ECONOMETRIC ANALYSIS OF WEAK-FORM EFFICIENCY AND CALENDAR EFFECTS IN DAR ES SALAAM STOCK EXCHANGE

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A DISSERTATION SUBMITTED IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE DEGREE OF MASTER OF SCIENCE IN ECONOMICS OF THE OPEN UNIVERSITY OF TANZANIA

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CERTIFICATION

The undersigned certifies that, he has read and hereby recommends for acceptance by Open University of Tanzania a Dissertation entitled: "Econometrics analysis of Weak form efficiency and Calendar effects in Dar es salaam Stock Exchange "in partial fulfilment of the requirements for the Degree of Master of Science in Economics of Open University of Tanzania.

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DECLARATION

I, **Maximillian Michael Katabi,** hereby declare that this dissertation is my own original work, and that it has not been presented and will not be presented to any other university for a similar or any degree award.

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Date

DEDICATION

To God Almighty and to my Lord & Saviour Jesus Christ who has been my strength and help in times of need and to my beloved mother, the late Ruth M. Chaula

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ABSTRACT

This study examines the empirical evidence for efficient market hypothesis and calendar effects in the Dar es Salaam Stock Exchange (DSE). Specifically, the study investigated the empirical evidence for weak-form efficiency hypothesis, the empirical evidence to suppose the presence of the day of the week effect and the empirical evidence to suppose the presence of month of the year effect. The daily closing market index and monthly closing market index (All share Index-DSEI) were used, covering the sample period from January 2009 to March 2015. To examine the weak-form efficiency hypothesis, the study employed various statistical tests: serial correlation test-The Ljung-Box test, Unit root tests, parametric runs test and the variance ratio test. For investigating the calendar effects, the study used two econometric models: Ordinary Least Square (OLS) regression model and the Generalized Autoregressive Conditional Heteroscedastic - GARCH (1,1) model. The results of all statistical tests employed showed that the Dar es Salaam Stock Exchange (DSE) was a weak form inefficient market for the sample period investigated. Regarding the seasonality in the market, the findings from both OLS regression and GARCH (1,1) indicated the presence of calendar effects in the market. Inefficiency of the market (DSE) general implies that trading strategy such as the technical analysis can be valuable in the market considering other factors. The presence of seasonality in the market implies that the policy makers and regulatory authority should strive to ensure the market is sufficiently informational and operational.

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LIST OF ACRONYMS

ADF	Augmented Dickey Fuller
ARCH	Autoregressive Conditional Heteroscedasticity
DSE	Dar es Salaam Stock Exchange
EGM	Enterprise Growth Market
EMH	Efficiency Market Hypothesis
GARCH	Generalized Autoregressive Conditional Heteroscedastic
PP	Phillips Perron
OLS	Ordinary Least Square

CHAPTER ONE

INTRODUCTION

1.1 Chapter Overview

This chapter covers the background of the study, statement of the problem, research objectives, and research questions. In addition, the hypotheses of the study have been stated and presented as well as significance of the study, scope of the study and the organization of the study.

1.2 Background of the Study

For several years, the studies on the behavior of the return in the stock markets have drawn a great attention among scholars, researchers and academicians. Numerous studies have been conducted to find finding empirical evidence for Efficient Market Hypothesis (EMH) and the existence of seasonality in stock price behavior.

Financial literature has described "Efficient Market Hypotheses" as the concept that stock prices already reflect available information. According to Arnold (2005) "the efficient market hypothesis (EMH) implies that if new information is revealed about the firm , it will be incorporated into share price rapidly and rationally, with respect to the direction of the share price movement and size of that movement" . Fama (1970) who categorized efficient markets into three forms namely: Weak-form, Semi-strong and Strong form efficient markets asserted that "A market in which prices always reflect available information is called efficient".

The extent to which the level of information is incorporated in the stock /share prices is what distinguishes the three forms of efficient markets. A stock market is said to be weak form efficient if share prices fully reflect past information. Semi-Strong efficient market is one in which the current share prices fully reflect past as well as available public information while the Strong-form efficient market refers to the market in which share prices reflect all information, both public and private. (Fama 1970).

Various econometrics tools, statistical tools and techniques have been developed and used in determining the empirical evidence for Efficient Market Hypothesis (EMH) and Seasonality of share return in a stock market. For well developed stock markets, the focus has been to determine the empirical evidence for Semi-Strong form efficiency hypothesis as well as Strong form efficiency hypothesis while the empirical evidence for weak-form efficiency hypothesis has been extensively explored in some of the emerging stock markets in third world countries. In both developed and developing stock markets, the empirical evidence of seasonality of share prices (i.e., calendar effects) which contradict the efficiency hypothesis has been done and documented.

Although much has been done in relation to efficient market hypothesis and seasonality of share prices, the focus has been on the well developed stock markets leaving behind developing stock market especially African stock markets, as it is believed that these markets are weak-form inefficient. However, this idea needs to be empirically investigated and documented and therefore much needs to be studied and documented from these African stock markets. Therefore, the aim of this study is to determine empirical evidence for weak-form efficiency hypothesis and the existence of calendar effects in the Dar es Salaam Stock Exchange.

1.3 An Overview of the Dar es Salaam Stock Exchange

The Dar es Salaam Stock Exchange (DSE) is a body corporate incorporated in September 1996. Even though the DSE was incorporated in September 1996, the actual trading activities of the stock market started on 15th April 1998 after two years of preparation. TOL limited (formerly Tanzania Oxygen Limited) was the first company to start operating in the market. The deployment of the Central Depository System and Listing of the first corporate debt started in 1999. The listing of Treasury bonds was carried out in 2002, while the cross listing of the first foreign company and listing of the first airline company was done in 2004.

The deployment of Automated Trading System linked with a new three tier Central Depository started in 2006. The market listed the first commercial bank in 2008 and the first mining company in 2011. The Dar es salaam Stock Exchange experienced the launching of the second tier market: EGM- Enterprise Growth Market in 2013, and in the same year the market listed the first EGM company (Dar es Salaam Stock Exchange 2015).

Currently, the Dar es Salaam Stock Exchange has fourteen (14) domestic listed companies and seven (7) cross listed companies. Furthermore, DSE has three categories of indexes, namely: All share index, Domestic index and Sectorial indexes which composed of Banking, Finance and Investment index (BI), Industrial and Allied Index (IA) and lastly Commercial services index (Dar es salaam Stock Exchange 2015). The highlights performance of DSE for the past four years in terms of market capitalization, value of share traded are shown in appendix 1.

1.4 Statement of the Problem

As noted earlier, the testing of Efficient Market Hypothesis (EMH) and seasonality in a stock market has drawn great attention for several decades. The findings of empirical evidence for weak form efficiency have been a major focus for the emerging stock markets. However, the behavior of stock return in African stock markets has not been extensively investigated and documented, especially for stock markets in East Africa.

The few studies for Weak form efficiency and anomaly in African stock markets include the recent study by Mazviona and Nyangara (2013) who tested the weak-form efficiency of the Zimbabwe stock exchange after currency reform using auto-correlation test, Q-statistic test and runs test. The findings of the study indicated that the Zimbabwe stock exchange is not weak form efficiency following currency reform. Similarly, Ogege and Mojekwu (2013), using runs test, correlegram and regression analysis , investigated the random walk hypothesis in the Nigerian Stock market. The results revealed that investors can use past data to predict the future prices which symbolized inefficiency.

In relation to seasonality in the stock markets, a few studies conducted in African stock markets include Kuria and Riro (2013) ,who investigated the seasonal effect on Average returns of Nairobi securities exchange using T-test, F-test and ANOVA. The analysis provided the evidence on the presence of the seasonal effect in Nairobi stock exchange, and hence it was concluded that the market was not yet free from seasonal anomalies.

Though there are some documents on behavior of share returns in the African stock markets as stipulated, in other parts of Africa, these still remain areas of research interest since they have not been well explored. For example, the current behavior of share returns in the Dar es Salaam Stock Exchange, is not well known and documented hence this creates the need and the necessity for studies to be conducted so as to cover this knowledge gap and provides the empirical evidence for the weak – form efficiency and calendar effects in Dar es Salaam stock exchange. Therefore, this study aims at finding the empirical evidence for weak-form efficiency and determining the existing of calendar effects in DSE.

1.5 Objectives of the study

The study is guided by the following general objective and three specific objectives

1.5.1 General Objective

(i) The general objective of the study is to find empirical evidence for Weak-

(ii) Form efficiency hypothesis and the existence of calendar effects in DSE.

1.5.2 Specific Objectives

The following specific objectives have guided this study:

(i) To test the Weak-Form Efficiency Hypothesis for Dar es salaam stock exchange (DSE).

(ii) To examine the presence of the day of the week effect in Dar es salaam Stock Exchange (DSE).

(iii) To examine the presence of month of the year effect in Dar es salaam Stock Exchange (DSE).

1.6 Hypothesis of the Study

The following null and alternative hypotheses have guided this study:

Null Hypothesis:

H_0 :The Dar es salaam Stock Exchange (DSE) is a weak form inefficient market.H_0: There is no statistical evidence to support the presence of day of the week effect in DSE.

H_0: There is no statistical evidence to support the presence of month of the year effect in DSE.

Alternative Hypothesis:

H_1 : The Dar es Salaam Stock Exchange (DSE) is a weak form efficient market.

H_1: There is statistical evidence to support the presence of day of the week effect in DSE.

H_1: There is statistical evidence to support the presence of month of the year effect in DSE.

1.7 The Scope of the Study

The study has been conducted in Dar Salaam region, and it covers the period between 2009 and 2015. Though there are three forms of market efficiency and several stock market anomalies, this study has mainly focused on investigating the weak-form efficiency hypothesis only and studying two types of anomaly- day of the week effect and month of the year effect.

1.8 Significance of the Study

Academically, the study is expected to add up to knowledge and information regarding emerging African stock markets and stimulate other researchers, scholars and students in economics and business studies to undertake further research in this area. The study can also be used as the reference for students and other academicians aspiring to undertake research in this area of study.

The study will also add into few empirical studies and literature available so far in emerging African Stock Markets in an effort to complement the existing gap of lack of enough literature and empirical studies for the African Stock Markets. Further, findings of this study are expected to be benefit policy makers, businessmen and women, and development agencies who are stake holders of the Dar es Salaam Stock Exchange

1.9 Organization of the Study

This study has been organized as follows: while chapter one presents the introduction of the study, chapter two provides and discusses the theoretical review of the efficiency market hypothesis and stock market anomalies. It also presents the review of previous empirical studies on weak form efficiency and seasonality in the stock markets for both developed and emerging economies.

Chapter three describes the methodology adopted for this study, which includes research philosophy, research designed, data used in the study, research questions and hypotheses tested. Chapter four reports and discusses the analysis and findings of the study while chapter five draws the conclusion of the whole study and provides suggestions for future studies.

CHAPTER TWO

LITERATURE REVIEW

2.1 Chapter Overview

This chapter discusses the theoretical and empirical literature reviews; it describes various theories / models for efficient market hypothesis and the conceptual literature review on stock market anomalies. The summaries of other empirical studies conducted in the field have also been presented. Besides, the conceptual framework to guide this study has been developed and presented in this chapter.

2.2 Conceptual Definitions

It is necessary to describe the concepts included in the study, the following are the major concepts applied in this research study.

2.2.1 Efficient Market Hypothesis

This is a concept/ hypothesis which postulate that the stock prices reflect all available information. Bodie et all (2007) described Efficient Market Hypothesis as one where prices of securities fully reflect available information about securities. Similarly, Levy and Post (2005) defined Efficient Market Hypothesis as” the theory that all assets are priced correctly and that there are no bargains in the market”.

2.2.2 Calendar Anomaly (Effects)

Levy and Post (2005) described calendar anomaly as “anomalous phenomenon that trading strategies based on calendar events generate systematic abnormal returns”. It is an anomaly that depends solely on time. Month of the year effect/January effect, day of the week effect/weekend effect, seasonal and holiday effect are among well researched calendar effects. Month of the year effect is the tendency of stock prices for a certain particular month to be significantly different from other months of the year and January effect is the tendency of for stock prices to be abnormally up in January while weekend effect is the tendency of stock prices to be abnormally up on Fridays and down on Mondays.

2.3 The Theories/ Models of Efficiency Markets

Financial economics literature describes the following forms/theories of Efficient Market Hypotheses (EMH) namely; Expected return or Fair game model, Martingale, Sub martingale and the Random walk model.

2.4 The Fair Game / Expected Return Model

According to LeRoy (1989) " A stochastic process y_t is a fair game with respect to the sequence of information set $\emptyset_t$,if the conditional expectation of y_{t+1} is zero". Mathematically this model can be shown as follows:

E$(y_{t+1} \mid \emptyset_t)$= E y_{t+1} = 0 ……………………………………………………………2.1

Fama (1970) describes the fair game model with the following equation:

$x_{j,t+1}$= $P_{j,t+1}$ - E$(y_{t+1} \mid \emptyset_t)$ ……………………………………………………2.2

And then

$E(\tilde{X}_{j,t+1} \mid \emptyset_t)$ = 0 ……………………………………………………………......2.3

Where ;

$x_{j,t+1}$= the excess market value of security j at the time t+1

$P_{j,t+1}$ = Observed or actual price of security J at time t+1

p_{jt} = Price of security j at time t

$E(P_{j,t+1}|\emptyset_t)$= Expected value of the price that was projected at time t on the basis of the information $\emptyset_t$

Equivalently;

$z_{j,t+1}$ = $r_{j,t+1}$- $E(\tilde{r}_{j,t+1}|\emptyset_t)$ ………………………………………………………2.4

Then $E(\tilde{z}_{j,t+1}|\emptyset_t)$ = 0 …..……………………………………………………….. 2.5

where

$z_{j,t+1}$ = Excess return of the security j at time t+1

$r_{j,t+1}$ = observed or actual return for security j at time t+1

$E(\tilde{r}_{j,t+1}|\emptyset_t)$ = Expected return projected at time t on the basis of the information $\emptyset_t$

Equation 2.1 implies that the excess market value of security j is the difference between price of security j and the expected value of the price at time t on basis of information $\emptyset_t$.Similarly, equation 2.4 denotes the excess return of the security j at time t+1 is the difference between observed or actual return for the security j at time t+1 and the expected return projected at time t+1 on basis of information $\emptyset_t$.

Equation 2.3 and 2.5 indicate that market value and excess return respectively are fair game with respect to information $\emptyset_t$. The fair game model implies that on average and considering a larger number of sample, the expected market value and expected return on security equals to its actual return i.e expected excess market value and expected return is zero.

According to Copeland et al (2005). the fair game model only implies that the expectations of return are not biases and does not imply that positive returns will be earned as with sub martingale model. For the larger number of samples, the fair game model means expected return is equal to actual return of an asset.

2.5 Martingale Model

LeRoy (1989) asserted that “a stochastic process x_t is a martingale with respect to a sequence of information set $\emptyset_t$, if x_t has the property $E(x_{t+1}|\emptyset_t)= x_t$,

Where:

x_t, = stock price at time t

E$(x_{t+1}|\emptyset_t)$ = conditional expectation.

Martingale which is also a fair game implies that tomorrow’s price as projected on the basis of information $\emptyset_t$ is expected to be equals to today’s price. In other words, martingale hypothesis/model means the expected return is zero.

2.6 Sub Martingale Model

A stochastic process p_{jt} where p_{jt} is the price sequence for security j is referred as Sub martingale model with respect to information $\emptyset_t$, if it has the following

$$E\left(p_{j,t+1}|\emptyset_t\right) \geq p_{jt} \quad \text{...2.6}$$

Equivalently;

$$E\left(\check{r}_{j,t+1}|\emptyset_t\right) \geq 0 \quad \text{...2.7}$$

Sub martingale which is also a fair game, implies that the expected value of next period’s as projected on the basis of information $\emptyset_t$ is equal to or greater than current price Fama (1970),in other words expected returns on conditional $\emptyset_t$ are non negative i.e expected returns are greater than or equal to zero.

Copeland et al (2005) argued that ‘ A sub martingale has the following implication: Because prices are expected to increase over time, any test of the abnormal return from any experimental portfolio must compare its return from a buy- and- hold strategy from a control portfolio of the same composition. If the market is an efficient sub martingale, both portfolios will have a positive return and the difference between their return will be zero.’

2.7 The Random Walk Model

According to Fama (1970), the random walk model constitutes two hypotheses: (1) successive price changes are independent (2) successive price changes are identically distributed. The model can be represented as follows;

$$f(r_{j,t+1} | \emptyset_t) = f(r_{j,t+1})$$

The random walk model/ theory is regarded as the extension of fair game model, since the random model provides details of stochastic process generating return, the fair game model says little about that and it just explains that the condition of market equilibrium can be stated in terms of expected returns. The random walk model imposes much stronger conditions than martingales and fair games. This model constitutes two hypotheses: (1) successive price changes are independent and (2) price changes follow some known probability distribution Fama (1965). The independence of price changes means the price changes at time t is unrelated to price changes at time t+1.

Between the two hypotheses in which the theory of random walk is based, the more important one is the independence of the series of price changes. The theory is only valid if successive price changes are independent. Regarding the probability distribution of price changes, it has been argued that any distribution is consistent with the random walk theory provided that it correctly characterizes the process generating the price changes (Fama 1965). In finding empirical evidence of weak form efficiency of Dar es Salaam Stock Exchange, this study was based on the random walk model. Statistical tests which test the randomness of the return series have been employed to test the efficiency of the stock market (DSE).

2.8 Forms of Market Efficiency (EMH)

Levy and Post (2005) defined efficient market as a well functioning financial market in which prices reflect all relevant information. Similarly, Bodie et al (2007) asserted that the notion that stocks already reflect all available information is referred to as Efficient Market Hypothesis (EMH). Based on the notion, "relevant available information", three forms of efficiency market hypothesis have been proposed by Fama(1970). They include weak-form, semi-strong and strong form hypotheses.

