing thus frustrating the investors.

It was noted that the Nairobi stock exchange is not an efficient capital market, thus, an investor can earn consistently returns above average. This can be achieved by carrying out technical
analysis prior to any decision pertaining investment is made. Further, it was noted that any addition shares in the market in form of IPO, SPO or listing should be taken cautiously especially in service industries.
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ACKNOWLEDGEMENT

It is with sincere heart that I would like to appreciate the expert role of my lecturers. The guidance that they gave was so timely and invaluable. I whole heartedly acknowledge the immense contribution of the lecturers in the Actuarial science for their effort to bring up a professional from a scrap. I appreciate the guidance of Mr. Kairu in data analysis. May God reward them greatly.
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.
**LIST OF ACRONYMS**

<table>
<thead>
<tr>
<th>Acronym</th>
<th>Definition</th>
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<tbody>
<tr>
<td>IPO</td>
<td>Initial public Offer</td>
</tr>
<tr>
<td>SPO</td>
<td>Secondary Public Offer</td>
</tr>
<tr>
<td>NSE</td>
<td>Nairobi Securities Exchange</td>
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</table>
CHAPTER 1: INTRODUCTION

1.0 Background

For many years, since the idea of investing in stock market was conceived, many have successfully invested in stock market while still a good number has failed. This can be traced back in 1929 where the US stock market crushed leaving many miserable. Prior to this year, people had successfully invested in stock market and could see themselves in verge of attaining their goals. This has happened time and again in many capital markets, NYSE being just an example. In order to understand a given market one needs to carry out an analysis on the level of efficiency. For the purpose of this analysis our focus is NSE. The main objective of establishment of NSE was to give investor an opportunity to partake the benefits of a given company without being the sole owner which would be rather expensive.

1.1 What is stock market?

Stock Exchange is an organized market for buying and selling financial instruments known as securities, which include stocks, bonds, options, and futures. Most stock exchanges have specific locations where the trades are completed known as stock exchange. For the stock of a company to be traded at these exchanges, it must be listed, and to be listed, the company must satisfy certain requirements.

1.2 Market Capitalization

Capital market is divided into four independent market segments: the Main Investments Market Segment (MIMS), the Alternative Investments Market Segment (AIMS), the Fixed Income Securities Market Segment (FISMS) and later Futures and Options Market Segment (FOMS).
1.3 History

During the 1920s millions of Americans began to purchase stocks for the first time. Many new investors entered the stock market with borrowed money. Stock prices rose steadily as inflated market demand outpaced increases in the value of the real assets of these businesses as well as their profits. Investors eventually realized that a large imbalance existed between stock prices and the real assets available to back them up, including profits, and decided to sell. On October 29, 1929, great numbers of people tried to sell their stocks all at once. Prices tumbled so drastically on the NYSE and other exchanges that the event became known as the crash of 1929. Millions of investors lost their savings in the crash, and many found themselves deeply in debt because they could not repay the money they had borrowed to buy stocks.

During the years immediately following the crash, most investors refused to put any more money in stocks. Without the flow of new funds, many businesses failed, and others laid off many workers because they could not afford to pay them. The lack of investment funds contributed to the Great Depression of the 1930s, an economic crisis that left one of every four American workers unemployed and resulted in widespread poverty.

1.4 Nairobi stock exchange

In the 1920s when Kenya was a British colony, an informal way of dealing in shares and stocks was commenced in Kenya.

In 1951, an Estate Agent Francis Drummond established the earliest professional Stock broking firm, and impressed upon the then finance minister of Kenya Sir Ernest Vasey the idea of creating a stock exchange in East Africa.
Considering the proposal, which was given by the then finance minister of Kenya Sir Ernest Vasey and Francis Drummond, the London Stock Exchange officials approved to recognize the creation of the Nairobi Stock Exchange as an overseas stock exchange in July, 1953. In 1954, the Nairobi Stock Exchange was comprised as a voluntary organization of stockbrokers enrolled under the Societies Act. The business of shares trading was restricted only to the resident European community though Africans and Asians were not permitted to deal in securities.

In 1963, Kenya became independent and Africans and Asians were permitted to deal in securities. In the first three years of independence the economic development was stable, market confidence was regenerated and the exchange operated several highly oversubscribed public issues.