2.8.1 Weak- Form Hypothesis

Literature in financial economics describes Weak-form hypothesis as the model /theory in which stock prices already reflect all information about the past stock prices, which means that today's stock prices already reflect all information on historical prices of the stocks. Weak form efficiency implies that a trading strategy such as technical analysis which depends on analyzing historical prices to beat the market is futile. Abnormal return cannot be earned by studying and analyzing past stock prices since all past information on stock prices would have been instantaneously and spontaneously incorporated in the current stock prices.

If the stock market is a weak-form efficient market, stock price changes will follow the random walk i.e. the current stock prices will be independent of the patterns of the past stock prices. The weak form efficiency hypothesis can be tested using various techniques such as statistical tests of price changes and the technical trading rules.

2.8.2 Semi-Strong Form Hypothesis

Semi-strong hypothesis states that current stock prices already reflect all relevant publicly available information. In addition to past prices, the public available information include fundamental data on the firm's product line, quality of management, balance sheet composition, patents hold, earning forecasts and accounting practices (Bodie et al (2005).

If semi- strong hypothesis holds, a trading strategy such as fundamental analysis which relies on studying public available information to earn abnormal return, will not be successful since the current stock prices in addition to past prices will have already incorporated all available public information rapidly and rationally.

2.8.3 Strong Form Hypothesis

Under strong form efficient hypothesis, the current stock prices already reflect all public and privately available information. In addition to private information and public information, stock prices in strong form efficient market incorporate historical information on stock prices. If Strong form hypothesis holds, no trading strategy which depends on analyzing the private information can succeed in earning abnormal returns.

Jones (2004) asserted that ‘one way to test for strong-form efficiency is to examine the performance of groups presumed to have access to true non public information. If such groups can consistently earn above-average risk-adjusted returns, then extreme version of the strong form will not be supported’.

2.8.4 The Rationale of Investigating the Weak-form Efficiency Hypothesis

Although there are three forms of efficient market hypothesis, this study specifically decided to investigate the empirical evidence for weak-form efficiency due to the following reasons: Firstly, the weak-form efficiency being the lowest form among the three forms is the starting point, since if the evidence to support weak form efficiency hypothesis won’t be found, then there will be no need to test the other efficiency forms. However, if someone starts with semi-strong or strong forms and fails to find the empirical evidence to support, then he/she will have to test the weak-form as well, which is a time consuming exercise and unnecessary waste of time and resources.

Secondly, economic literature suggests that most small and emerging stock markets are either inefficient or efficient in weak form hence, it is appropriate to start with the testing of the lowest form of efficiency market i.e the weak- form efficiency market. Based on these arguments, many studies on efficient market hypothesis in emerging stock markets have started with the investigation of weak for efficiency hypothesis.

Following the examples from previous studies on efficiency markets and based on the fact that DSE is one of the smallest stock markets in emerging economy, the researcher decided to investigate the weak-form efficiency hypothesis because if the evidence to support weak-form efficiency won't be found, then the study will be concluded and there will be no need to test for semi-strong and strong form of efficiency in DSE.

2.9 Behavioral Finance and Efficiency Market Hypothesis

Behavioral finance and efficient market hypothesis (EMH) are the main two contradicting fundamental investment paradigms, while EMH is the oldest, the behavioral finance is the recent field emerging from early 1980s.

Gupta et al (2014) defined behavioural finance as the study of investor's market behavior that derives from psychological principles of decision making to explain why people buy or sell stocks. Further, Bonie et al (2005) defined behavioural finance as the models of financial markets that emphasize potential implication of psychological factors affecting investors' behavior. The contradiction of the two investment paradigms has originated from various factors but the main one being the investor's rationality. As noted earlier, efficient market hypothesis assumes that investors are rational in their investment decisions, while Behavioural finance argued that investors are not rational all the time.

Sharmer (2014) described another contradiction of these two investment concepts, these includes, the role of emotions, information accuracy, demographic factors, interdisciplinary and the market crisis. Table 2.1 show the detailed explanation of these contradiction.

Table 2.1: Summary of Contradiction

Basis	**Efficient Market Hypothesis**	**Behavioural Finance**
Investor Rationality	EMH presumes that investors in the financial markets are always rational in respect of analysis of information and decision making	Behavioural Finance discipline says that investors are not always rational. Most of the time their behavior shows they are irrational
Role of Emotion	There is no place emotion in decision making process as per EMH	Behavioural Finance has incorporate emotion and psychology too in the investment behavior study
Informational Accuracy	Strong form EMH says that all the investors have equal access to all information and the stock price reflect that Behavioural finance denies the equal access to information information and as such the prices happen to be informationally accurate	Behavioural finance denies the equal access to information principle of EMH and says that stock prices do not always reflect all information
Demographic Factors	EMH does not make any distinction between a new and experienced investor	Behavioural Finance makes distinction between investors as per age, sex , income, education level and experience.

Source: Sharma (2014)

Despite the widely increased acceptance of Behavioral finance as a new investment paradigm which pin points the weaknesses of Efficient market hypothesis and explains the irrational behaviour of individuals in their decision making, behavioural finance has been criticized on several issues. Bodie et al (2005) discussed some of the behavioural critiques which includes:

(i) The largely silence of behavioural finance in explaining how efficient market anomalies due to irrationally could be exploited to the extent of producing abnormal returns because of mal pricing.

(ii) The efficient market hypothesis advocates are not convinced that the anomalies literature as a whole is convincing indictment of the efficient market hypothesis. Behavioural financé is believed to be too unstructured and in effect allowing virtually any anomaly to be explained by some combination of irrationalities of behavior biases.

2.10 Efficiency Market Critiques

Since early 1980s, the Efficient Market Hypothesis theory has come under attack. Various arguments have been presented to show the weaknesses of this investment model. The major critics came from behavioralist and psychologist whose arguments are based on the rational assumption of EMH. Behavioural economists argued that the assumption that investors are rational in their decision making is not realistic and counterfactual. According to behaviourists and Psychologists, investors are not always rational, often their decision making process is affected by psychological factors. Thus they show irrational behaviour. In additional to these arguments, the presence of stock markets anomalies such as small firms anomaly, January effects and month of the year effects have also increased the critics against Efficient Market Hypotheses.

2.11 Argument to support Efficient Market Hypothesis

Despite the critique of EMH, some scholars continue to believe in Efficient Market Theory. Arguments have been presented to support the model .For example, Fama(1998), responding to EMH critiques in his paper ‘ Market efficiency, long term returns and Behavioural Finance’, asserted that ‘Market efficiency survives the challenges from the literature on long-term return anomalies. Consistent with the market efficiency hypothesis that the anomalies are chance results, apparent over reaction to information is about as common as under-reaction, and post-event continuation of pre-event abnormal returns is about as frequent as post – event reversal. Most importantly, consistent with market efficiency prediction that apparent anomalies can be due to methodology, most long-term return anomalies tend to disappear with reasonable change in technique.

2.12 Financial Market Anomalies

Financial markets anomaly, which implies the inefficiency of Stock markets, has been well documented by various Financial writings. In literally, the word "Anomaly" refers to a thing or something, a phenomenon that is different from what is normal or expected (Oxford 2010). In Financial markets, anomalies have been defined in relation to security return/stock return. For example, Bonie et al (2007) defined anomalies as "patterns of returns that seem to contradict the efficient market hypothesis". Similarly Archan et al (2014) defined anomalies as "the situation, when a security or group of securities performs contrary to the notion of efficient markets, where security prices are said to reflect all available information at any point in time".

Market anomalies have been classified into various categories. Latif et al (2011) categorized market anomalies into Fundamental Anomalies, Technical anomalies and Calendar anomalies. Levy and Post (2005) identified four categories of anomalies namely: Firm anomalies, Accounting Anomalies, Event anomalies and Calendar anomalies. The discussion of anomalies in this study has been based on the categories depicted by Levy and Post (2005).

(i) Firm Anomalies

These include anomalies such as Size effect anomaly, Closed-end mutual funds, Neglect and Institutional holding anomaly, These anomalies are the results of firm-specific characteristics.

(ii) Accounting Anomalies

These describe the changes in stock prices that arise as a consequence of the releases of accounting information. It includes Price Earning ratio, Earning surprises, Price/sales ratio, Market-to-book ratio, dividend yield ratio and the Earning momentum anomaly.

(iii) Event Anomalies:

They are price changes that occur after some easily identified event. They include Analysts' recommendations, insiders trading, listings and Value line rating changes.

(iv) Calendar anomalies

These are anomalies linked to a particular time or those that depend solely on time. Among the anomalies mentioned, there are well researched anomalies. A vast of studies have been undertaken to find the empirical evidence for these calendar effects. Calendar anomalies include: January effect, Turn –of-the year effect, Weekend effect/Monday effect, Turn-of-the month effect, Seasonal effect and Holiday effects. The description summary of these market anomalies have been presented in Table 2.2A and Table 2.2B.

Table 2.2A: Summary of the Market Anomalies

Anomaly Category	Sub –Category	Description/Implication
FIRM ANOMALIES	Size	Return on small firms tend to be higher, even on a risk-adjusted basis
	Closed-end mutual funds	Returns on closed-end funds that trade at a discount tend to be higher
	Neglect	Firms that are not followed by many analysts tend to yield higher returns
	Institutional Holdings	Firms that are owned by few institutions tend to have higher returns
ACCOUNTING ANOMALIES	Price/earnings ratio	Stock with low P/E ratios tend to have higher returns
	Earnings surprises	Stocks with larger-than anticipated earnings announcements tend to continue to rise even after the announcement
	Price/sales ratio	If the price/sales ratio is low, then the stock tends to outperform
	Market-to-book ratio	If the market-to-book value (M/B) ratio is low, then the stock tends to outperform
	Dividend yield	If the dividend yield is high, then the stock tends to outperform
	Earning momentum	Stocks of firms whose growth rate of earnings is rising tend to outperform

Source: Levy & Post (2005)

Table.2.2B: Summary of the Market Anomalies

Anomaly Category	Sub –Category	Description/Implication
EVENT ANOMALIES	Analysts' recommendation	The greater the number of analysts recommending purchase of a stock, the more likely it will go down
	Insider trading	The greater the number of insiders buying a stock, the more likely it is to go up
	Listings	Security prices rise after it is announced that a firm will be listed on an exchange
	Value line rating Changes	Security prices continue to rise after Value Line places a security in its number-one category
CALENDAR ANOMALIES	January	Security prices tend to be up in January, especially in the first few days (as well as in the last days of December)
	Weekend	Securities tend to be up on Fridays and down on Mondays
	Time of day	Securities tend to be up in the first 45 minutes and the last 45 minutes of the day
	End of Month	Last trading day of the month tends to be up
	Seasonal	Firms with highly seasonal sales tend to be up during high sales periods
	Holiday	Returns tend to be positive on the last trading day before a holiday

Source: Levy & Post (2005)

2.13 Empirical Literature Review on Efficient Market Hypothesis (EMH)

2.13.1 Evidence from Developed Stock Markets

A vast number of studies have been undertaken worldwide in an effort to determine the empirical evidence of Efficient Market Hypothesis (EMH). The empirical evidence from developed stock markets includes the famous and most cited study done by Fama (1965), using runs test, Alexander's filter rule technique and serial correlation test on daily return of 30 individual stocks listed in Dow Jones Industry for the period between 1957 and 1962. Fama found insignificant correlation and hence it was concluded that the Dow Jones Industry Average was weak-form efficient.

Another empirical evidence from developed stock markets is the study by Worthington and Higgs (2005) who investigated five developed stock markets namely: Australia, Hong Kong, Japan, New Zealand and Singapore and ten emerging markets. Employing serial correlation test, unit root tests (ADF, PP & KPSS), runs test and variance ratio test on daily return, the study found that out of the five developed market investigated, the random walk hypothesis was only rejected for Australia by unit root tests. The multiple variance ratio tests supported the random walk model for New Zealand, Japan and Hong Kong while the serial correlation test and runs test rejected weak form hypothesis for all markets.

The recent empirical evidences from developed stock market include Shaker (2013), who tested the weak-form efficiency of the Finnish and Swedish stock markets by employing serial correlation test, Augmented Dickey-Fuller test and Variance ratio test as proposed by Lo and Mckinlay (1988). The study used daily returns of the OMX Helsinki and OMX Stockholm indices data from year 2003 to 2012. The findings of the study show that daily returns do not follow random walks in any of the two countries which imply that both markets are not weak form efficient.

2.13.2 Evidence from Asia and Middle East Emerging Stock Markets

There are a good number of studies done in Asia and Middle East in relation to efficient market hypothesis, for example Nisar and Hanif (2012), examined the Weak form efficient market hypothesis for major South-Asia markets namely; Pakistan, Bangladesh, Sri Lanka and India.

Using daily, weekly as well as monthly data for a period between 1997 and 2011 and applying four different statistical tests; runs test, serial correlation test, unit root test and variance ratio test, the study found that none of the four major stock followed random-walk and therefore it was concluded that the markets were not weak form efficient.

Similarly, Rahman and Uddin (2012), examined the weak form efficiency of three South Asian markets; Dhaka stock exchange, Bombay stock exchange and Karache stock exchange for the period between 2000 and 2010. Employing auto correlation test, unit root tests, co-integration test and Granger causality test on monthly closing values of the market indices, the empirical evidence revealed that the markets were not weak form efficient.

Among the studies of weak form efficient conducted in the Middle East , it include the study by Abushammala (2011), who examined the weak form efficient for Palestine stock exchange for the period covering 2007 to 2010. Applying unit root tests ; Argumented Dickey Fuller (ADF), the Phillips Perron (PP), and the Kwiatkoowski-Phillips-Schmidt-Shin (KPSS) and using daily prices of general index and AL-Quds index, the study concluded that the Palestine stock exchange (PEX) was weak form inefficient market for the period understudy. These findings from Palestine stock exchange are supported by the recent study by Alkhatib and Harsheh (2013) who also investigated the weak form efficiency hypothesis for Palestine

Exchange (PEX) using the Augmented Dickey-Fuller test (ADF) and the non parametric runs test. The results of both tests supported non-random behavior of returns and hence it was concluded that Palestine stock exchange was weak form inefficient market.

Another study of weak form efficiency done in the Middle East is the study by Moustafa (2004), investigating the weak form efficiency of the United Arab Emirates stock Markets for the period covering October 2001 to September 2003 and employing only runs test on 43 stocks included in the Emirates market index.

The results revealed that the returns of 40 stocks out of 43 sample stocks are random at a 5% level of significance, hence the conclusion drawn from the study is that the market is weak-form efficient. However, these have been surprising findings, considering the size of the market and the existence of thin trading in the market. The findings contradict the results of many studies not supporting the weak-form efficiency of thinly traded markets. Perhaps employing other statistical tests such as variance ratio test and using longer time series data could result into different findings.

The following studies investigated the weak form efficiency of Pakistan stock market; Awais et al (2010), Haque et al (2011) and Sania (2014) covering various periodse. These studies used different econometric tests such as unit root tests, auto correlation test, ARIMA model and Variance ratio test. The findings from these econometric tests resulted into the same conclusion for all studies:s Pakistan stock exchange is not a weak form efficient market.

Srinivasan (2010), Ayyappan et al (2013) and Jain K and Jain P (2013), examined the empirical evidence of the weak form efficiency hypothesis in the Indian stock market using unit root tests and runs test and auto correlation tests. While the results from Srinivasan (2010) and Ayyappan et al (2013) revealed that returns in the Indian stock exchange did not follow random walk model and hence weak form inefficient, the Jain K and Jain P(2013) produced contradictory results, the results from unit root tests and runs test results supported the weak form efficiency hypothesis and therefore concluded that the Indian stock exchange was weak form efficient market for the period considered ,despite the fact that auto correlation test results suggested high degree of correlation between values.

2.13.3 Evidence from African Stock Markets

Among the studies of weak form efficiency for emerging African stock markets include; Mollah (2006) who tested the weak form efficiency in Botswana stock exchange for the period covering 1989 – 2005, using daily returns series and employing runs test, auto correlation test and ARIMA model. The empirical evidence of both statistical tests rejected the hypothesis of random walk model and hence it was concluded that Botswana stock exchange is not weak form efficient market.

Similarly, McKerrow (2013), examined the random walks in frontier stock markets of Botswana, Cote d'Ivore, Ghana, Mauritius and Namibia using monthly time series data for about 16 years and applying naïve random walk, the runs test and the multiple variance ratio test. The findings of the study resulted into mixed conclusion, while the analysis using runs test revealed a rejection of the random walk hypothesis for the markets of Namibia and Cote d'Ivoire and acceptance of random walk hypothesis for the markets of Botswana, Ghana and Mauritius.

The results from the multiple variance test performed at 5% level of significance indicated the rejection of the random walk hypothesis in the markets of Ghana, Mauritius and Botswana while for the markets of Cote d'Ivoire and Namibia the random walk hypothesis could not be rejected. The findings from these statistical tests contradict the results and cannot draw conclusion regarding the efficient market hypothesis for these stock markets.

Afego (2012) investigated the weak form efficiency of Nigerian stock market using monthly return over the period between 1984 and 2009 by employing non parametric runs test. The findings of the study suggested that the stock returns in the Nigerian stock market is predictable and therefore the market is weak form inefficient. Other studies on market efficiency hypothesis which were conducted in African stock markets have been summarized in Table 2.3A – 2.3E, showing the researchers, study title, data and methodology employed and lastly the major findings obtained.