Later in 2001, basic reformation of the capital market of Kenya took place and divided the market into four independent market segments: the Main Investments Market Segment (MIMS), the Alternative Investments Market Segment (AIMS), the Fixed Income Securities Market Segment (FISMS) and later Futures and Options Market Segment (FOMS).

In the 2001/2002 budget, the Government offered the extra incentives to capital markets investments. On 17th April 2002, the CMA (Capital Market Authority) declared the sanction of the new NSE trading and settlement rules with amendments. On 26th July 2002, with the introducing of a New Foreign Investor Regulations, there are three categories of investor on the capital markets; local, East African and foreign.

On 5th August 2002, the Nairobi Stock Exchange, the Capital Markets Authority of Kenya, the Association of Kenya Stockbrokers, the CMA Investor Compensation Fund, and 9 institutional investors through the Capital Markets Challenge Fund signed a Shareholder Agreement for
establishment of the Central Depository and Settlement Corporation (CDSC).

In 2006, his Excellency President Mwai Kibaki launched the automated system to increase the efficiency.

Nairobi Stock Exchange is Africa's fourth largest stock exchange in terms of trading volumes, and fifth in terms of market capitalization as a percentage of GDP. The Exchange works in cooperation with the Uganda Securities Exchange and the Dar es Salaam Stock Exchange, including the cross listing of various equities.

The exchange has 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. Trading is done through the Electronic Trading System (ETS) which was commissioned in 2006. A Wide Area Network (WAN) platform was implemented in 2007 and 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 brokers' offices through the WAN. However, brokers under certain circumstances can still conduct trading from the floor of the NSE.

1.5. Capital Market efficiency.

An efficient capital market is one in which security prices adjust rapidly on arrival of new information and therefore, the current prices of securities reflect all information about the security. This can also be referred to as informational efficient market. There are set of assumption that imply a market efficient

- A large number of profit maximizing participants analyze and value securities.
- New information regarding the security comes to market in a random fashion.
• And investors adjust security prices rapidly to reflect the effect of new information.

(Though the price adjustment may be imperfect, it is unbiased.)

The combined effect of information coming in a random, independent fashion and numerous competing investors adjusting stock prices rapidly to reflect this 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, in the journal of finance, the overall efficient market hypothesis and the empirical test are divided into three sub hypothesis depending on the information set involved:

• Weak form EMH
• Semi strong form EMH
• Strong form EMH

1.5.1 Weak form efficient market hypothesis.

The weak form EMH assumes that the current stock prices reflect all the security market information, including the historical sequence of prices, rates of return, trading volume data, and other market generated information. Because it assumes that current market prices already reflects all past returns and any other security market information, this hypothesis implies that the past rates of returns and any other market data has no relationship with future rate of returns. Therefore, one should gain little from any trading rule that decides whether to by or sell a security based on past rates of return or any other market data.
1.5.2 Semi strong form efficient market hypothesis.

The semi strong form EMH asserts that security prices adjust rapidly to release of all public information. It encompasses the weak form hypothesis, because all the market information considered by weak form hypothesis is public. Public information also includes all nonmarket information, such as earnings and dividend announcements, price to earning ratios P/E, dividend yield D/P ratios, book value–market value (BV/MV) ratios, stock split, news about economy, and political news. 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.

1.5.3 Strong form efficient market hypothesis

The strong form EMH contends 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 EMH encompasses both the weak form EMH and semi strong form EMH. Further the strong form extends the assumption of efficient market, in which prices adjusts rapidly to the release of new public information, to assume perfect markets, in which all information is cost free and available to everyone at the same time.

1.6. Statement of the problem

Many investors in Kenya are looking for an opportunity where they can make an extra coin.

They were amazed the boom that was experience in the recent past when Kengen and Scangroup were listed in NSE.
From market efficient theory, no superior return can be made from technical/ fundamental analysis than from market portfolio itself. Currently we have many advisors who include fund managers and stock brokers/agents who assist in investment. They are well able to create a superior portfolio than market portfolio from history and other information regarding stocks. This can only happen if and only if the market is not efficient. Recently many investors got a rude shock when market came tumbling following recession and post election violence which crippled Kenya economy in 2007/08. Many lost their valuable investment. This caused panic among the investors and less confidence with the stock market.