Table 2.3A: Summary of Studies Conducted in African Stock Markets

S/N	Author/S &Year	Study Title	Data	Methodology	Findings
1	Batsirai Mazviona & Davis Nyangara (2013)	A test of the weak form efficiency of the Zimbabwe Stock exchange after currency reform	Daily closing prices and indices from 2009 - 2012	Auto-correlation test, Runs test and Q-statistic test	Zimbabwe Stock exchange is not weak form efficiency
2	Okpara G. Chigozie (2009)	Analysis of weak-form Efficiency on the Nigerian Stock Market: Further Evidence from GARCH Model	Monthly returns of the quoted companies	GARCH Model	Nigerian stock market is weak form efficient
3	Olowe R. Ayodeji (1999)	Weak form Efficiency of the Nigerian Stock Market: Further evidence	Monthly return For the sample of 59 individual stock in NSM from 1981 to 1992	Autocorrelation Tests	The further evidence of weak form efficiency was found

Source: Surveyed Literature

Table 2.3B: Summary of Studies Conducted in African Stock Markets

S/N	Author/S & Year	Study Title	Data	Methodology	Findings
4	Joe Appiah Kusi and Kojo Menyah(2003)	Return predictability in African Stock Market	Weekly returns adjusted for thin trading. Study included 11 African stock markets	EGARCH-n Model	Botswana, Ghana, Ivory Coast, Swaziland and South Africa was found to be weak form inefficient markets. Egypt, Kenya, Zimbabwe, Mauritius and Morocco was found to be weak form efficient
5	Samson Ogege & J.N.Mojekwu (2013)	Econometric Investigation of Random walk Hypothesis In the Nigerian Stock exchange	Monthly time series data , from 1985-2010	Regression analysis, Runs test, correlegram	The results indicated that the market is Weak form inefficient.
6	C.Mlambo &N.Biekpe (2007)	The efficient market hypothesis: Evidence from ten African stock markets	Daily closing stock prices and volume traded for individual stocks	Runs test	Except for Namibia, A significant number of stocks rejected the random walk for all other markets

Source: Surveyed Literature

Table 2.3C: Summary of Studies Conducted in African Stock Markets

S/N	Author/S & Year	Study Title	Data	Methodology	Findings
7	John.Dikson and Kinandu Muragu (1994)	Market Efficiency in Developing Countries: A Case Study of the Nairobi Stock Exchange	Autocorrelation tests & Run test	Weekly prices for the sample of 30 securities listed on Nairobi Stock Exchange from 1979 - 1989	Nairobi Stock Exchange was found to be weak form efficient market
8	Frimpong J.Magnus, Oteng-Abayie and Eric Fosu (2007)	Market Returns and Weak-Form Efficiency: the case of the Ghana Stock Exchange.	The study used Daily data for the sample for the period from 15th June 1994 to 28th April 2004.	The Basic Random walks model and The GARCH model	Ghana Stock Exchange was found to be weak form inefficient market
9	Mind Mabhunu (2004)	The Market Efficiency Hypothesis and Behavior of Stock Returns on the JSE Securities Exchange	Weekly closing price covering the period from Jan 1999 to July 2003 for the basic and industrial economic sectors	Autocorrelation Test	The JSE was found to be weak form efficient market.

Source: Surveyed Literature

Table 2.3D: Summary of Studies Conducted in African Stock Markets

S/N	Author/S & Year	Study Title	Data	Methodology	Findings
10	Victor K. Gimba (2013)	Testing the Weak-form Efficiency from Nigerian Stock Market	Daily and weekly all share index from January 2007 to December 2009 for daily data and from June 2005 to December 2009 for weekly data	Autocorrelation tests, Runs test and Variance ratio test	Nigeria stock exchange is weak form inefficient market
11	Keith Jefferis and Graham Smith (2004)	Capitalization and Weak – Form Efficiency in the JSE Securities Exchange	The study employed weekly data for the sample of seven stock prices indices	Variance ratio tests and Tests of evolving efficiency (TEE)	Mid Cap, Industrial and Small Cap indices were not following the random walks while JSE All Share 40, Industrial 25, Data stream and Gold indices were following a random walk

Source: Surveyed Literature

Table 2.3E: Summary of Studies Conducted in African Stock Markets

S/N	Author/S & Year	Study Title	Data	Methodology	Findings
12	Frimpong J.Magnus, Oteng-Abayie and Eric Fosu (2007)	Market Returns and Weak-Form Efficiency: the case of the Ghana Stock Exchange.	The study used Daily data for the sample of 1,508 observations covering the period from 15^{th} June 1994 to 28^{th} April 2004.	The Basic Random walks model and The GARCH model	The market was found to be weak form inefficient
13	Keith Jefferis and Graham Smith(2005)	The Changing Efficiency of African Stock Markets	GARCH Aproach	The study used weekly data running from Jan 1990 to June 2001.Study covered seven African stock Markets	While Johannesburg Stock Market was found to be weak form efficient .Morocco, Egypt and Nigeria became weak efficient towards the end of the period. Mauritius Stock market depicted slow tendency toward efficiency while Kenya and Zimbabwe did not depict any tendency towards weak form efficiency.

Source: Surveyed Literature

2.14 Thin Trading

One of the major problems or limitations affecting some of these empirical studies for emerging stock market is the failure to consider the thin trading effect. This is a phenomenon which occurs when stocks do not trade at every consecutive interval. The consequences of ignoring the thin trading effect are the statistical biases in the time series of stock prices. Therefore it is very essential to take into account the thin trading effect when testing weak-form efficiency in thinly traded emerging stock markets. As A-Khazali et al (2007) asserted, ‘in testing the efficiency of emerging markets, it is necessary to take into account thin trading’.

Infrequency trading or thin trading can be categorized into two groups or forms: non synchronous trading and non trading .Non synchronous trading occurs when the stocks are not necessarily traded at the close of each interval despite the fact that the stocks trade every consecutive interval. Non trading occurs when the stocks do not trade on each consecutive interval (Miller et al 1994).

Several approaches have been suggested to overcome the problem of infrequency trading. For example thin trading effect can be avoided by eliminating thin traded stocks. Stoll and Whaley (1990) used ‘the fitted ARMA regression residual as a proxy for the true index return innovations’ in dealing with thin trading effect (Jokivulle, 1995) . Basset et al (1999) proposed the use of Kalman filter in eliminating thin trading problem. To overcome the thin trading problem, this study decided to use the market index rather than individual stocks, which greatly suffers from influence trading problem.

2.15 Empirical Literature Review on Calendar Anomalies

As mentioned earlier, among market anomalies categories, the calendar anomalies are the most researched anomalies. Enormous studies have been undertaken in an effort to determine the empirical evidence of various calendar effects worldwide. Table 2.4 presents the summary of studies undertaken to determine empirical evidence for the calendar effects.

Table 2.4A: Summary of Studies on Calendar Effects

S/N	Author/S & Year	Study Title	Calender Effect Studied	Data	Methodology	Main Findings
1	Hassan Aly,Seyed Mehdian and Mark .J. Perry (2004)	An analysis of Day-of-the Week Effects in the Egyptian Stock Market	Day of the Week Effects	Daily closing values for stock market index from April 1998 to June 2001	OLS regression	Monday stock returns are significantly positive, they are not significantly different from returns during the rest of the week.
2	Andreas Georgantopoulos and Anastasios Tsamis (2011)	Investigationg Seosonal Patterns in Deloping Countries: The Case of FYROM Stock Market	Day-of-the Week Effect, The January Effect. The half of the month Effect, The turn of the Month Effect, Time of the Month Effect	Daily closing values for MBI-10 index ,from Jan 2002 to July 2008	OLS regression and GARCH (1,1) MODEL	: January effects and Day of the week effect were found.. The study documented the non existence of the half month effect, the turn of the month effect and the time of the month effect
3	Faryad Hussain,Kashif Hamid,Rana Shahid Imdad Akash and Majid Imdad Khan (2011)	Day of the Week Effect and Stock Returns: (Evidence from Karachi Stock Exchange-Pakistan)	Day of the Week Effects	Daily stock prices from Jan 2006 to December 2010	OLS regression	Study concluded that Tuesday returns are quite significant and positive and hence it is inferred that there exists day effect in Pakistan stock market

Source: Surveyed Literature by author

Table 2.4B: Summary of Studies On Calendar Effects

S/N	Author/S & Year	Study Title	Calender Effect Studied	Data	Methodology	Main Findings
4	Dimitris Kenourgios and Aristeidis Samitas (2008)	The day of the Week Effect Patterns on Stock Market Return and Volatility: Evidence for the Athens Stock Exchange	Day of the Week Effects and volatility	Daily closing values of general index of the Athens stock exchange ,from 1995 to 2000 and 2001 to 2005	GARCH (1,1) and M-GARCH (1,1)	Day of the week effect in both the return and volatility equations is present for emerging ASE over the period 1995-2000.
5	Truong Dong Loc (2012)	Day-of-the-Week Effect on the Stock Return and Volatility: The case of Ho Chi Minh Stock Exchange, Vietnam	Day –of-the Week Effect	Daily series of the market index from March 2002 to March 2011	OLS regression and GARCH (1,1)	Empirical findings confirm the presence of the day of the week effect on stock return and the volatility in the market.
6	Abhijeet Chandra and Jamia Millia Islmia (2010)	Stock Market Anomalies : A Calender Effect in BSE-Sensex	Turn of the Month Effect & Time of the Month Effect	Daily stock index of sensex ,from April 1998 to March 2008	OLS regression	Study reveal that a very anomalous behavior towards return has been found in BSE.

Source: Surveyed Literature by author

Table 2.4C: Summary of Studies on Calendar Effects

S/N	Author/S & Year	Study Title	Calender Effect Studied	Data	Methodology	Main Findings
7	Noppohon Tangjitprom(2011)	The Calender Anomalies of Stock Return in Thailand	Month-of-year Effect, Turn-of-month Effect & Weekend Effect	Daily data	OLS regression and GARCH (1,1) Model	Calendar anomalous exist in Thai stock market
8	Archna.S, Mohammed Safeer and S.Kevin (2014)	A study on market anomalies in India Stock Market	Weekend Effect,Turn of the Month Effect and Turn of the Year Effect	Daily closing prices from 2008 to 2012	T-Test	The weekend effect was proved in Indian stock market. Turn of the month effect and turn of the year effect are minimally visible but statistically proven for the analyzed period . Stock split effect testing was proved negative except for Jindal steel
9	Sarbapriya Ray (2012)	Investigating Seasonal Behaviour in the Monthly Stock Returns: Evidence from BSE Sensex of India	Month of the year effect	Monthly closing share prices from Jan 1991 to Dec 2010	OLS regression	The results of the study provides evidence for month-of the year effect in Indian stock market

Source: Surveyed Literature by author.

Table 2.4D: Summary of Studies on Calendar Effects

S/N	Author/S & Year	Study Title	Calender Effect Studied	Data	Methodology	Main Findings
10	Ashish Garg, b.s Bodla and Sangeeta Chhabra (2010)	Seosonal Anomalies in Stock Returns: A study of Developed and Emerging Markets	Turn of the Month Effect, Semi-Monthly Effect, Monthly Effect Monday and Friday Effect	Daily closing prices of indices from Jan 1998 to Dec 2007	T-Test one-way Anova post-Hoc Test	Analyses provides the evidence about the presence of the Monday effect only in India but the semi monthly and turn of the month effect are not found in both markets.
11	P.Nageswari , M.Selvam, S.Vanitha & M.Babu (2013)	An Empirical analysis of January Anomaly in the Indian Stock Market	January Effect	Daily closing prices from April 2002 to March 2011	Dummy variable regression model	It was found that the highest mean return was earned in December and lowest Negative mean return earned in January.
12	Suliman Zakaria & Suliman Abdalla (2012)	Stock Return Seasonalities : Empirical Evidence from the Egyptian Stock Market	Day of the Week Effect	Daily prices for market index, from July 2007 to Novem ber 2011	OLS regression and GARCH approach	Indicates that the day of the week effect is not influenced by stock market risk. Day of the week effect is not present in the Egyptian stock market

Source: Surveyed Literature by author

Table 2.4E: Summary of Studies on Calendar Effects

S/N	Author/S & Year	Study Title	Calender Effect Studied	Data	Methodology	Main Findings
13	Sevinc Guler (2013)	January Effect in Stock Return: Evidence from Emerging Markets	January Effect	Monthly return	Power ratio method	Results indicated the existence of the January effect in China, Argentina and Turkey returns and no evidence of January effect is found at Brazil and India stock market
14	Manish.R. Pathak (2013)	Stock Market Seasonality: A study of the Indian Stock Market (NSE)	Monthly of the Year and Day of the Year Effect	Daily closing prices of the market index from April 2002 to March 2012	Kruska Walis Test	Non existence of the day effect and month of the year effect
15	Iulian Panait (2013)	The month-of-the-year on Bucharest Stock Exchange	Month-of-the-Year Effect	Monthly returns from 2007 to 2009 and 2009 to 2013	OLS regression and GARCH-M model	The market does not exhibit month of the year effect for January effect

Source: Surveyed Literature by author

Table 2.4F: Summary of Studies on Calendar Effects

S/N	Author/S & Year	Study Title	Calender Effect Studied	Data	Methodology	Main Findings
16	Rosa Maria Caceres Apolinario, Octavio Maroto Santana ,Lourdes Jordan Sales and Alejandro (2006)	Day of the Week Effect on European Stock Markets	Day of the Week Effect	Daily return from the correspond ing stock indices	GARCH and T-ARCH models	The findings indicate that abnormal behavior is not present in the return of these stock market
17	Idries M.Al-jarrah, Basheer A.Khamees and Ibrahim Hashem Qteishat (2011)	The Turn of the Month Anomaly in Amman Stock Exchange: Evidence and Implications	Turn of the month Effect	Daily closing prices of ASE index from Jan 1992 to September 2007	Paired T-test is used to test if there is significance in mean returns. OLS regression	The market does not significantly exhibit the turn of the month effect
18	Md. Lutfur Rahaman (2009)	Stock Market Anomaly: Day of the Week Effect in Dhaka Stock Exchange	Day –of-the Week Effect	Daily closing prices of DSE indices for a period from 2005 to 2008	One sample T-test, two sample T-test , ANOVA and OLS regression, GARCH (1,1) Model	The result indicates that Sunday and Monday returns are negative and only positive on Thursdays are statistically significant

Source: Surveyed Literature by author

Table 2.4G: Summary of Studies on Calendar Effects

S/N	Author/S & Year	Study Title	Calender Effect Studied	Data	Methodology	Main Findings
19	Pak.J.Commer Soc Sci (2013)	Investigating Day-of-the-Week Effect in Stock Return: Evidence fromKarachi Stock Exchange-Pakistan	Day –of-the Week Effect	Closing prices of KSE-100 index from Jan 2004 to Dec 2011	OLS regression with separate five models, T-test, one factor ANOVA	No effect found in sub period I, while negative Monday and positive Friday effect revealed in sub period II
20	Iulian Panait,Carmen Marilena and Corina Maria (2013)	The Day- of-the- Week Effect on Bucharest Stock Exchange(2013)	Day –of-the Week Effect	Daily prices for all the indices from May 2007 to March 2013	GARCH-M model	Results don’t offer clear enough and sufficient statistically argument to confirm the presence of the day of the week effect on 6 indices.

Source: Surveyed Literature by author.

2.16 Research Gap

Following the discussion of the literature review, it is clear that even though there is much empirical evidence on weak form efficiency hypothesis which has been documented for both developed and emerging stock markets, the behavior of stock returns in other markets is not well known and documented. For example there are more than three studies which have been undertaken at different time intervals to examine the empirical evidence of weak form efficiency hypothesis for Nigeria stock market. Similarly, there are a good number of studies have been done to investigate the efficient market hypothesis in South Africa. However, the behavior of security returns in the Dar es Salaam stock exchange is yet to be known and it is not well documented compared to other stock markets in Africa. Therefore, this necessitates the need to undertake research on the behavior of stock returns in DSE, in an effort to fill in this research gap by adding new knowledge regarding efficiency market hypothesis and calendar effects in the Dar es salaam stock exchange.

2.17 Conceptual Framework

Figure 2.1 below represents the conceptual framework adopted by this study.

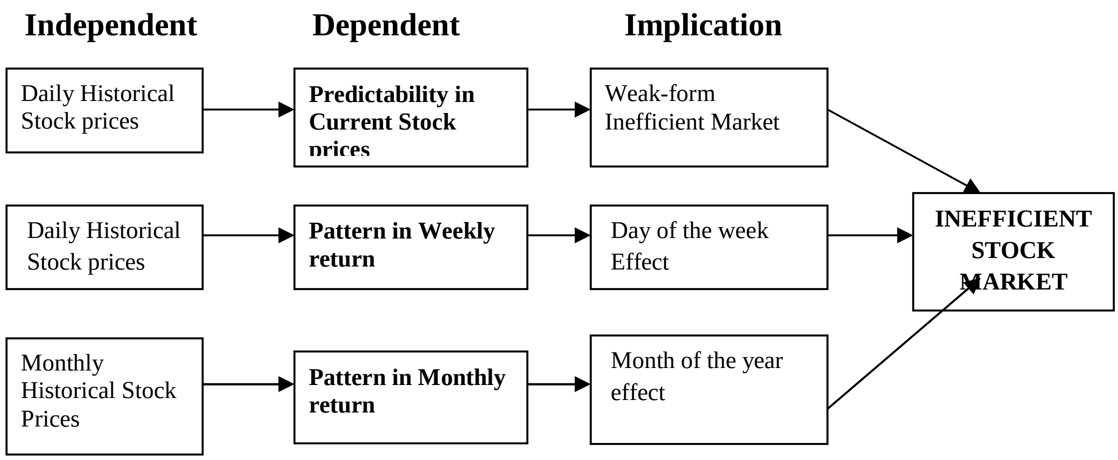

Figure 2.1 The Conceptual Framework
Source: Developed by Researcher from the Literature review

As Figure 2.1 shows, if the current stock prices (dependent variable) are determined by historical stock prices (independent variable), which means that by analyzing past information on past stock prices someone can predict the current or future stock prices, past information is not instantaneously incorporated in the current stock prices and as a results the markets become inefficient in weak form. Based on this relationship between past historical prices and the current stock prices, the first hypothesis of this study was constructed to determine if the current stock prices can be predicted on the basis of past information. Using the random walk theory – various tests were employed to determine the empirical evidence for weak-form efficient market.

Similarly, if by analyzing the daily past stock prices, the pattern in daily return for the week (i.e, the daily return in one of the days in a week will be significantly different from others)can be revealed, then the market will be said to exhibit the day of the week effect. Therefore the second objective of this study has focused on analyzing this stock market anomaly, the second hypothesis of the study has been developed on the basis of this relationship to find the empirical evidence for day of the week effect in DSE.

Figure 2.1 also depicts that if we analyze the monthly stock prices (returns) and find the significant differences on monthly returns i.e some of the months recording higher or lower return than others, this will be a sign of the existence of the calendar effect and the month of the year effect. Hence, the third hypothesis of this study has been developed to analyze whether monthly returns exhibit any anomaly.

Various econometric models have been used in this study to find the empirical evidence for weak for form efficiency, day of the week effect and month of the year effect as guided by the three hypotheses developed on the basis of this conceptual framework. As noted in figure 2.1, if current market prices can be predicted on the basis of historical stock prices and if the market exhibits day of the week effect as well as month of the year effect, it implies that the stock market (DSE) is inefficient market and trading strategy could be valuable in the market.

CHAPTER THREE

RESEARCH METHODOLOGY

3.1 Chapter Overview

This chapter presents the methodology that has been used in this study. The chapter has included the following: research philosophy, approach and design, the sample (data types) and the sample sources i.e. data sources, sample size and statistical methods to be used in analyzing the data collected.

3.2 Research Philosophy

Saunders et al (2008) described four research philosophies namely: Positivism, Realism, Interpretivism and Pragmatism. This study has adopted the positivism research philosophy since it has adopted the philosophical stance of natural scientist using a highly structured methodology which facilitates replication. The study has worked on the " observable social reality". The stock prices collected and used in the study are the observable facts and not the impression which is similar to what has been employed by the physical and natural scientists.

The use of various statistical analyses (tests) in testing the random walk theory and calendar effects signifies the adoption of highly structured methodology which facilitates the replication of the study using different sample periods and data. Another element of positivism is that the research is conducted in a value-free way which, according to Remeny et al (1998 cited in Saunders et al 2008), implies that the 'researcher is independent and neither affects nor affected by the subject of the research". In this study, the data collection process has been done in value free way, the researcher did not and was not influenced by the data collection process. Therefore, for these arguments it is clear that the study has adopted the positivism research philosophy.

3.3 Research Approach

Research approaches have been categorized into two main groups: the deduction approach and induction approach. Saunders et al (2008) described the differences and emphasis of these two approaches. While the deduction approach emphasizes scientific principles and the collection of quantitative data as well as the use of highly structured approach.

The induction approach on the other hand, emphasis the gaining and understanding of the meanings humans attach to events, the collection of qualitative data and a more flexible structure to allow changes of research emphasis as the research progress. Based on these differences and the emphasizes of the two approaches, it is obvious clear that this study has adopted the deduction research approach.

3.4 Research Design

Kothari (2004) defines, research design as the arrangement of conditions for collection and analysis of data in a manner that aims at combining relevance to the research purpose with economy in the procedure. Research design can be broadly classified as exploratory research and Conclusive research. The exploratory research has been explained in the literature as a valuable means of finding out what is happening, seeking new insight, asking questions and assessing phenomena in a new light (Gimbi 2010). According to Nargundkar (2008) ‘conclusive research is more likely to use statistical tests, advanced analytical techniques and lager sample sizes compared to exploratory studies. Conclusive research is more likely to use quantitative rather than qualitative techniques'. Since this study involves the testing of specific hypothesis and examination of relationships and data analysis is quantitative and the research process is formal, the research designed adopted is conclusive research design.

3.5 Population of the Study

The population of this study comprises the daily and monthly historical stock prices of all indices found in DSE as shown in Table 3.1.

Table 3.1: Market Indices

Index Name	Short Name	Companies In The Index
Banking, Finance and Investment index	BI	NMB, CRDB , DCB , MAENDELEO BANK , MKOMBOZI BANK
Industrial and Allied index	IA	TBL, TOL, TATEPA, TCC, SIMBA, TWIGA , SWALA GAS & OIL
Commercial services index	CS	PRECISION, SWISSPORT
Tanzania Share Index	TSI	NMB, CRDB, DCB, TBL, TOL, TATEPA, TCC, SIMBA, TWIGA, PRECISION, SWISSPORT, MAENDELEO BANK , MKOMBOZI BANK , SWALA GAS & OIL
All Share Index	DSEI	NMB, CRDB, DCB, MAENDELEO BANK , MKOMBOZI BANK , KA, KCB, TBL, TOL, TATEPA, TCC, SIMBA, TWIGA, SWALA GAS & OIL, PRECISION, SWISSPORT, NMG, EABL, JUBILEE INSURANCE,ACACIA MINING PLC, UCHUMI SUPERMARKET

Source: DSE (2015)

3.6 Sampling Techniques

The study employed purposive sampling technique in identifying the sample data, type and sample size. The study purposely chose All share indexes to be used in the study. The rationale of picking All share index lies in its being the oldest index comprising all companies in the DSE. Since the focus of the study is to examine the empirical evidence for the efficiency market hypothesis and calendar effects for the entire market, it is ideal to use the DSEI since it represents the whole market.

3.7 The Sample (Data Types) and Data Sources

The (Sample) data which have been employed in this study has comprise the daily and the monthly closing stock market index (The All share Index-DSEI) data have been collected from Dar es salaam stock exchange and have excluded public holidays and non trading days.

Although the stock prices market index was collected for the purpose of undertaking statistical tests , the actual statistical tests were performed using the natural logarithmic of the relative prices which are proxy of stock return. Therefore, to generate continuously compounded stock returns the following equation was used.

$$R_t = [\ln(P_t) - \ln(P_{t-1})] = \ln\left(\frac{P_t}{P_{t-1}}\right) \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots 4.1$$

Where:

R_t = Return of the price indices at time t

P_t = Price at time t

P_{t-1} = Price at time t-1

3.8 The Sample Period

The sample period for this study has covered the period from January, 2009 to March, 2015.The data prior to January 2009 were not found. The study had therefore, to use the available data which covers this period.

3.9 The Sample Size

The sample size of the study has ranged between 75 observations and 1546 observations depending on the type of data. Table 3.2 depicts the sample size employed in this study.

Table 3.2: The Sample Size

Data Type (Sample)	**Sample Period (Coverage)**	**No. of Observations (Sample Size)**
Daily	5/1/2009 – 27/3/2015	1546
Monthly	January 2009 – March 2015	75

Source: Surveyed Data

3.10 Methods Employed

In finding the empirical evidence for both weak – form efficiency hypothesis and calendar effects in Dar es Salaam Stock exchange, different methods were used. These include: the descriptive statistics, the test of goodness – of fit and the statistical tests of weak form efficiency as well as the statistical tests for testing the calendar effects. The detailed explanations of the methods employed are as follows.

3.10.1 Descriptive Statistics

The descriptive statistics for the daily and monthly returns series for the Dar es salaam All share index (DSEI) were determined and presented, since one of the basic assumption of the random walk model is that the distribution of return series should be normal. The descriptive statistics help in revealing the nature of the distribution of the return series employed in the study.

3.10.2 Test of Goodness – of-fit: (The Kolmogorov-Smirnov – (K-S test)

In order to confirm whether the returns series employed in this study follow the normal distribution or not, the Kolmogorov-Smirnov test was employed. This is a non parametric test which is used to determine how well a random sample of data fits particular hypothesized distribution. The null and alternative hypotheses tested were as follows:

H_0 : The returns series follow a normal distribution

H_1 : The returns series do not follow normal distribution

The null hypothesis of normal distribution of returns series is rejected at the chosen level of significant (α) in favour of alternative hypothesis , if the kolmogorov-Smirnov test statistic (D) is greater than the critical value obtained.

3.10.3 Statistical Tests for Testing Weak–form Market Efficiency

In determining the empirical evidence for weak-form efficiency hypothesis, various statistical tests were used namely: Serial correlation test- the Ljung-Box Test, non parametric runs test and two types of the Unit root tests- the Augmented Dickey fuller test and The Phillips-Perron Test (PP) have also been used. Lastly, the variance ratio test was used to confirm the results obtained from other statistical tests.

3.10.3.1 Serial Correlation Test- Ljung Box Test

In testing the first null hypothesis of this study, the weak form inefficiency of Dar es Salaam Stock Exchange (DSE) and the serial correlation test were used. This is the parametric test which determines the serial correlation (ρ_k)/autocorrelation between current returns (r_t) and previous returns (r_{t-k}) of the same series. If the autocorrelation in return series is found (positive or negative) it can be concluded that the return series does not behave in random fashion and hence there is weak form inefficiency in the stock market.

Serial correlation test determines whether the correlation coefficients are significantly different from zero by measuring the correlation coefficient between series returns and lagged returns in the same series. The serial correlation coefficient for lag K can be expressed by the following model

$$\rho_{(K)} = \frac{\text{Covariance}\,(\mu_t\,,\mu_{t-1})}{\sigma(\mu_t).\ (\mu_{t-1})} = \frac{\text{Covariance}\,(\mu_t\,,\mu_{t-1})}{\text{Variance}\,(\mu_t)} \qquad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \quad 4.2$$

Similarly written as

$$\rho_{(K)} = \frac{Cov\,(r_t,\ r_{t-K})}{\sqrt{Var\,(r_t)}\sqrt{Var\,(r_{t-1})}} = \frac{E[(r_{t-}\,\mu)(r_{t-k}-\mu)]}{E[(r_t-\mu)^2]} \qquad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \quad 4.3$$

Where:

$\rho_{(K)}$ = Serial correlation coefficient of time series r_t

r_t= Return on the security at time t

K = Lag of the period

$r_t - K$ = The return after K lags

Var(r_t),Var ($r_t - K$) = Variance on return over time period (t , $t - K$)

Cov (r_t ,$r_t - K$) = The covariance between two returns.

The serial correlation can be estimated using sample autocorrelation coefficient at lag K given as follows:

$$\rho_{(K)} = \frac{\sum_{t-1}^{N-K}(r_t - \bar{r})(r_{t-k} - \bar{r})}{\sum_{t-1}^{N}(r_t - \bar{r})^2} \quad \text{...} \quad 4.4$$

Where:

$\rho_{(K)}$ = Autocorrelation coefficient of lag K

N= Number of observations

K = The time lag

r_t = Security return at time t

$\bar{r}$ = Sample mean of security/stock return

$r_t - k$ = Return after K lags

If autocorrelation coefficients $\rho_{(K)}$ are statistically different from zero, it implies that the stock returns are serially correlated and hence the hypothesis of random walk can be rejected, which is similar to rejection of weak-form efficiency hypothesis. To test the significance of serial correlations of return series in this study the Ljung-Box test has been used.

The test statistic for the Ljung-Box test statistic is given by

$$Q_{LB} = n(n+2)\sum_{k=1}^{m}\frac{\rho^2 k}{n-k} \quad \text{..} \quad 4.5$$

Where by:

Q_{LB} = Test Statistic

n = Sample size or number of observations

ρ_k = Is the k^{th} autocorrelation for lag K or sample autocorrelation at lag K

m = Number of lags being tested.

Using this test statistic, the following null and alternative hypothesis tested are :

H_0 = All autocorrelation up to ρ_k are zero

H_1 = At least one autocorrelation up to ρ_k is not zero.

Given the value of Q_{LB} obtained, the null hypothesis of all autocorrelation up to ρ_k are zero will be rejected if Q_{LB} statistic exceeds critical Q value (x with m degrees of freedom) from Chi-square table (Gujarat 2004) . Alternatively, the P-value can be used to test the hypothesis. The null hypothesis of all zero autocorrelation can be rejected if the P-value obtained from statistical test is less than the chosen level of significance.

3.10.3.2 Runs Test

Unlike serial correlation test, Runs test is a non parametric test, which has also been employed to determine the randomness of the return series in DSE. A run can be defined as a succession of identical events or attribute that may be represented by a letter or another symbols, followed by different successions of events or attributes or no event at all (Ndunguru 2007). Similarly, Spiegel et al (2000) defined run as a 'set of identical (or related) symbols contained between two different symbols or no symbol (such as at the beginning or end of the sequence).

In order to perform the run test, the number of actual runs denoted by (R) is computed and then compared with the expected number of runs (m) which can be estimated as

$$m = \frac{[N(N+1) - \sum_{i=1}^{3} n_i^2}{N} \quad \text{......} \quad 4.6$$

Where:

m = Expected number of runs

N = Total number of return observations

n_i^3 = Sample size of each category of price change

For a large number of observations (N>30), the sampling distribution of m is approximately normal and the standard error of σ_m is given by

$$\sigma_m = \left[\frac{\sum_{i=1}^{3} n_i^2 \left[\sum_{i=1}^{3} n_i^2 + N(N+1)\right] - 2N \sum_{i=1}^{3} n_i^3 - N^3}{N^2\ (N-1)}\right]^{1/2} \quad \text{.................................} \quad 4.7$$

Then, the standard normal z-statistic used in run test is given by:

$$Z = \frac{R \pm 0.5 - m}{\sigma_m} \quad \text{...} \quad 4.8$$

Where:

Z = Z-Test statistic

R = Actual number of runs

M = Expected number of runs

0.5 = Continuity adjustment, in which the sign continuity adjustment is positive

if R≤ m and negative if R ≥ m

The following null and alternative hypotheses are tested by the runs test:

H_0 = The series is random

H_1 = The series is not random

If the number of runs falls below the expected runs i.e. Z-value is negative, it will be an indication of the presence of positive serial correlation and if the number of runs exceeds the expected runs i.e. when Z-value is positive, it will be an indication of the presence of negative serial correlations. The presence of positive serial correlation in return series indicates the positive dependence of stock returns and hence implies the violation of random walk hypothesis i.e. the null hypothesis of randomness of the return series is rejected.

Furthermore the P-value obtained can be used to draw conclusion on the randomness of the return series as tested by run test. If P-value obtained is less than the level of significant (eg. 0.05), the test will be significant at that chosen level of confidence.

3.10.3.3 Unit Root Tests

Unit root tests are among widely statistical tests used to examine the randomness of the return series. Basically, the test is done to investigate the presence of a unit root i.e non stationary of the return series.

Although the presence of a unit root is not a sufficient condition for the random walk, it is a necessary condition for the random behavior of the series. That is the rationale for many researchers to employ unit root tests in testing the Weak form efficiency hypothesis. For example, Ayyappan et al (2013), Sultan et al (2013), Shaker (2013) and Sania (2014) used unit root tests to examine empirical evidence for Efficiency Market Hypothesis (EMH). The series containing unit root is said to be non stationary i.e behaving in random fashion which supports the Weak form efficiency hypothesis.

Although there are various types of unit root tests, only two types of unit root tests namely: the Augmented Dickey-Fuller (ADF) and The Phillips-Perron Test (PP) will be employed in this study to investigate the randomness behavior of the return series.

Both Augmented Dickey-Fuller (ADF) test and the Phillips-Perron Test (PP) use the following null and alternative hypotheses; and these are the hypotheses that have been pursed in employing unit root tests.

H_0 = The series does contain a unit root (Non-Stationary)

H_1 = The series does not contain a unit root (Stationary).

3.10.3.3.1 The Augmented Dickey-Fuller (ADF) Test:

The presence of a unit root test in a series can be tested by ADF test using three differential-form autoregressive equations

$$\Delta Y_t = \gamma y_{t-1} + \sum_{i=1}^{p} \beta_i \Delta \gamma y_{t-1} + u_t \qquad \ldots\ldots\ldots\ldots\ldots\ldots\ldots \quad 4.9$$

$$\Delta Y_t = \alpha_0 + \gamma y_{t-1} + \sum_{i=1}^{p} \beta_i \Delta \gamma y_{t-1} + u_t \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots.. \quad 4.10$$

$$\Delta Y_t = \alpha_0 + \gamma y_{t-1} + \alpha_1 t + \sum_{i=1}^{p} \beta_i \Delta \gamma y_{t-1} + u_t \ldots\ldots\ldots\ldots\ldots\ldots\ldots 4.11$$

Where:

Δ = represent first differences

Y_t = the log of price index

α_0 = the constant

α_1 = estimated coefficient for the trend

t = trend term

p = number of lagged terms

γ and β_i = coefficients to be estimated

u_t = Error term

The presence of deterministic elements α_0 (a drift term) and α_1t (a linear time trend) is what differentiate the three regressions. The first equation (4.9) is concerned with testing a pure random walk model without constant and time trend. The second equation (equation 4.10) is concerned with testing a random walk with drift and the third equation (equation 4.11) regards the testing of random walk with drift and deterministic trend. The following null and alternative hypotheses correspond to these models:

Model 1:

H_0 : Y_t is random walk or $\gamma = 0$

H_1 : Y_t is a stationary process or $\gamma < 0$

Model 2:

H_0 : Y_t is random walk around a drift or ($\gamma = 0, \alpha_0 \neq 0$)

H_1 : Y_t is a level stationary process or ($\gamma < 0, \alpha_0 \neq 0$)

Model 3:

H_0 : Y_t is random walk around a trend or ($\gamma = 0, \alpha_1 \neq 0$)

H_1 : Y_t is a trend stationary process or ($\gamma < 0, \alpha_1 \neq 0$)

After performing the ADF test, if the computed absolute value of the tau statistic | (τ) exceeds the DF or MacKinnon critical tau values, the hypothesis that $\gamma = 0$ is rejected in which case the time series is stationary. If computed absolute value of the tau statistic ($|\tau|$) does not exceed the critical tau value, the null hypothesis is not rejected, in which case time series is non stationary. Gujarat (2004). MacKinnon

(1991 cited in Asteriou and Hall 2007) computed the critical values for ADF test as shown in Table 3.3.