1.7. Significance of the problem
NSE was formed so that investors can be able to earn proceed from preferred company without necessarily buying the whole company. The investor can buy as little as 100 shares from a given company and will enjoy the rights of a share holder. Until now many investor are losing the value of their investment when the fail to carry their due diligence. Many people thinks any counter in the in the market will always be favorable which is the case of efficient market. Some instances, they ignore the advice of experts in the field. There are other groups who constantly get superior returns on their investment. This research is important to establish the best basis of investment; whether the market makes best portfolio or one needs an expert to do so. This will assist investors to avoid losing in unworthy counters.
CHAPTER 2: LITERATURE REVIEW

According to Campbell et al. 1997, "... the entire history of information of an asset is reflected in its price and that the market responds instantaneously to new information..." thus EMH implies that if any patterns do exist, they must be so small that no systematic trading strategy can have a better risk return profile than a market portfolio. Hence no profitable information about future movements can be obtained by studying the past movement.

According to Frank R. Keilly, in his book portfolio management (1994), the time series tests assumes that in an efficient market the best estimate for future rates of return will be long-run historic rates of returns. The point of test to determine whether there is any public information that will provide superior estimate of returns for short time horizon and long run horizon.

According to studies latane and the associates on the usefulness of quarterly report, it has consistently failed to support the semi strong EMH. Thus the assimilation of publicly available information into the security prices is not instantaneous. In another study by Joy, Litzenberger, and McEnally (JLM) examined firms that experienced unanticipated changes in quarterly earnings using three categories based upon how actual earnings deviated from expectations. They observed an abnormal price changes from 13 weeks prior to announcement to 26 weeks following it. The abnormal price movements for any deviations category for companies with earning above expectation was about 1%-2% during the period compared to transactions of 2-3 percent indicating lack of profit opportunities. The results also indicated that the favorable information contained in quarterly earnings reports is not instantaneously reflected in stock prices and that a significant relationship existed between the size of the unexpected earnings performance and the post- announcement stock price change.
Currently the IFC is carrying a research on New York stock exchange to determine the existence of cycles in the market. In their work individual stock prices for NYSE stocks over the period 1815 to 1925 and individual dividend data over the period 1825 to 1870 were collected. They use monthly price and dividend information on more than 600 individual securities over the period to estimate a stock price index and total return series that extends virtually to the beginning of the New York Stock Exchange. They will use this data to estimate the power of past returns and dividend yields to forecast future long-horizon returns. They found some evidence of predictability in sub-periods but little predictability over the long term. They estimate the time-varying volatility of the U.S. market over the period 1815 to 1925 and find evidence of a leverage effect on risk. The new database created would allow future researchers to test a broad range of hypotheses about the U.S. capital markets in a rich, untouched sample.

In Nairobi stock exchange, 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 Airways, Safaricom, Nation Media Group, Barclays Bank Kenya, Equity Bank, 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 (NASI) was introduced as an alternative index. Its measure is an overall indicator of 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 select counters.

On 20th March 2006, the Government of Kenya (GoK) offered 30% of its shareholding in KenGen for sale to the public through an Initial Public Offer (IPO). The IPO attracted a historic 236% oversubscription.

The KenGen shares were listed on the Nairobi Stock Exchange (NSE) on 17th May 2006 and instantly revitalized the capital markets. Effective 1st August 2007, the NSE carried out a revision of six constituent companies in the NSE 20-Share index. In recognition of KenGen's large market capitalization and sustained tradability (liquidity), KenGen was included as an Index-linked company. The review of the Index is aimed at ensuring that it is a true barometer of the overall stock market.

In 2008, the sale Safaricom shares to the public through an Initial Public Offer (IPO) were done. The Kenya's largest mobile service provider, Safaricom, shares was oversubscribed by 532 percent by both local and international investors.

According to finance minister, Amos Kimunya, the demand was beyond the equity value of the company of 200 billion shillings at the offer price of 5 shillings per share. It represented a subscription rate of about 532 percent and was a positive endorsement by Kenyans.

The retail investors received only 21 percent of what they had applied for while institutional buyers and international investors got a partly 31 percent and 15 percent of what they bid, respectively. Safaricom employees received 84 percent of what they applied for while Safaricom dealers will receive 31 percent of what they bid. East African retail and institutional investors would take the rest, bringing the issue's value to 51.75 billion shillings although it had raised demand worth over 226 billion shillings.
Later in the year Safaricom was included in the NSE-20 share index.
CHAPTER 3 : METHODOLOGY

3.1 sampling

The sampling methods employed were probability and non-probability method, i.e. purposive, quota sampling and simple random. Purposive sampling was applied in selection of time for which data was to be collected. This was done in light of relevance in future prices forecasting. Quota sampling was applied in selection of securities in various market segments and then simple random.

3.2 Data collection

Data collection was done through observation and also from secondary sources. Stock quotes were collected for individual days, volume and dividend earnings from Nairobi stock exchange for a period of 1.0 year. This period starts from 1st Jan, 2009. This year was considered favorably to be free of political influence unlike 2007 and 2008 which was adversely affected by post election violence, 2010 passage of new constitution while 2011 and 2012 customer are likely to be influenced by polls prediction.

3.3 Data analysis

Data collected was subjected to test for randomness, serial correlation test and survival analysis.

3.3.1 Empirical test of weak form of efficiency

For weak form of market efficiency we postulated the independence between successive price changes since all security market information is reflected in the current price of stock and any new piece of information is absorbed immediately. These price changes assumed random walk.

13
This is so because we cannot predict what information that will get to the market tomorrow.

**Autocorrelation in Time Series Data**

When regression is performed on time series data, the errors may not be independent. Often errors are auto correlated; that is, each error is correlated with error immediately before it. Autocorrelation is also a symptoms of systematic lack of fit. DW option provides the Durbin-watson $d$ statistic to test that the autocorrelation is zero.

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

Where $d$ is close to 2 if the errors are uncorrelated

The sample autocorrelation estimate is displayed after the Durbin-Watson statistics.

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

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

Any missing observation in the regression is treated as though the missing observation did not exist, when computing these measures.

Positively autocorrelation of errors generally tends to make the estimate of the error variance too small, so confidence intervals are too narrow and true null hypothesis are rejected with a higher
probability than the stated significance level. Negative autocorrelation of the errors generally tends to make the estimate of the error variance too large.

Most of problem involving time series data exhibit positive autocorrelation, in analyzing this data the hypothesis that will be considered in Durbin Watson are

\[ H_0: \rho = 0 \]
\[ H_1: \rho > 0 \]

**WALD- WALFOWITZ TEST**

The runs test also called Wald-Wolfowitz after Abraham Wald and Jacob Wolfowitz) is a non parametric statistical test that a 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. A run of a sequence is a maximal non-empty segment of the sequence consisting of adjacent equal elements. For example "++++---+++++++++-------+++-----++++-----" consist of eight runs, four of which consist of +'s and another four of -'s the run test is based on the null hypothesis that the two elements + and - are independently drawn from the same distribution.

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 \[ \mu = \frac{2N_+ N_-}{N} + 1 \]
• Variance \( \sigma^2 = \frac{2N_+ N_-(2N_+ N_- - N)}{N^2(N-1)} = \frac{(\mu-1)(\mu-2)}{N-1} \)

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 independent and identically distributed. If the number of runs is significantly higher or lower than expected, the hypothesis of statistical independence of the elements may be rejected.

The run test was be used to test the randomness of the distribution, by taking the data in the given order and marking with + the data greater than median, and with − the data less than the median; (Number equaling the median were omitted.)

First, autocorrelation tests of independence was done which was used to measure the significance of positive or negative autocorrelation in error over time, i.e. does the change of stock prices on day \( t \) correlate with the rate of return on day \( t-1, t-2, \) or \( t-3 \)?

Wald-Wolfowitz test was carried out to test randomness in stock price movement. In the test, the absolute price changes were ignored, only the direction of change was considered. Then increase of price was denoted by (+) positive sign and the decrease was denoted by (−) negative sign. The actual number of runs observed in a series of stock price movement was compared with a number of runs in a randomly generated series. With the knowledge of randomness of random series, we test the similarities of the two samples. If the two samples are the same, then the stock series will be random. If the samples will be different the stock series will be not random since
the other one is random sample. Wald-wolfowitz was used as an alternative serial autocorrelation tests. The two does similar test and they were used to complement and a certain the results of the other. Wald-wolfowitz

3.3.2 Empirical tests of semi strong form of efficiency

Empirical test of semi strong form of efficiency was not carried out since it failed to show significance in the empirical test for weak form of market efficiency.