Table 3.3: ADF Critical Values

Model	**1%**	**5%**	**10%**
Δy_{t-1} = yy_{t-1}+ u_t	-2.26	-1.94	-1.62
Δy_{t-1} = α_0 + yy_{t-1}+ u_t	-3.43	-2.86	-2.57
Δy_{t-1} = α_0 $+a_2 t$ + yy_{t-1}+ u_t	-3.96	-3.41	-3.13
Standard critical values	-2.33	-1.65	-1.28

Source : Mackinnon(1991 cited in Asteriou and Hall 2007)

3.10.3.3.2 The Phillips-Perron Test (PP)

This is another test for unit root which was used in this study. According to Gujarat (2004) ‘The ADF test adjusts the DF test to take care of possible serial correlation in error terms by adding the lagged difference terms of the regressand. Phillips and Perron use non parametric statistical methods to take care of the serial correlation in the error terms without adding lagged difference terms’, Asteriou and Hall (2007) asserted that “The PP statistics are just modifications of the ADF t statistics that take into account the less restrictive nature of the error process”. Therefore in performing this test the same regression equations have been used and the same critical values as depicted in Table 3.3 were used to compare with the computed test statistic values obtained. Similar to ADF test, the null hypothesis tested by PP test is the non-stationary of the series i.e the presence of unit a root.

3.10.3.4 Variance Ratio Test

There are several versions of variance ratio tests. However, in testing for the randomness of stock returns, the variance ratio test proposed by Lo and Mackinlay (1988) was employed. The variance ratio test proposed by Lo and Mackinlay (1988) is based on the property that the variance of its increment is linear in the sample interval, that is if the return series follows the random walk process, then the variance of its q-differences would be q times the variance of its first difference which is denoted as;

$$Var(P_t - P_{t-q}) = qVar(P_t - P_{t-1}) \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \quad 4.12$$

Where :

q is any positive integer.

Equation 4.12. Shows how the variance ratio test can thus be estimated

$$VR(q) = \frac{\frac{1}{q}Var(P_t - P_{t-q})}{Var(P_t - P_{t-1})} = \frac{\sigma^2(q)}{\sigma^2(1)} \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \quad 4.13$$

Where:

$\sigma^2(q) = \frac{1}{q}$ the variance of the q-differences

$\sigma^2(1)$ = the variance of the first differences

Lo and Mackinlay (1988) developed the test statistics for both the null hypothesis of homoscedastic increments Z(q) and the heteroscedastic increments ($Z^*(q)$ of the random walk process given by the following equation

$$Z(q) = \frac{VR(q)-1}{[\theta(q)]^{1/2}} \approx N(0,1) \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \quad 4.14$$

Where:

$$\theta(q) = \frac{2(2q-1)(q-1)}{3q(nq)}$$

$$Z^*(q) = \frac{VR(q)-1}{[\theta^*(q)]^{1/2}} \approx N(0,1) \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \quad 4.15$$

Where:

θ^* = the asymptotic variance of the variance of the variance ratio under heteroscedasticity assumption

θ = the asymptotic variance of the variance of the variance ratio under homoscedasticity assumption

$$\theta^*(q) = \sum_{j=1}^{q-1}\left[\frac{2(q-j)}{q}\right]^2 \hat{\delta}(j) \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \quad 4.16$$

Then,

$$\hat{\delta}(j) = \frac{\sum_{t=j+1}^{nq}(P_t - P_{t-1} - \hat{\mu})^2 (P_{t-j} - P_{t-j-1} - \mu)^2}{[\sum_{t=1}^{nq}(P_t - P_{t-1} - \hat{\mu})^2]^2} \ldots\ldots\ldots\ldots \quad 4.17$$

Where:

$\hat{\delta}(j)$ = heteroscedasticity consistent estimator

$\hat{\mu}$ = Average return

P_j = Average price of security at time t.

Based on the test statistic $Z^*(q)$ and $Z(q)$, if variance ratio is greater than one, it will imply that the return series is positive correlated and it can be concluded that the return series are predictable and hence the heteroskedastic and homoskedastic random walk can be rejected and if the variance ratio is less than one it will suggests that the return is negative serial correlated.

3.10.4 Statistical Tests for Testing Calendar Anomaly

In determining the empirical evidence for Day of the week effect and Month of the year effect in Dar es salaam Stock Exchange, two models were employed, the Ordinary least square (OLS) and Generalized Autoregressive Conditional Heteroscedastic (GARCH 1,1) model. These models are among the widely used approaches in calendar effects studies. For examples, Dong (2012) used both OLS regression and GARCH (1,1). Similarly, Rahman (2009) testing the day of the week effect in Dhaka Stock Exchange employed both OLS regression and GARCH (1,1).

3.10.4.1 Day-of-the Week Effect Using OLS- REGRESSION MODEL

To determine the day of the week effect, the OLS model was employed with the following specifications.

$$R_t = \beta_0 + \beta_1 D_1 + \beta_2 D_2 + \beta_3 D_3 + \beta_4 D_4 + \beta_5 D_5 + \varepsilon_t \quad \text{……………………. 4.18}$$

Where:

R_t = The index returns on day t

β_0 = The intercept which presents Monday.

D_2 = Dummy variable equal to 1 if t is Tuesday and 0 otherwise

D_3 = Dummy variable equal to 1 if t is Wednesday and 0 otherwise

D_4 = Dummy variable equal to 1 if t is Thursday and 0 otherwise

D_5 = Dummy variable equal to 1 if t is Friday and 0 otherwise

$\beta_2, \beta_3, \beta_4, \beta_5$ = Coefficients to be estimated

ε_t = error term

The dummy variable for Monday has been dropped from equation 4.18 to avoid perfect collinearity problem i.e. The dummy trap problem. The following Null hypothesis and Alternative hypotheses were tested:

$H_0 : \beta_{2,} = \beta_3 = \beta_4 = \beta_5 = 0$

$H_1 : \beta_i \neq 0$ for i = 1,…,5.

If the null hypothesis is rejected then it implies that the stock returns exhibit some form of the day of the week seasonality. The use of conventional OLS regression has been warned due to the drawbacks of this approach which may result into the wrong conclusion/inference. The major problem of OLS has been depicted as;

(i) The residual obtained from the regression model may be auto correlated.

(ii) Heteroskedasticity problem may arise

In eliminating the first problem of autocorrelation of residual, the lagged values of the return variable was included in equation 4.18, hence the improved equation which was actually estimated is depicted as follows:

$$R_t = \beta_0 + \beta_2 D_2 + \beta_3 D_3 + \beta_4 D_4 + \beta_5 D_5 + \sum_{i=1}^{n} \beta_i \ R_{t-i} + \varepsilon_t \ldots\ldots.. \qquad 4.19$$

Where n = is the lag order.

3.10.4.2 Day of the Week Effect Using GARCH (1,1) Model

The second problem of heteroscedasticity can be addressed by allowing variance of errors to be time dependent and include a conditional heteroskedasticity that capture time variation of variance in return. In this study, the simplest form of autoregressive conditional heteroscedastic model- GARCH (1,1) has been employed with the following specification;

Mean Equation:

$R_t = \beta_0 + \beta_2 D_2 + \beta_3 D_3 + \beta_4 D_4 + \beta_5 D_5 + \sum_{i=1}^{n} \beta_i R_{i-1} + \varepsilon_i$……… 4.20

Variance Equation:

$h^2 = w + \alpha\varepsilon_{t-1}^2 + \beta h_{t-1}^2$

Where:

h^2 = conditional variance

W = constant

α *and* β = lagged squared error term and conditional variance respectively

3.10.4.3 Month of the Year Effect using OLS Regression Model

The month of the year effect will be examined through regression model with the following specification

$R_t = \sum_{i=1}^{12} \beta_i D_{it} + \varepsilon_t$ …………………………………………………………4.21

Where:

R_t = Index return on month t

D_{it} = Are dummy variable so that

D_{1t} = 1 if month t is January and zero otherwise

D_{2t}= 1 if the month is February and zero otherwise

D_{3t}= 1 if the month is March and zero otherwise and so forth

β_i = (where i=1,2,….12) parameters to be estimated

ε_t= is the error term

The hypotheses tested were:

$H_0 = \beta_2 = \beta_3 \ldots\ldots\ldots\ldots\ldots\beta_{12} = 0$

$H_1 = \beta_i \neq 0$, for i=2………12

If null hypothesis is rejected, then stock return exhibit seasonality in the month of the year effect. As discussed earlier, the regression model may have the problem of autocorrelation of residual. To address this drawback, the autoregressive terms were included in equation 4.21.and in order to avoid the dummy trap problem, the dummy for January was dropped and hence the model estimated was specified as

$$R_t = \beta_0 + \sum_{i=1}^{11} \beta_i D_{it} + \sum_{i=1}^{n} \beta_i R_{i-1} + \varepsilon_t \ldots\ldots 4.22$$

3.10.4.4 Month of the Year Effect using GARCH (1,1) Model

The month of the year effect was empirically determined through GARCH (1,1) with the following mean equation and variance equations. As discussed earlier, the GARCH model helps in solving the problem of heterodescadisticity.

Mean equation:

$$R_t = \beta_0 + \sum_{i=1}^{11} \beta_i D_{it} + \sum_{i=1}^{n} \beta_i R_{i-1} + \varepsilon_t \ldots\ldots 4.23$$

Variance equation:

$$h = w + \alpha\varepsilon_{t-1}^2 + \beta h_{t-1} + \sum_{1=2}^{11} \theta_i L_{it} \ldots\ldots 4.24$$

Where:

L_{it} = Monthly dummies

h_t = conditional variance

α and β = lagged squared error terms and conditional variances respectively

3.11 Applying OLS Regression and GARCH (1,1) Model (Assumptions)

Applying the regression model for statistical analysis requires non-violation of its assumptions. Wooldridge (2009) described the following classical linear Model assumptions for the time series regression.

Assumption 1: Linear in parameters

The classical linear regression time series model assumes that 'The stochastic process follows a linear model (i.e Linear in parameters).

i.e $Y_t = \beta_0 + \beta_1 X_t + \ldots\ldots + \beta_k X_{tk} + U_t$…………………………………………4.25

This implies that the model must have linear coefficients. The assumption or implication is not violated in this study as the regression equations 4.19 and4.22 employed in this study show that the parameters (i.e coefficients) are linear, which means the model is linear in parameters.

Assumption 2: No perfect Collinearity

This assumption requires that in a time series process the independent variable must not be constant- there must be at least some variation in the sample used. Besides, there should not be a perfect linear combination between independent variables. To avoid the violation of this assumption, both dummies for Monday and January were dropped from equation 4.18 and 4.21 respectively. Hence it can be concluded that this assumption it is also not violated, since dropping the dummy variables has helped to solve the perfect collinearity problem.

Assumption 3: Zero Conditional Mean

This assumption states that for each time t, the mean (expected value) of error term (u_t) given any value of independent x for all time, periods must be equal to zero.

Mathematically it can be presented as:

$$E(U_t|X) = 0\ ,\ \ t = 1,2 \ldots\ldots n$$

The assumption implies that the error at time t (u_t) is not correlated with each explanatory variable in every time period. (Wooldridge 2009). In relation to this study, this assumption is also not violated.

Assumption 4: Homoskedasticity

According to this assumption, given conditional on x, the variance of error term for all time t is constant.

Mathematically: Var (u_t | x) = Var (u_t) = σ^2

If this assumption does not hold, then the error terms are said to be heteroskedasticity. Therefore, it is very important to conduct a post diagnostic test to determine if the model suffers from heteroskedasticity. In this study after running the regression model, residuals were analyzed to check the presence of heteroskedasticty using the Breusch-Pagan Godfrey test. The following null and alternative hypothesis were tested by Breusch-Pagan-Godfrey test.

H_0 : No heteroscadisticity in the residuals

H_1: There is heteroscadisticity in the residuals

The findings of this test have been presented in Table 4.14 and 4.24

Assumption 5: No serial correlation

The assumption states that given the conditional on X, the error terms in two different time periods are uncorrelated with one another.

Mathematically: Corr (u_t, u_s) = 0 for all t $\neq$ s

There are several statistical tests which can be used to determine if the error terms are correlated. However, in this study the Ljung Box test and Breusch-Godfrey serial correlation LM test have been used. The null and alternative hypotheses tested by this test are:

H_0 : There is no serial correlation in residuals

H_1: There is serial correlation in the residuals

The results of this test have been presented in Table 4.13, 4.17 and 4.23.

Assumption 6: Residuals are normally distributed

According to this assumption, the errors (u_t) are independent of X and are independently and identically distributed as normal (0, σ^2) Wooldridge (2009 p. 351).To determine the normality of the residuals, the study has employed the Jacque bera test. The following null and alternative hypotheses are tested by this test.

H_0 : Residual are normally distributed

H_1: Residuals are not normally distributed

The findings of this test are shown in Table 4.15 and 4.19.

3.12 Applying GARCH (1,1) Model

Similar to OLS regression model, applying the GARCH (1,1) model also requires the following assumptions to be met in order for the model to be a good model.

(i) **No serial correlation in residual**- similar hypotheses and the same statistical tests as in OLS regression have been applied to determine the presence of correlation in the residual.

(ii) **Normality of the residual**- the same test as in OLS regression was conducted to determine the normality assumption in the residuals.

(iii) **Absence of the arch effect**- The presence of arch effect in the residual was determined using Heteroskedasticity test. The following null and alternative hypotheses were tested;

H_0 : No arch effect

H_1: There is arch effect

The findings of this test are reported in Table 4.18 and 4.29

3.13 The Rationale of Statistical Tests Choice

Four different statistical tests (Serial correlation test- The ljung box test, runs test, unit root tests and variance ratio test) have been used to test the first null and alternative hypotheses of this study. In determining the empirical evidence for the calendar effects (day of the week effect and month of the year effect), which is the second and third null and alternative hypotheses of the study, two techniques have been used – Ordinary Least Square regression analysis and the GARCH (1,1) model. Different methods were used to ensure that consistent and reliable results are obtained. The rationale for choosing these particular statistical tests is that these techniques have been proven to produce consistent results and they are generally good and well accepted techniques.

As indicated in the empirical literature review, these econometric models have been used extensively in many similar studies worldwide. Hence, it was necessary to follow the examples from previous studies in the field by using similar methodology to ensure the validity and reliability of the empirical evidence obtained.

3.14 Validity

Validity has been defined as the extent to which the data collection methods accurately measure what they were intended to measure. Moreover, validity implies the extent to which research findings are really about what they profess to be about (Saunders et al 2008). To ensure the validity of data in this study, the study collected the data from the original source – the Dar es Salaam stock exchange office.

Furthermore, the study decided to use the daily and monthly market index (DSEI) instead of individual stocks. The use of market indices helps in solving the infrequence trading problems as compared to individual stocks which normally suffers from this problem because some of the stocks are not traded often.

3.15 Reliability

Saunders et al (2008) defined reliability as "the extent to which data collection techniques or technique will yield consistent findings, similar observations would be made or conclusion reached by other researchers.". The study has addressed the issue of reliability by employing the most reliable statistical tests such as non parametric runs test, variance ratio test and unit root test. The empirical literature reviews section has revealed that all the statistical tests employed in this study have been used previously by other researchers and produced consistent results. Therefore, it is believed that by employing the same econometric models, the findings obtained are reliable and consistent.

3.16 Data Analysis

As the study involves the testing of hypothesis through various statistical tests, therefore data were analyzed with the help of two statistical packages namely; EVIEWS and SPSS. Only runs test was computed using SPSS, and the rest of the statistical tests were computed using EVIEWS program version. Both quantitative and qualitative approaches have been used in interpreting and presenting the results of the analysis.

CHAPTER FOUR

FINDINGS /RESULTS AND DISCUSSION

4.1 Chapter Overview

This chapter presents the results obtained from various statistical tests used in this study and discusses the findings obtained with reference to other empirical evidence obtained from previous studies worldwide.

4.2 Descriptive Statistics

According to Fama (1970), one of the assumptions of a random walk model is that the return series is normally distributed. Therefore, it is very important to analyze the distribution of the returns series used in the study as violation of normality assumption could be a signal for the violation of a random walk model. To study the distribution of the returns series employed in this study, descriptive statistics were used followed by Kolmogorov Smirnov Test. The descriptive statistics of the daily and monthly returns for Tanzania All Index (DSEI) have been presented in Table 4.1.

Table 4.1: Descriptive Statistics Results

DSEI Returns		
	Daily Return	**Monthly Return**
Mean	1.000067	1.001396
Median	1.000000	1.000502
Maximum	1.012218	1.012863
Minimum	0.994723	0.994878
Std.Dev	0.000768	0.003499
Skewness	3.293301	1.426798
Kurtosis	62.05578	5.112525
Sum	1546.103	74.10329
Sum sq Dv	0.000912	0.000894
Observation	1546	74

Source: Analyzed Data

The results from Table 4.1, show that the Kurtosis of daily returns is 62.05578 and Kurtosis of monthly returns is 5.112525.The Kurtosis measure the sharpness or the flatness of the distribution series. The normal distribution series has a kurtosis of 3. It is clear from the findings that both the daily return series and monthly return series are leptokurtic relative to normal since their kurtosis has exceeded 3.

The asymmetric distribution of the series from its mean as measured by skewness, shows that the daily and monthly returns series are both heavier, right tailed as their skewness are positive. A skewness of zero indicates that a series is normally distributed. However, since the skewness of both returns is different from zero (i.e 3.293301 and 1.426798 respectively) it can be concluded that both returns series are not normally distributed.

4.3 Kolmogorov Smirnov Test

In order to confirm the nature of the distribution of return series employed in this study, a test of goodness of fit known as Kolmogorov Smirnov test was also used. The findings of this test are reported in Table 4.2.

Table. 4.2: One-Sample Kolmogorov- Smirnov Test

		DSEI Daily	DSEI Monthly
N		1546	74
Normal Parameters[a]	Mean	0.725744	0.635135
	Std. Deviation	0.446283	0.4846782
Most Extreme Differences	Absolute	0.456	0.409
	Positive	0.269	0.270
	Negative	-0.456	0.409
Kolmogorov-Smirnov Z		17.942	3.521
Asymp. Sig. (2-tailed)		0.000	0.000
a. Test distribution is Normal.			