3.2.3 Test of strong form of efficiency

The empirical test of strong form of market efficiency was not carried out since the preceding two had failed to show any significance.

The following are hypothesis to be tested.

H₀: stock prices fully reflect all information from public and private sources.

Against

H₁: stock prices do not fully reflect all information from public and private sources.

And

H₀: IPOs, SPOs and listings are source of funds to facilitate growth.

Against

H₁: IPOs, SPOs and listings are exit strategy for entrepreneurs.
CHAPTER 4: RESULTS

4.1 Test for independence in price changes

In test for the hypothesis

\[ H_0: \text{the successive price changes in the stock market are independent.} \]

\[ H_1: \text{the successive price changes in the stock market are dependent.} \]

Test for randomness for the successive price changes was done using Wald-Wolfowitz test.

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

RESULTS FOR WALD-WOLFOWITZ TEST

1 Safaricom

Wald-Wolfowitz Test for Randomness

\[ H_0: \text{The data are random} \quad 06:47 \text{ Wednesday, March 24, 2012} \]

Wald-

Wolfowitz Pr >

\[ Z \quad |Z| \]

-15.3979 < 0.0001

2 Nation Media

Wald-Wolfowitz Test for Randomness

\[ H_0: \text{The data are random} \]

Wald-

Wolfowitz Pr >

\[ Z \quad |Z| \]

-14.1930 < 0.0001
From the sample selected, the test proved that the price changes of various securities was not random, thus, $H_0$ was rejected.
TEST FOR AUTOCORRELATION

1

Model: MODEL1
Dependent Variable: access

Durbin-Watson D 1.200
Number of Observations 251
1st Order Autocorrelation 0.399

2

Model: MODEL1
Dependent Variable: equity

Durbin-Watson D 0.683
Number of Observations 192
1st Order Autocorrelation 0.647

3

Model: MODEL1
Dependent Variable: coop

Durbin-Watson D 1.164
Number of Observations 251
1st Order Autocorrelation 0.418

4

Model: MODEL1
Dependent Variable: eabl

Durbin-Watson D 1.452
Number of Observations 251
1st Order Autocorrelation 0.272

5

Model: MODEL1
Dependent Variable: cable

Durbin-Watson D 1.420
From the above sample tested for autocorrelation, $H_0: \rho = 0$ was rejected, i.e. there was positive autocorrelation since $0 < r < 2$. It is evident that the price changes of the stocks are dependent and therefore Nairobi stock exchange is not efficient stock in weak form. Other tests of efficiency in stock market, i.e. empirical test for semi strong form of efficiency and empirical test for strong form of efficiency was not tested since it failed to show significance in weak form of market efficiency.
Data for recently listed counter in the Nairobi securities exchange.

Hypothesis tested:

\[ H_0: \text{IPOs, SPOs and listings are source of funds to facilitate growth.} \]

Against

\[ H_1: \text{IPOs, SPOs and listings are exit strategy for entrepreneurs.} \]

Our time frame is 6 years from now and we are going to investigate whether the newly listed shares are going to survive the turbulent market with entrepreneurial mindset of the management.

We are focusing on the counter listed within the last 6 years and investigate whether the appealing returns will still be sustained after an ipo/listing.

**DATA**

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<th>Company</th>
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<th>Time</th>
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<td>9.50</td>
<td>3</td>
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<tr>
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<td>2011</td>
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<th>No. censored (c,)</th>
<th>No. at risk (y,)</th>
<th>Product limit estimator S(t)</th>
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<td>5</td>
<td>3/20</td>
</tr>
<tr>
<td>3</td>
<td>1</td>
<td>0</td>
<td>4</td>
<td>9/80</td>
</tr>
<tr>
<td>4</td>
<td>0</td>
<td>1</td>
<td>3</td>
<td>9/80</td>
</tr>
<tr>
<td>6</td>
<td>0</td>
<td>3</td>
<td>3</td>
<td>9/80</td>
</tr>
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</table>

First we estimate the survival function using product limit estimator as proposed by Kaplan and Meier in 1950. From the results it is evident that the probability of profit dying out soon after IPO is increases with time. Some may never get back to profitability level as it were before IPO.
CHAPTER 5 CONCLUSIONS AND RECOMMENDATIONS

Nairobi stock exchange is a reliable form of investment. From the test carried out, the result strongly indicated that NSE is not efficient in 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 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.

In light of good identification and timely purchase of the right stock, it's possible to create a portfolio that is superior to the market portfolio. One is able to come up with a set of securities that has minimum risk and high return. The main worry of many investors is the magnitude of risk involved. This is because some are risk averse while others have high affinity of risk. To them who have high risk affinity they have the opportunity to influence the growth of their portfolio rather than leaving everything to fate. For them who are risk averse, they should no longer shy away from the market since it's a viable investment option. One is advised to analyze all available information on all newly listed shares because some entrepreneurs use IPO as exit strategy rather than an avenue to raise more funds for development. In case of exit strategy, no developments are done and thus, the good profits dwindle as soon as they are listed in NSE.

From the sample selected, the test proved that the price changes of various securities was not random, thus, $H_0$ was rejected.

In the second test for autocorrelation i.e. $H_0: \rho = 0$, Durbin-Watson test was done to test for autocorrelation.
From the sample tested for autocorrelation, $H_0: \rho = 0$ was rejected, i.e. there was positive autocorrelation since $0 < d < 2$. It is evident that the price changes of the stocks are dependent and therefore Nairobi stock exchange is not efficient stock in weak form. Other test of efficiency in stock market, i.e. empirical test for semi strong form of efficiency and empirical test for strong form of efficiency was not tested since it failed to show significance in weak form of market efficiency.

**Recommendation**

Nairobi stock exchange is viable business opportunity and therefore I wish to recommend further research on the topic especially the application of Fibonacci and Elliot wave in the Nairobi securities exchange.
## APPENDIX

Main investments market listings

### Agricultural sector

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Listing</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Kakuzi Limited</td>
<td>Coffee, tea, passion fruit, avocados, citrus, pineapple, others</td>
</tr>
<tr>
<td>RVP</td>
<td>Rea Vipingo Sisal Estate</td>
<td>Sisal</td>
</tr>
<tr>
<td>STC</td>
<td>Sasini Tea and Coffee</td>
<td>tea, coffee</td>
</tr>
<tr>
<td></td>
<td>Unilever Tea</td>
<td>tea</td>
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### Commercial and Services

<table>
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<th>Symbol</th>
<th>Listing</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Access Kenya Group</td>
<td>internet service provider</td>
</tr>
<tr>
<td></td>
<td>Car &amp; General Kenya</td>
<td>vehicals</td>
</tr>
<tr>
<td>CMC</td>
<td>CMC Holdings</td>
<td>Cooper Motor Corporation; automobile distribution</td>
</tr>
<tr>
<td>HBL</td>
<td>Hutchings Biemer Limited</td>
<td>furniture</td>
</tr>
<tr>
<td>KAL</td>
<td>Kenya Airways</td>
<td>Kenya's flagship airline; Crosslisted at Uganda Securities</td>
</tr>
<tr>
<td>Symbol</td>
<td>Listing</td>
<td>Notes</td>
</tr>
<tr>
<td>--------</td>
<td>---------------------------------</td>
<td>-----------------------------------------------</td>
</tr>
<tr>
<td>ARM</td>
<td>Athi River Mining</td>
<td>cement, fertilizers, minerals, mining and manufacturing</td>
</tr>
<tr>
<td>BCC</td>
<td>Bamburi Cement</td>
<td>cement</td>
</tr>
<tr>
<td>BOC</td>
<td>BOC Kenya</td>
<td>East African Oxygen</td>
</tr>
<tr>
<td>BAT</td>
<td>British American Tobacco Limited</td>
<td>cigarettes</td>
</tr>
<tr>
<td></td>
<td>British Oxygen Kenya</td>
<td>oxygen</td>
</tr>
<tr>
<td>Symbol</td>
<td>Company</td>
<td>Description</td>
</tr>
<tr>
<td>--------</td>
<td>---------</td>
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</tr>
<tr>
<td>CIL</td>
<td>Carbacid Investments</td>
<td>carbon dioxide</td>
</tr>
<tr>
<td>CBL</td>
<td>Crown-Berger (Kenya)</td>
<td>paints</td>
</tr>
<tr>
<td>ECL</td>
<td>EA Cables</td>
<td>cable manufacture</td>
</tr>
<tr>
<td>EPC</td>
<td>EA Portland Cement</td>
<td>Portland cement</td>
</tr>
<tr>
<td>--</td>
<td>East African Breweries</td>
<td>beer; Crosslisted at Uganda Securities Exchange and Dar es Salaam Stock Exchange</td>
</tr>
<tr>
<td>--</td>
<td>Eveready East Africa</td>
<td>batteries, disposable shavers</td>
</tr>
<tr>
<td>--</td>
<td>Kengan</td>
<td>electricity generation</td>
</tr>
<tr>
<td>KOC</td>
<td>Kenya Oil</td>
<td>petroleum</td>
</tr>
<tr>
<td>MSC</td>
<td>Mumias Sugar</td>
<td>sugar estates and manufacture</td>
</tr>
<tr>
<td>--</td>
<td>Olympia Capital Holdings</td>
<td>vinyl floor tiles; vinyl sheeting; rubber tiles; building materials</td>
</tr>
<tr>
<td>--</td>
<td>Samcer Group</td>
<td>High tech, agribusiness, manufacturing, transport</td>
</tr>
<tr>
<td>TKL</td>
<td>Total Kenya</td>
<td>petroleum</td>
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<tr>
<td>UGL</td>
<td>Unga Group</td>
<td>flour milling</td>
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Finance and Investment