Source: Analyzed Data

The results from the test show that the P-value obtained is 0.000, which is below alpha and therefore the test is statistically significant at 1% , 5% as well as 10% levels. This imply that the null hypothesis of returns series follow a normal distribution as measured by Kolmogorov Smirnov test can be rejected in favour of alternative hypothesis which profess that 'return series do not follow normal distribution' and hence it can be concluded that both daily and monthly returns series do not follow normal distribution pattern.

These findings confirm the earlier findings from descriptive statistics. The violation of normality assumption is not a strange phenomenon in weak form efficiency and calendar effects studies. Several studies rejected the normality hypothesis. For example, Chaity and Sharmin (2012) studied the efficiency measures of capital market a case of Dhaka Stock Exchange using all share price index and DSE general index and employing Kolmgorov Smirnov test, concluded that both indices (ASPI and DSEGI) did not follow normal distribution.

Similarly, Ayyapan et al (2013) conducted a study on empirical analysis of weak form efficiency the evidence from National Stock Exchange of India Ltd using descriptive statistics to explain the characteristics of the data used. The study found that all nine indices included in the study did not follow normal distribution.

Irfan et al (2010) investigated the weak-form efficiency of an emerging market using parametric tests in Karach Stock Market of Pakistan and using the daily and monthly closing prices of KSE-100 indices for the period covering Jan 1999 to August 2009. The findings show that both daily and monthly return series did not follow normal distribution.

Normally, when the returns series are not normally distributed, the non-parametric statistical tests such as runs tests which do not require normal distribution, assumptions are more suitable to be used in the analysis rather than parametric tests, such as autocorrelation tests and unit root tests. Despite this fact, many studies in efficient hypotheses and calendar effects have employed both parametric and non parametric tests regardless of the rejection of normality assumption, this could be due to the fact that under the large sample (i.e. n>30) the normality assumption can be relaxed. Following previous examples from other studies and based on this argument, this study also decided to use both parametric and non parametric statistical tests.

4.4 Objective One: To Determine the Empirical Evidence for the Weak-form Efficiency Hypothesis for DSE

In determining the empirical evidence for weak-form efficiency for the Dar es salaam Stock Exchange (DSE), which is the first objective of this study, various statistical tests were used namely: Serial correlation test- The Ljung- Box test, Runs test, Unit root tests and the Variance ratio test. The following are the results obtained from these statistical tests.

4.4.1 Serial Correlation Test – The Ljung-Box Test

This was the first statistical test to be employed, the test examines if there is correlation of return series between time t and time t-1. The findings of the Ljung-Box test are presented in Table 4.3.

Table 4.3: The Ljung-Box Test Results

LAG	AC	PAC	Q-Stat	Prob
1	-0.082	-0.082	10.335	0.001
2	0.052	0.045	14.5	0.001
3	0.026	0.034	15.555	0.001
4	0.030	0.032	16.919	0.002
5	-0.024	-0.022	17.792	0.003
6	0.011	0.003	17.971	0.006
7	0.024	0.025	18.848	0.009
8	0.031	0.035	20.305	0.009
9	0.021	0.025	20.964	0.013
10	-0.057	-0.06	25.989	0.004
11	-0.022	-0.038	26.764	0.005
12	0.018	0.017	27.258	0.007
13	-0.024	-0.014	28.153	0.009
14	-0.012	-0.012	28.384	0.013
15	0.037	0.033	30.506	0.010
16	-0.042	-0.039	33.283	0.007
17	-0.039	-0.045	35.619	0.005
18	0.052	0.054	39.908	0.002
19	-0.026	-0.009	40.928	0.002
20	0.042	0.039	43.761	0.002
21	-0.004	-0.001	43.783	0.002
22	0.016	0.009	44.18	0.003
23	0.013	0.016	44.433	0.005
24	-0.007	-0.009	44.516	0.007
25	0.018	0.024	45.052	0.008
26	0.046	0.045	48.356	0.005
27	0.020	0.013	48.974	0.006
28	-0.056	-0.057	54.000	0.002
29	-0.040	-0.058	56.518	0.002
30	0.025	0.018	57.481	0.002
31	-0.044	-0.025	60.484	0.001
32	0.014	0.014	60.778	0.002
33	0.016	0.013	61.159	0.002
34	-0.008	-0.01	61.259	0.003
35	-0.011	-0.01	61.454	0.004
36	0.045	0.057	64.729	0.002

Source: Analyzed Data.

The Ljung-Box was conducted under 36 lags. The results show that the P-values for all lags are below alpha (0.05), thus the test is statistically significant at 5% level. Therefore the null hypothesis of 'all autocorrelation up to 36 lags are zero" is rejected in favour of an alternative hypothesis.

The results indicate that there is negative correlation for lag 1, 5, 10, 11, 13, 14, 16, 17, 19, 21, 24, 28, 29, 31, 34 and 35, while for the remaining lags return series are positively correlated. The correlation of the return in time t and time t-1 implies that the daily return series in DSE does not behave randomly as there is a degree of predictability for the future daily returns in DSE.

Based on the findings of the Ljung Box , the first null hypothesis of this study which says that ‘The DSE is weak form inefficient market’ is not rejected and therefore it can be concluded that Dar es Salaam Stock Exchange is a weak-form inefficient market which implies daily stock returns do not incorporate instantaneously all historical information hence trading strategy such as technical analysis may be valuable in DSE considering other factors.

Similar findings have been reported in the recent study by Raquib and Alom(2015), studying weak form efficient in Dhaka Stock Exchange , using a sample size of 2924 daily observation of price indices for DSE general index (DGEN) covering period from 2001 to 2013. Employing serial correlation test, the study found that there were movements of autocorrelation at various lags, hence it was concluded that DSE was not weak-form efficient market following the presence of serial correlation in the return series.

Similarly, Alkhatib and Harsheh (2013), tested the weak form efficiency for Palestine Exchange (PEX), using serial correlation, unit root and runs test on sample of daily closing index returns of the seven indices in PEX for the period covering between Jan 1998 and October 2012. The findings from serial correlation test showed that at lag 1 the return of all seven indices employed in the study were serially correlated and therefore the market was regarded as weak-form inefficient market.

Investigating the random walk hypothesis prices in the Nairobi stock exchange and employing the serial correlation test and runs tests Muthama and Mutothya (2013), found that the daily price returns for eighteen companies which constituted the Nairobi Stock Exchange (NSE 20) for the period covering July 2008 to June 2011 , did not behave in random fashion and hence the study concluded that the future return price could be predicted on the basis of historical prices i.e NSE was weak-form inefficient market for the period investigated.

These findings are similar to the findings of this study, however, the findings contradict the earlier results on the efficiency of Nairobi Stock Exchange reported by Dickson and Murugu (1994), Githiga (2008) and Anyumba (2010) as cited in Muthana and Mutothya (2013) which failed to find the empirical evidence against Weak form efficiency hypothesis.

4.4.2 Runs Test

This is a non parametric test which was employed to examine whether the daily returns series behave randomly. The results for the runs test are shown in Table 4.4.

Table 4.4: Runs Test Results

	DSEI Return
Test Value[a]	1
Cases < Test Value	424
Cases >= Test Value	1122
Total Cases	1546
Number of Runs	577
Z	-2.520
Asymp. Sig. (2-tailed)	0.012
a. Median	

Source: Analyzed Data

As shown in Table 4.4, the Z- statistic value is negative (-2.520), which indicates that observed runs/ actual runs are less than expected runs. This implies that there is positive serial correlation in daily return series (i.e the series does not behave in random fashion).

Furthermore, the P-value obtained (0.012) is less that 5% (alpha) , hence the test is statistically significant at 5% level and therefore the null hypothesis of 'series is random' as tested by runs test is rejected in favour of alternative hypothesis .Based on these findings, the conclusion drawn from runs test is that the daily return series does not behave randomly hence DSE is a weak form inefficient market. This conclusion is similar to the conclusion drawn by previous test (Serial correlation test).

Similar findings have been found by Ogege and Mojekwu (2013) investigating the random walk hypothesis in the Nigerian Stock Exchange using monthly price index from 1985 to 2010 and employing runs test and other statistical tests. The results from runs test showed that there was high degree of autocorrelation among the variables as the test was statistically significant at all levels (1%, 5%, 10%) and the null hypothesis of randomness of the return series was rejected hence the Nigerian Stock Exchange was said to be Weak-form inefficient market for the particular period studied.

Using runs test on daily closing values of S&P CNX indices and CNX NIFTY junior indices for the period covering Jan 2000 and March 2013, Kumar and Singh (2013) studied the weak-form efficiency on selected Indian stock indices (CNX NIFTY and S&P NIFTY) and found that the randomness hypothesis as tested by runs test was rejected and hence it was concluded that Indian Stock Market did not exhibit weak form market efficiency.

Similarly, Mollah (2006) tested the weak-form market efficiency in emerging market of Botswana Stock Exchange using daily returns series of BSE for the period between 1989 and 2005. Employing non parametric runs test, the results depicted that the daily return series violated the random walk model and therefore the BSE was declared to be a weak-form inefficient market.

4.4.3 Unit Root Test

Although there are several unit root tests, the study employed only two types of unit root tests: namely Augmented Dickey-Fuller test and Phillip Perron Test. The following are the results obtained from these statistical tests.

4.4.3.1 Augmented Dickey-Fuller Test

The results of this test for both equations; intercept and trend and intercept are reported in Table 4.5 and Table 4.6 respectively.

Table 4.5: Augmented Dickey Fuller Test: (Intercept)

Null Hypothesis:	DSEI_RETURNS has a unit root		
Exogenous:	Constant		
Lag length:	0 (Automatic - based on SIC, maxlag=23)		
		t-Statistic	**Prob***
Augmented Dickey - Fuller test statistic		-42.61300	0.0000
Test critical values:	1% level	-3.434376	
	5% level	-2.863205	
	10% level	-2.567705	

Source: Analyzed Data

Table 4.6: Augmented Dickey Fuller Test Results: (Trend & Intercept)

Null Hypothesis:	DSEI_RETURNS has a unit root		
Exogenous:	Constant, Linear Trend		
Lag length:	0 (Automatic - based on SIC, maxlag=23)		
		t-Statistic	**Prob***
Augmented Dickey - Fuller test statistic		-42.91231	0.0000
Test critical values:	1% level 5% level 10% level	-3.963995 -2.412721 -2.128334	

Source: Analyzed Data

Using max lag of 23 based on Schwarz Information Criterion (SIC) ,the results show that the absolute value of t- Statistic for both intercept and intercept and trend are greater than the absolute value of Mackinnon critical tau value at 1%, 5%, and 10% level of significant respectively, hence the null hypothesis of presence of unit root in a return series is rejected.

These results mean that the daily return series do not have a unit root (i.e the series is stationary) and therefore does not behave in random fashion. Although the presence of a unit root is not a sufficient condition for the random walk, it is a necessary condition, which implies that the series cannot behave randomly if it does not have a unit root. Based on these results, the first null hypothesis of this study about the efficiency of DSE is not rejected therefore it can be concluded that DSE is a weak-form inefficient market.

Recently, Sania and Rizwan (2014) found similar results while testing weak form efficiency of capital markets, a case of Pakistan using daily data of KSE-100 index for two years from 2009 to 2010 and employed the Augmented Dickey Fuller tests as one of the statistical tests. They found that there was a positive correlation in KSE-

100 index and therefore based on the results of ADF test, they concluded that the KSE was not behaving in random fashion and hence it was not a weak form efficient market.

Similarly, Shaker (2013) investigated the weak-form efficiency of Finnish and Swedish stock markets using a sample of daily OMX Helsinki index and OMX Stockholm index for the period of ten years. Using the Augmented Dickey Fuller test among other statistical tests, the findings of the study showed that the return series did not follow random walk for both Finnish and Swedish stock exchange hence the conclusion drawn was that both these markets were not a weak-form efficient markets.

4.4.3.2 The Phillips-Perron Test (PP)

In order to confirm the stationarity of the return series, the study also employed this test. Similar to the ADF test, the same null and alternative hypotheses were tested. The results for the PP test are shown in the Table 4.7 and Table 4.8.

Table 4.7: The PP Test Results: Intercept

Null Hypothesis:	DSEI_RETURNS has a unit root		
Exogenous:	Constant		
Bandwidth:	10 (Newey-West automatic) using Bartlett		
		Adj.t-Statistic	**Prob***
Phillips-Perron test statistic		-42.47733	0.0000
Test critical values:	1% level	-3.434376	
	5% level	-2.863205	
	10% level	-2.567705	

Source: Analyzed Data

Table 4.8: The PP Test Results: Trend & Intercept

Null Hypothesis:	DSEI_RETURNS has a unit root		
Exogenous:	Constant		
Bandwidth:	7 (Newey-West automatic) using Bartlett		
		Adj.t-Statistic	**Prob***
Phillips-Perron test statistic		-42.76451	0.0000
Test critical values:	1% level	-3.963998	
	5% level	-3.412723	
	10% level	-3.128335	

Source: Analyzed Data

As Tables 4.7 and 4.8 show, for both equations – intercept and trend & intercept, absolute values of test statistic are greater than Mackinnon critical value at all levels (i.e 1%, 5% and 10%), hence the null hypothesis tested by PP test is rejected and it is concluded that the daily return series is stationary (i.e does not behave randomly). A similar conclusion can be drawn using the P-values obtained.

The results of PP test confirm the earlier results obtained by ADF test; both have failed to reject the first null hypothesis of this study. Therefore once again it is concluded that DSE is not a weak-form efficient market. Srinivasan (2010) found similar results when investigating the weak-form efficiency hypothesis for Indian Stock markets using daily observations for two major indices (S&P CNX NIFTY and SENSEX) for the period from July 1997 to August 2010. Applying the unit roots test (Phillip Perron test and ADF), the findings of PP tests clearly revealed that the null hypothesis of unit root was rejected and therefore suggested that Indian Stock market did not follow random walk model. It was therefore not a weak-form efficient market.

Similarly, Abushammaala (2011) studied the weak-form efficiency of Palestine Exchange using daily prices of General index and Al-Qids index for the period covering Jan 2007 to December 2010. The findings from PP test showed that the return series of PEX did not behave randomly and therefore the market was a weak form inefficient market

4.4.4 Variance Ratio Test

To confirm the results of all previous statistical tests, regarding the empirical evidence of weak-form efficiency in DSE, the study also employed the more robust statistical test- Variance ratio test according to (Lo and Mackilay 1988). The results for this test under both assumptions; heteroskedasticity and homoskedasticity are presented in Table 4.9 and 4.10 respectively.

Table 4.9: Variance Ratio Test Results - Heteroskedasticity Assumption

Null Hypothesis:		DSEI_RETURNS is a martingale		
Included observations:		1545 (after adjustments)		
Heteroskedasticity estimates robust standard error estimates				
User-specified lags:		2 4 8 16		
Joint Tests		**Value**	**df**	**Probability**
Max|z| (at period 2)*		4.768365	1545	0.0000
Individual Tests				
Period	**Var.Ratio**	**Std.Error**	**z-Statistic**	**Probability**
2	0.438783	0.117696	-4.768365	0.0000
4	0.224973	0.182861	-4.238348	0.0000
8	0.112709	0.223627	-3.967720	0.0001
16	0.059993	0.258465	-3.636880	0.0003
*Probability approximation using studentized maximum modulus with parameter value 4 and infinite degrees of freedom.				

Source: Analyzed Data

Table 4.10: Variance Ratio Test Results – Homoskedasticity Assumption

Null Hypothesis:	DSEI_RETURNS is a random walk			
Included observations:	1544 (after adjustments)			
Standard error estimates assume no heteroskedasticity				
Use biased variance estimates				
User-specified lags:	2 4 8 16			
Joint Tests		**Value**	**df**	**Probability**
Max |z| (at period 2)*		22.07445	1544	0.0000
Wald (Chi-square)		493.0789	4	0.0000
Individual Tests				
Period	**Var.Ratio**	**Std.Error**	**z-Statistic**	**Probability**
2	0.438220	0.025449	-22.07445	0.0000
4	0.224091	0.047611	-16.29672	0.0000
8	0.111691	0.075280	-11.800050	0.0000
16	0.058834	0.112020	-8.401733	0.0000
*Probability approximation using studentized maximum modulus with parameter value 4 and infinite degrees of freedom.				

Source: Analyzed Data

The results of variance ratio test (Lo and Macklay 1988) under heteroskedasticity assumption as depicted in Table 4.9, shows that the P-value for the joint test is below alpha (0.05) and therefore the test is statistically significant at 5% , which suggests the rejection of the null hypothesis (DSEI_RETURNS is a martingale) of the random walk in daily return series. Similarly, the individual test for all period (2,4,8,16) strongly reject the random walk null hypothesis as the P-values are below 5% level of significance.

Under homoskedasticity assumption (Table 4.10) the results show that the joint tests (i.e tests of joint null hypothesis for all periods) strongly reject the null hypothesis of a random walk with the P-value of 0.0000 which is obtained using the studentized maximum modulus with infinite degrees of freedom.

Considering the individual tests (i.e test of individual period) for period 2,4,10 and 16 the P-value for all period (0.0000) are below alpha (0,05), this also rejects the null hypothesis for random walk under homoskedsticity assumption.

Based on the results of variance ratio test, it is concluded that the daily return series of DSE does not behave in random fashion and hence the first null hypothesis of the study cannot be rejected and it is concluded that DSE is not a weak-form efficiency market. The same conclusion has been reached by various studies, for example Nisae and Hanif (2011) who examined the weak-form efficiency hypothesis on the four major stock exchanges of South Asia (India, Pakistan, Bangladesh and Sri Lanka).