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<th>Symbol</th>
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Notes
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<tr>
<th>Code</th>
<th>Company Name</th>
<th>Industry</th>
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<tbody>
<tr>
<td>BKAR</td>
<td>Barclays Bank of Kenya</td>
<td>banking, investments</td>
</tr>
<tr>
<td>CFC</td>
<td>CFC Stanbic Bank</td>
<td>banking, investments</td>
</tr>
<tr>
<td>DTB</td>
<td>Diamond Trust Bank of Kenya</td>
<td>banking, investments</td>
</tr>
<tr>
<td>EBL</td>
<td>Equity Bank Group</td>
<td>Crosslisted at the Uganda Securities Exchange</td>
</tr>
<tr>
<td>HFC</td>
<td>Housing Finance Company</td>
<td>mortgage financing</td>
</tr>
<tr>
<td>HIC</td>
<td>Jubilee Insurance</td>
<td>Insurance Crosslisted at the Uganda Securities Exchange</td>
</tr>
<tr>
<td>NBK</td>
<td>National Bank of Kenya</td>
<td>banking</td>
</tr>
<tr>
<td>Symbol</td>
<td>Listing</td>
<td>Notes</td>
</tr>
<tr>
<td>--------</td>
<td>-----------------------</td>
<td>------------------------------</td>
</tr>
<tr>
<td>ABC</td>
<td>A Baumann</td>
<td>machinery</td>
</tr>
<tr>
<td>CTL</td>
<td>Citytrust Ltd</td>
<td>financial services</td>
</tr>
<tr>
<td>EAL</td>
<td>Eaagads</td>
<td>Coffee</td>
</tr>
<tr>
<td>EXP</td>
<td>Express Kenya</td>
<td>logistics</td>
</tr>
<tr>
<td>KTC</td>
<td>Kapchorua Tea</td>
<td></td>
</tr>
<tr>
<td>--</td>
<td>Kenya Orchards</td>
<td>fruit, preserves, juice</td>
</tr>
<tr>
<td>LTC</td>
<td>Limuru Tea</td>
<td></td>
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<tr>
<td>GWK</td>
<td>Williamson Tea Kenya</td>
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</table>
Fixed income security market segment

(FISMS)

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Listing</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>--</td>
<td>Kenya Power &amp; Lighting Ltd 7% Pref</td>
<td><em>electrical transmission, distribution and retail</em></td>
</tr>
<tr>
<td>--</td>
<td>Kenya Power &amp; Lighting Ltd 4%</td>
<td>--</td>
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</table>
REFERENCE


S. Kevin Portfolio management.