They used monthly, weekly and daily historical index covering a period of 14 years and applying four statistical tests which include the Variance ratio test. The results of variance ratio test (Lo and Mackilay 1988) done under both homosdedasticity and heteroskedsticity revealed that none of the four major stock markets of South Asia followed random walk and hence the markets were declared weak form inefficient for the particular period.

Besides, Haque et al(2011) investigated the weak form efficiency of Pakistan stock market using weekly return of KSE-100 index over the period between 2000 and 2010. The study used various statistical tests including the variance ratio tests (Lo and Mckanlay 1988). The results of variance ratio test under homoskedasticity and heteroskedasticity assumptions showed that the test was significant at 1% level which clearly rejected the random walk hypothesis and therefore concluded that the

Pakistan stock market was not weak-form efficient market for the period between 2000 and 2010.

The findings of all four statistical tests (Serial correlation test, Runs test, Unit root test and Variance ratio tests) employed in this study are consistent , both have revealed that the daily return series of DSEI do not behave randomly and hence based on these findings the first null hypothesis of this study which states that ‘The Dar es salaam Stock Exchange (DSE) is a weak form inefficient market” cannot be rejected, and therefore it is concluded that DSE is not a weak form efficient market.

4.5. Objective Two: To determine the Empirical Evidence for Day of the Weak Effect

In finding the empirical evidence for day of the week effect which is the second objective of this study, two econometric models were employed; the OLS regression model and the GARCH (1,1) model. However, before employing these models it was necessary to conduct the preliminary analysis – to determine if the return series employed were stationary, since the application of the model required the series to be stationary.

4.5.1 Preliminary Analysis – Augmented Dickey Fuller Test

To determine if the return series employed were stationary or not, the study employed the Augmented Dickey Fuller test .The test was conducted using both intercept and Trend & intercept. The results for the test are reported in Table 4.11 and 4.12.

Table 4.11: Augmented Dickey Fuller Test: Intercept

Null Hypothesis:	DSEI_RETURNS has a unit root		
Exogenous:	Constant		
Lag length:	0 (Automatic - based on SIC, maxlag=23)		
		t-Statistic	**Prob***
Augmented Dickey - Fuller test statistic		-42.61300	0.0000
Test critical values:	1% level 5% level 10% level	-3.434376 -2.863205 -2.567705	

Source: Analyzed Data.

Table 4.12: Augmented Dickey Fuller Test Results: Trend & Intercept

Null Hypothesis:	DSEI_RETURNS has a unit root		
Exogenous:	Constant, Linear Trend		
Lag length:	0 (Automatic - based on SIC, maxlag=23)		
		t-Statistic	**Prob***
Augmented Dickey - Fuller test statistic		-42.91231	0.0000
Test critical values:	1% level 5% level 10% level	-3.963995 -2.412721 -2.128334	

Source: Analyzed Data.

From Table 4.11 and 4.12, it is clear that the null hypothesis of the presence of unit root in daily return series is strongly rejected as the results show that the absolute value of t- Statistic for both equations- Intercept and trend & intercept are greater than the absolute value of Mackinnon critical tau value at 1%, 5%, and 10% level of significance respectively, and therefore it is concluded that the daily return series is stationary.

4.5.2. Post Diagnostic Tests: OLS Regression Analysis

After confirming that the daily return series is stationary, the study went on to run OLS regression as per equation 4.19. However, before interpreting these results it is very crucial to determine if the regression model employed is a good model. This was achieved through Post diagnostic tests. After running the regression model, residuals obtained were analyzed to determine the presence of serial correlation, heteroskedasticity and the violation of normality assumption. The following post diagnostic tests were employed: Breusch-Godfrey serial correlation LM test, Heteroskedasticity Test- Breusch-Pagan-Godfrey and the normality test – The Jarque-Bera test. The findings of these tests are shown in table 4.13, 4.14 and 4.15 respectively.

4.5.2.1 Post Diagnostic test – Breusch-Godfrey Serial Correlation LM Test

This test was conducted to determine if residuals were correlated since the correlation of the residuals would imply that the model is not a good model. The findings of this test are reported in Table 4.13.

Table 4.13: Breusch-Godfrey Serial Correlation LM Test: Results

F-statistic	2.584023	Prob. F(2,1536)	0.0758
Obs*R-squared	5.177542	Prob. Chi-Square(2)	0.0751
Included observations: 1544			

Source: Analyzed Data

The results show that the P-value for both F-statistic and the Chi-Square are above the alpha (0.05) which means that the test is insignificant at 5% level and therefore the null hypothesis ‘there is no serial correlation’ as tested by BG-LM test cannot be rejected. These results imply that the model might be a good one since the residuals are not correlated. However, to conclude whether the model employed is good, the researcher had to continue with other post diagnostic tests.

4.5.2.2 Post Diagnostic Test: Heteroskedasticity Test-The Breusch-Pagan-Godfrey

The linear regression analysis requires the homoskedasticity assumption of the residuals. Therefore this test was conducted to check the violation of this assumption i.e the heteroskedasticity of the residuals. The results of the test are shown in Table 4.14.

Table 4.14: Heteroskedasticity Test: Breusch-Pagan-Godfrey

F-statistic	0.472559	Prob. F(5,1538)	0.5653
Obs*R-squared	2.368373	Prob. Chi-Square(5)	0.5644
Included observations: 1544			

Source: Analyzed Data.

As shown in Table 4.14, the P-value for Chi-Square and F-statistic are above 0.05 (the alpha), which implies that the test is statistically insignificant at all levels (1% , 5% and 10%) and therefore the null hypothesis of this test which states that ‘No heteroskedasticity in the residuals’ cannot be rejected. It can, therefore be concluded that there is no heteroskedasticity in the residuals and this is a sign of a good model.

4.5.2.3 Post Diagnostic Test: Normality Test – The Jarque – Bera

To confirm the goodness of fit model, the study had to conduct the normality test using the Jarque Bera test. The results of the test are depicted in Table 4.15.

The findings of the normality test as depicted in Table 4.15, clearly show the violation of the normality assumption i.e the residuals are not normally distributed. This is indicated by the P-value obtained (0.0000) which is statistically significant at all levels (1%, 5% and 10%) and this is not a good sign for the model.

Table 4.15: Normality Test: The Jarque – Bera test

Mean	-5.35e-16
Median	-5.59e-05
Maximum	0.012093
Minimum	-0.004868
Std. Dev	0.004868
Skewness	3.343563
Kurtosis	61.18508
Jarque-Bera	220677.6
Probability	0.000000

Source: Analyzed Data.

Despite the fact that normality assumption was violated, the researcher had the best linear unbiased estimators (i.e BLUE estimators). Furthermore, the economic literature suggests that non-normality of the residuals under certain circumstances (i.e when sample is large n>30) may not be a problem. For example, Brooks (2008) asserted that ‘it is not obvious what should be done, it is of course possible to employ an estimation method that does not assume normality but such a method may be difficult to implement and one can be less sure of its properties. It is thus desirable to stick with OLS if possible, since its behavior in a variety of circumstances has been well researched. For sample sizes that are sufficiently large, violation of the normality assumption is virtually inconsequential”. Similarly, Gujarati (2003) argued that the normality assumption takes a critical role if the sample size is small or finite. However, if the sample size is reasonably large, the normality assumption can be relaxed. Based on these facts and considering that the sample size used is reasonably large (i.e n>30), the normality assumption is relaxed and considering the fact that the estimators are BLUE, then it can be concluded that the model is a good one and therefore the interpretation of the OLS regression results can continue.

4.5.3 OLS Regression Results

Upon confirming the goodness fit of the model, the interpretation of the results obtained continues. The results of this regression model are reported in Table 4.16.

Table 4.16: OLS Regression Results

Variable	Coefficient	Std. Error	t-Statistic	Prob.
Intercept	1.082324	0.025429	42.56231	**0.0000**
Tuesday	1.36E-05	6.18E-05	0.220059	0.8259
Wednesday	-3.96E-05	6.17E-05	-0.642131	0.5209
Thursday	-6.07E-05	6.17E-05	-0.982752	0.3259
Friday	-2.90E-05	6.17E-05	-0.470382	0.6381
DSEI_RETURN(-1)	-0.082229	0.025428	-3.233851	0.0012

Source: Analyzed Data

As Table 4.16 shows, the coefficient of the intercept which is the benchmark (Monday) is positive and statistically significant at 5% level, which implies the presence of anomaly in the market. The highest return comparative is recorded on Monday (1.082324) followed by Tuesday (0.00000136). However, the coefficient of Tuesday is insignificant.

The negative and insignificant coefficients are reported for Wednesday and Thursday and Friday with the comparative return of -3.965E-05, -6.07E-05 and -2.90E-05 respectively. These results imply the presence of calendar effects in DSE since the largest return is registered on Monday. However, to confirm the presence of day of the week effect in the market, the study went on and employed GARCH (1,1) model

4.5.4 GARCH (1,1) Model: Day of the Week Effect

The study also employed this model to confirm the presence of the day of the week effect in DSE. However, as noted earlier, the application of GARCH (1,1) requires the use of a good model. Hence, to confirm the goodness of the GARCH (1,1) model, the researcher had to conduct the post diagnostic tests.

4.5.5 Post Diagnostic Test: GARCH (1,1)

After running the model (GARCH 1,1), residuals were analyzed to determine the presence of serial correlation, normality of the residual and the presence of an arch effect, as the presence of any of these would make the model unfit. The serial correlation of the residual was tested using the Ljung Box test, and the heteroskedacticity test was employed to determine the presence of an arch effect while the normality distribution of the residuals was determined by the Jarque Bera test. The results of these tests are presented in table 4.17, 4.18 and 4.19 respectively.

4.5.5.1 Post Diagnostic Test: Serial Correlation test -The Ljung-Box Test results

This test was used to check for the serial correlation in the residual as the good GARCH (1,1) model, requires the absence of serial correlation in the residuals. The results of the test are reported in Table 4.17.

The results of Ljung Box test as depicted in Table 4.17, imply a strong acceptance of the null hypothesis ‘no serial correlation in the residuals’; because the P-values for all lags (36 lags) are greater than 0.05 (alpha) which means the test is statistically insignificant at 5% level and therefore the null hypothesis cannot be rejected and it can be concluded that residuals are not correlated which is the sign of a good model.

Table 4.17: The Ljung-Box Test Results

LAG	AC	PAC	Q-Stat	Prob*
1	0.024	0.024	0.8882	0.346
2	0.021	0.021	1.583	0.453
3	0.020	0.019	2.2132	0.529
4	0.031	0.030	3.7495	0.441
5	0.036	0.033	5.7085	0.336
6	0.010	0.007	5.8569	0.439
7	0.005	0.003	5.9034	0.551
8	0.013	0.01	6.1501	0.630
9	0.015	0.012	6.5103	0.688
10	-0.028	-0.031	7.715	0.657
11	0.000	0.000	7.7153	0.739
12	0.005	0.004	7.7475	0.805
13	-0.025	-0.026	8.7074	0.795
14	-0.016	-0.015	9.1113	0.824
15	0.024	0.027	9.9916	0.820
16	-0.037	-0.037	12.107	0.737
17	-0.042	-0.04	14.893	0.603
18	0.011	0.016	15.077	0.657
19	-0.008	-0.005	15.166	0.712
20	0.041	0.042	17.758	0.603
21	0.002	0.005	17.762	0.664
22	-0.005	-0.002	17.795	0.718
23	-0.015	-0.018	18.169	0.748
24	0.005	0.003	18.210	0.793
25	0.023	0.025	19.070	0.794
26	0.037	0.035	21.255	0.729
27	0.009	0.004	21.391	0.768
28	-0.046	-0.047	24.732	0.642
29	-0.064	-0.069	31.249	0.354
30	0.029	0.029	32.614	0.340
31	-0.036	-0.034	34.626	0.299
32	0.014	0.020	34.940	0.330
33	-0.002	0.001	34.947	0.376
34	0.015	0.019	35.294	0.407
35	-0.007	-0.009	35.382	0.450
36	0.056	0.063	40.264	0.287

Source: Analyzed Data

4.5.5.2 Post Diagnostic Test: Heteroskedsticity Test: ARCH Test

The heteroskedasticity test was employed to determine the presence of an arch effect in the residuals. The results of this test are shown in Table 4.18.

Table 4.18: Heteroskedsticity Test-ARCH Test

Heteroskedasticity Test: ARCH			
F-statistic	0.038296	Prob. F(1,1541)	0.8449
Obs*R-squared	0.038345	Prob. Chi-Square(1)	0.8448
Included observations: 1543 after adjustment			

Source: Analyzed data

Based on the results shown in Table 4.18, the null hypothesis "no arch effect in the residuals" is not rejected as the P-values of Chi-Square and F-statistic are greater than alpha (0.05). Hence, the test is statistically insignificant, which implies the null hypothesis cannot be rejected and it is concluded that arch effect is not found and the model is good.

4.5.5.3 Normality Test: The Jarque – Bera Test

The results of the normality test; the Jarque –Bera test are shown in Table 4.19. The test was conducted to determine the normality of the residuals.

Table: 4.19: The Jarque – Bera Test Results

Mean	0.046153
Median	0.006863
Maximum	15.87021
Minimum	-6.924629
Std. Dev	0.966962
Skewness	5.210560
Kurtosis	97.53242
Jarque-Bera	581893.6
Probability	0.000000

Source: Analyzed Data

It is clearly shown in Table 4.19 that the normality assumption is strongly rejected as the test is statistically significant at all levels i.e (1%, 5% and 10%). However, as it was noted earlier, this assumption can be relaxed in case of a reasonably large sample. Based on the same arguments stated earlier, the normality assumption is relaxed and the model is considered a good one.

4.5.6 GARCH (1,1), Results – Day of the Week Effect

The results of GARCH (1,1) model employed are depicted in Table 4.20. Being confident with the goodness –fit of the model, the presentation of the findings related to this model continue as follows:

Table 4.20: GARCH (1,1) Results –Day of the Week Effect

Mean Equation				
Variable	**Coefficient**	**Std. Error**	**z-Statistic**	**Prob.**
Intercept	1.080906	0.037540	28.79376	**0.0000**
Tuesday	0.000134	4.82E-05	-2.153523	**0.0056**
Wednesday	-6.09E-05	5.93E-05	-1.027087	0.3044
Thursday	-0.000108	7.01E-05	-1.536240	0.1245
Friday	0.000148	5.93E-05	-2.493009	**0.0127**
DSEI_RETURN(-1)	-0.080845	0.037541	-2.153523	0.0313
Variance Equation				
C	9.74E-08	4.72E-09	20.65041	0.0000
RESID(-1)^2	0.240308	0.013434	17.88794	0.0000
GARCH(-1)	0.614713	0.014900	41.25543	0.0000

Source: Analyzed Data

As in OLS regression analysis, the benchmark day, in the analysis is Monday represented by the intercept which provided the highest positive return of 1.0890906 comparatively, followed with Tuesday which records the return of 0.000134 comparatively. The coefficients of the intercept (Monday) and Tuesday are both positive and significantly at 5% level. Both Wednesday and Thursday have negative and insignificant coefficients. Friday also records negative coefficients. However, the coefficient for Friday is significant at 5% level.

Based on the findings of both OLS regression and GARCH (1,1) model, it is clear that Dar es Salaam Stock Exchange is not exempted from calendar effects. Specifically, the largest positive returns on Monday and the lowest negative returns on Friday as per GARCH (1,1) model, imply the presence of the anomaly known as 'Reverse weekend Effect'. This type of anomaly/calendar effect exists when Monday returns are significantly positive and larger than those on other days of the week (Kisaka et al 2014).

These findings on Reverse weekend effect in the Dar es Salaam Stock Exchange are consistent with the findings of Li and Liu (2010) who investigated the day of the week effects in the top 50 Australian companies across different industry sectors. Using daily data for the period from Jan 2001 to June 2010, the study found that the largest mean weekday returns occurred on Monday for 15 companies, which is similar to this study.

Similarly, Brusa et al (200), used daily data for the sample period from Jan 1 1990 to December 1994, re – examined the existence, disappearance, and reversal of the weekend effect after more than two decades of publicity. They found that the returns for Monday were positive and significantly greater than average returns for the rest of the week in the four major stock indexes 1.e S & P 500 index, the NYSE index, The DJIA index and the value weighted CRSP index, hence they provided the empirical evidence for the 'reverse weekend effect'.

The findings of Reverse weekend effect in DSE contradict the findings of Kisaka et al (2014) who analyzed the reverse weekend anomaly at the Nairobi Securities Exchange in Kenya, using daily stock return of 32 sample companies listed continuously at the NSE covering period from Jan 2001 to December 2005. Their study found that Monday returns were highly significant but their coefficient was not positive hence they concluded that there was no reverse weekend anomaly at the Nairobi Securities Exchange.

Based on the findings of OLS regression and specifically the GARCH(1,1) model, the second null hypothesis of this study which professes that 'there is no statistical evidence for the presence of the day of the week effect in DSE' is rejected and hence it is concluded that DSE is characterized with calendar effects (i.e Reverse weekend effect).

4.6 Objective Three: Determining the Empirical Evidence for Month of the Year Effects

In achieving the third objective of the study, monthly DSEI returns were analyzed through the same econometric models (OLS regression and GARCH (1,1) based on equation 4.22 and 4.23.The results of these tests are reported in Table 4.24 and 4.28 respectively. However, it was necessary to determine first, if the series employed was stationary and if the model used was a good model.

4.6.1 Preliminary Analysis – Augmented Dickey Fuller Test

To determine if the return series employed was stationary or not, the study employed the Augmented Dickey Fuller test .The test was conducted using both intercept and Trend & intercept. The results for this test are reported in Table 4.21 and 4.22.

Table 4.21: Augmented Dickey Fuller Test Results - Intercept

Null Hypothesis:	Monthly DSEI_RETURNS has a unit root		
Exogenous:	Constant		
Lag length:	0 (Automatic - based on SIC, maxlag=11)		
		t-Statistic	**Prob***
Augumented Dickey - Fuller test statistic		-7.836546	0.0000
Test critical values:	1% level	-3.522887	
	5% level	-2.901779	
	10% level	-2.588280	

Source: Analyzed Data

Table 4.22: Augmented Dickey Fuller Test Results – Trend and Intercept

Null Hypothesis:	Monthly DSEI_RETURNS has a unit root		
Exogenous:	Constant, Linear Trend		
Lag length:	0 (Automatic - based on SIC, maxlag=11)		
		t-Statistic	**Prob***
Augumented Dickey - Fuller test statistic		-8.979454	0.0000
Test critical values:	1% level	-4.088713	
	5% level	-3.472558	
	10% level	-3.163450	

Source: Analyzed Data

Using max lag of 11 based on SIC, the results from Table 4.21 and 4.22 shows that the absolute value of t- Statistic for both equations is greater than the absolute value of Mackinnon critical tau value at 1%, 5%, and 10% level significance respectively. Hence, the null hypothesis of presence of unit root in a return series is rejected and it is concluded that the Monthly return series is stationary.

4.6.2 Post Diagnostic Test: OLS Regression

As noted earlier, before interpreting the results based on OLS regression it is necessary to determine the goodness of the fit model. The following post diagnostic tests were conducted to determine if the model employing the monthly returns did not violate the time series OLS assumptions.

4.6.2.1 Post Diagnostic: Breusch- Godfrey (BG) Serial Correlation LM Test

The presence of serial correlation in the residuals was determined by the BG Test and results are reported in Table 4.23.

Table 4.23: Breusch- Godfrey (BG) Serial Correlation LM Test Results

F-statistic	0.621744	Prob. F(2,58)	0.5405
Obs*R-squared	1.532229	Prob. Chi-Square(2)	0.4648
Included observations: 73			

Source: Analyzed Data

Based on the results of BG test as depicted in Table4.23, the null hypothesis of no serial correlation cannot be rejected as P-values obtained are statistically insignificant. Therefore, it is concluded that the model does not exhibit serial correlation in the residuals and hence it is a good model.

4.6.2.2 Post Diagnostic: Heteroskedasticity Test- Breusch-Pagan-Godfrey Test

It was necessary also to determine the presence of heteroskedasticity in the residuals using Breusch-Pagan Godfrey test. The results are reported in Table 4.24.

Table 4.24: Heteroskedasticity Test: Breusch-Pagan-Godfrey Results

F-statistic	0.999409	Prob. F(12,60)	0.4607
Obs*R-squared	12.16068	Prob. Chi-Square(12)	0.4329
Included observations: 73			

Source: Analyzed Data

The test is statistically insignificant as P-values are greater than 0.05 for both F-statistic and Chi-Square and hence the researcher fails to reject the null hypothesis of no heteroskedasticity in the residual and this suggests that the model is good.

4.6.2.3 Post Diagnostic: Normality Test – The Jarque - Bera Test

To conclude the goodness of fit model analysis, the study employed the Jarque-Bera test to examine the normality of the residuals, the results are shown in Table 4.25.

Table 4.25: Jarque-Bera Test Results

Mean	1.39e-17
Median	-0.000887
Maximum	0.009860
Minimum	-0.004820
Std. Dev	0.003155
Skewness	1.234013
Kurtosis	4.060639
Jarque-Bera	21.94901
Probability	0.000017

Source: Analyzed Data

As Table 4.25 shows, the test is statistically significant at all levels (1% , 5% and 10%) the P- value is below alpha (0.05) and therefore it is concluded that the residuals are not normally distributed. However, once again this assumption was relaxed based on the arguments presented earlier and therefore the model is accepted as a good model.

4.6.3 OLS Regression – Month of the Year Effect

After the acceptance of the model, the results of OLS regression model based on monthly returns are shown in Table 4.26.

Table 4.26: OLS Regression Results – Month of the Year Effect

Variable	Coefficient	Std. Error	t-Statistic	Prob.
Intercept				
February	0.938082	0.128586	7.295365	**0.0000**
March	-0.000626	0.002056	-0.304559	0.7618
April	-0.001957	0.001966	-0.995151	0.3237
May	-0.001986	0.002018	-0.983807	0.3292
June	-0.000867	0.002012	-0.430982	0.6680
July	0.002323	0.002035	1.141708	0.2581
August	-0.000274	0.002157	-0.126799	0.8995
September	-0.001518	0.002060	-0.736676	0.4642
October	0.000476	0.002023	0.235353	0.8147
November	0.000581	0.002077	0.279906	0.7805
December	-0.001322	0.002085	-0.634093	0.5284
DSEI_MONTHLY RETURN	-0.004015	0.002028	-1.979817	**0.0523**
(-1)	0.064027	0.128816	0.497041	0.6210

Source: Analyzed Data

Since the Post diagnostic tests have confirmed that the OLS model is a good model, the interpretation of the results continues as follows: According to Table 4.26, the benchmark month is January which is represented by the intercept, with the positive and statistically significant coefficient of 0.938082 at 5% levels. The highest positive return comparative is recorded in January followed with October, September and

June which are all positive, but insignificant except for the month of January. The coefficients for February, March, April, May, July, August, November and December are both negative and insignificant expect for the month of December which has a negative coefficient but it is statistically significant.

The presence of negative and statistical coefficient in the month of December followed with the higher positive and statistically significant coefficient in January is the sign that DSE is suffering from calendar effect known as January effect. Therefore, based on the findings of OLS regression it can be concluded that DSE is characterized by January effect anomaly.

4.6.4 GARCH (1,1) Model – Month of the Year Effect

To confirm the presence of month of the year effect, the GARCH (1,1) model was employed based on equation 4.23. Table 4.30 reports the results. However, it is essential to determine the goodness fit of the GARCH (1,1) model before interpreting the results obtained.

4.6.5 Post Diagnostic Test: For GARCH (1,1) Model

The following Post diagnostic tests (The Ljung-Box test, Heteroskedastcity test and the Jarque-Bera test) were conducted and the results of these tests are shown in Table 4.27 ,4.28 and 4.29 respectively.

4.6.5.1 Post Diagnostic Test: Serial Correlation Test -The Ljung-Box Test Results

Firstly, we analyzed the serial correlation in the residual after the running of GARCH (1, 1) model through the Ljung-Box test. The results are shown in Table 4.27.

The P-values for all 32 lags as shown in Table 4.27 are insignificant at 5% level, (i.e the P- values are greater than 0.05). Therefore, the test fails to reject the null hypothesis of no serial correlation in the residuals, this suggests that our GARCH (1,1) model is a good model.

Table 4.27: The Ljung-Box Test Results

LAG	AC	PAC	Q-Stat	Prob*
1	0.011	0.011	0.010	0.922
2	0.165	0.165	2.111	0.348
3	0.170	0.171	4.371	0.224
4	0.159	0.141	6.379	0.173
5	0.158	0.119	8.381	0.136
6	-0.021	-0.090	8.417	0.209
7	0.210	0.128	12.069	0.098
8	0.080	0.046	12.610	0.126
9	0.128	0.077	14.021	0.122
10	0.152	0.106	16.037	0.099
11	0.016	-0.054	16.059	0.139
12	0.145	0.032	17.959	0.117
13	-0.016	-0.068	17.983	0.158
14	-0.066	-0.180	18.391	0.190
15	0.098	0.057	19.304	0.200
16	0.046	0.065	19.509	0.243
17	-0.165	-0.239	22.179	0.178
18	0.002	-0.006	22.179	0.224
19	0.027	0.013	22.251	0.272
20	-0.053	-0.075	22.546	0.312
21	-0.023	0.078	22.603	0.366
22	-0.023	0.011	22.661	0.421
23	0.107	0.124	23.904	0.409
24	-0.075	0.025	24.527	0.432
25	0.093	0.083	25.504	0.434
26	-0.030	0.012	25.611	0.485
27	0.045	0.080	25.851	0.527
28	-0.004	-0.066	25.853	0.581
29	-0.085	-0.032	26.760	0.585
30	0.036	-0.029	26.927	0.627
31	0.080	0.042	27.761	0.633
32	0.008	0.015	27.769	0.681

Source: Analyzed Data

4.6.5.2 Post Diagnostic Test - Heteroskedasticity Test: ARCH Test

The study also analyzed the presence of the arch effect in the residuals, the results are depicted in Table 4.28.

Table 4.28: Heteroskedasticity Test: ARCH Test Results

F-statistic	0.337195	Prob. F(1,70)	0.5633
Obs*R-squared	0.345167	Prob. Chi-Square(1)	0.5569
Included observations: 72 after adjustments			

Source: Analyzed Data.

The results from Table 4.28 suggest that the model is not affected by the arch effect and hence it’s a good model. This is because the test is statistically insignificant at 5% level and therefore the null hypothesis of no arch effect cannot be rejected.

4.6.5.3 Normality Test – The Jarque-Bera Test

Table 4.29 Shows the results on normality test which was conducted to determine the normality of the residuals.

Table 4.29: Normality Test – The Jarque-Bera Test Results

Mean	-0.117485
Median	-0.218428
Maximum	2.608191
Minimum	-1.878028
Std. Dev	1.024066
Skewness	0.580757
Kurtosis	2.858703
Jarque-Bera	4.164280
Probability	0.124663

Source: Analyzed Data

The results show that the residuals in this case are normally distributed, since the test is statistically insignificant at all levels, and therefore the null hypothesis of normal distribution of residual cannot be rejected. Hence, the GARCH 1,1 model under monthly returns series is a good model.

4.6.6 GARCH (1,1) Model – Month of the Year Effect

Being confident with the goodness of fit of our model, the researcher proceeded with the interpretation of the results. To confirm the presence of month of the year effect, the GARCH (1,1) model was employed based on equation 4.23 Table 4.30 reports the results.

Table 4.30: GARCH (1,1) Model Results

Mean Equation				
Variable	**Coefficient**	**Std. Error**	**z-Statistic**	**Prob.**
Intercept	0.964404	0.093828	10.27842	**0.0000**
February	0.001311	0.000437	3.002155	**0.0027**
March	0.001042	0.000568	1.835240	0.0665
April	0.000539	0.000525	1.026319	0.3047
May	0.001342	0.000516	2.602270	**0.0093**
June	0.001296	0.000748	1.731241	0.0834
July	2.12E-05	0.000185	0.025987	0.9793
August	0.000648	0.000536	1.208354	0.2269
September	0.000758	0.000426	1.779786	0.0751
October	0.000343	0.000531	0.647042	0.5176
November	0.000116	0.000658	0.176470	0.8599
December	-0.000890	0.000859	-1.036147	0.3001
DSEI_MONTHLY RETURN (-1)	0.035986	0.093926	0.383129	0.7016
Variance Equation				
C	1.23E-07	2.89E-07	0.425247	0.6707
RESID(-1)^2	2.266400	0.609849	3.716328	0.0002
GARCH(-1)	0.023010	0.030921	0.744156	0.4568

Source: Analyzed Data

According to Table 4.30 only the month of December has negative coefficient (-0.000890) which is insignificant. The benchmark month (i.e the intercept), the month of January depicts the highest return comparatively (0.964404) which is statistically significant at 5% level. Similarly, February and May both have positive and statistically significant coefficients.

The highest return in January as depicted by the benchmark and the positive and statistical coefficients of February and May, both imply the presence of anomaly in the market. Based on the findings of both OLS regression and GARCH (1,1) model , generally it ca-n be concluded that DSE is characterized by the month of the year effect, specifically the market exhibits the January effects.

These findings are similar to many studies which found empirical evidence to support January effect/month of the year effect. For example, Georgantopoulous and Tsamis (2011) investigated seasonal patterns in developing countries, the case of FYROM stock market. Using daily closing value of the index and employing both OLS regression and GARCH (1,1) model, the study indicated the presence of day of the week effect and January effects.

In addition, Ray (2012) investigated seasonal behavior in the monthly stock returns of Bombay stock exchange (BSE) sensex of India, using monthly closing share price from Jan 1991 to December 2010 through regression analysis, the study found the evidence to support the presence of the month of the year effect in Indian stock market, the study supported the presence of January effects. However, these findings contradict the findings of Pathak (2013), Panait (2013) and many others who did not find evidence to support the presence of calendar effects in the respective stock markets.

The OLS regression and Garch(1,1) model were conducted to test the third null hypothesis of this study which states that ‘ there is no statistical evidence for the month of the year effect in DSE’. Based on the findings obtained, this null hypothesis is rejected in favour of alternative hypothesis and hence the study concludes that DSE exhibits the month of the year effect, specifically the January effect.

CHAPTER FIVE

CONCLUSION AND RECOMMENDATION

5.1 Chapter Overview

This chapter summarizes and presents the conclusion of findings of the study. It also discusses the implication and limitations of the study as well as outlines the area for the further studies.

5.2 Summary and Conclusion

The purpose of this study was to determine the empirical evidence for Efficiency Market Hypotheses and calendar effects. Specifically the study aimed at achieving the following three specifics objects; to determine the empirical evidence for the weak-form efficiency, secondly to determine the empirical evidence for the day of the week effect and lastly to determine the empirical evidence for month of the year effect.

To achieve the first objective of the study, four different statistical tests were employed (serial correlation test-the Ljung –Box test, Unit root tests, runs test and variance ratio test). The results from all four statistical tests are consistent; all have rejected the random walk of daily returns series index hence the first null hypothesis of the study which states that 'Dar es salaam stock exchange is weak form inefficient market' could not be rejected. The conclusion drawn based on the results obtained from these four statistical tests was that Dar es Salaam stock exchange is a weak form inefficient market.

The second objective of the study was achieved through two different econometric models – OLS regression model and GARCH (1,1) model. The findings from OLS regression model shows that Monday had higher returns compared to other days in the week which is a sign of the presence of anomaly in the market. Further investigations through GARCH (1,1) model revealed that the lowest significant returns were recorded on Fridays and Higher returns recorded on Mondays. This calendar effect is known as 'reverse weekend effect'. Therefore on based these findings, the second null hypothesis of the study which professed that 'There is no statistical evidence for the day of the week effect in Dar es salaam stock exchange 'was rejected in favour of an alternative hypothesis. Hence, it is concluded that DSE exhibits the day of the week effect.

Similar econometric models (OLS regression and GARCH (1,1) model) were employed in determining the empirical evidence for the third objective of the study. The results from OLS regression analysis showed that the returns series for the month of January and December were statistically significant with January recording the highest returns and December the lowest significant returns. This is a sign of the stock market anomaly referred to as January effects.

The findings of the GARCH (1,1) model show that the returns series for the month of January, February and May are statistically significant with January recording the highest returns followed by May and then February, which implies that the market exhibit seasonality such as January Effect. Based on these findings, generally the third null hypothesis of the study which states that "there is no statistical evidence for month of the year effect'. i.e January effect was rejected in favour of alternative hypothesis and hence it is concluded that Dar es Salaam Stock Exchange exhibits month of the year effect.

5.3 Implication of the Study

The findings of this study have important implication to various stakeholders of Dar es Salaam Stock Exchange such as academicians and researchers, investors, regulatory authorities and managers. To academicians and researchers the findings of this study have important implications, the study has revealed the behavior of stock returns in DSE, and hence laid the foundation for other researchers and academicians to explore more the behaviour of securities in DSE.

In addition, for being used as a reference for other scholars, the study has added a new empirical literature regarding weak-form efficiency and calendar effect for DSE. To investors and other stakeholders, the study implies that trading strategy such as technical analysis could be developed by investors based on these results and could assist them in earning abnormal returns. The presence of calendar effects in the stock market implies that the regulatory authorities have much to do to ensure that appropriate measures are taken to bring informational and operational efficiency in the market.

5.4 Limitations of the Study

Despite the fact that the study had adequate sample size and sample data, it was limited to sample period between 2009 and 2015, this is because the data prior to January 2009 were not found. Another limitation of the study is that it did not consider the individual share prices, but rather the market index. Therefore, the application of any trading strategy on individual share prices based on these findings may not produce robust results**.**

5.5 Recommendations for Further Studies

As noted earlier, the study has used market index (DSEI) rather than individual share prices and hence the study recommends that other studies be conducted using individual shares. This will help in understanding the efficiency of individual stocks as well as the possibility of applying some of these trading strategies in individual shares.

In determining the efficiency of DSE the study used daily closing stock prices, to confirm inefficiency of the market other studies could be conducted using weekly and monthly data. Different statistical tests could also be used. The study has investigated two types of seasonality – day of the week effect and month of the year effect, other studies could concentrate on finding the empirical evidence of other types of stock market anomalies.

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APPENDICES

Appendix I: The Highlights Performance of Dar es Salaam Stock Exchange

	2010/2011	**2011/2012**	**2012/2013**	**2013/2014**
Market Capitalization (Tshs billions)	5,926.60	12,772.79	14,057.92	18,902.16
Value of share traded (Tshs Billions)	48.25	44.45	73.00	272.45
Tanzania Share Index (TSI) points	1051.92	1206.99	1840.11	3561.62
Value of outstanding listed Government bonds	1912.97	2287.31	2991.77	3073.59

Source: DSE (2015).

Appendix II: Daily DSE Index

Date	DSE-Index	Date	DSE-Index	Date	DSE-Index
05-JAN-09	1237.38	25-FEB-09	1234.50	22-APR-09	1222.40
06-JAN-09	1237.38	26-FEB-09	1234.50	23-APR-09	1222.40
07-JAN-09	1236.06	27-FEB-09	1234.18	24-APR-09	1222.40
08-JAN-09	1234.79	02-MAR-09	1234.69	27-APR-09	1222.40
09-JAN-09	1236.10	03-MAR-09	1234.69	28-APR-09	1222.40
13-JAN-09	1236.10	04-MAR-09	1234.69	29-APR-09	1217.31
14-JAN-09	1236.10	05-MAR-09	1234.69	30-APR-09	1217.31
15-JAN-09	1236.94	06-MAR-09	1233.77	04-MAY-09	1217.31
16-JAN-09	1236.94	09-MAR-09	1233.77	05-MAY-09	1217.31
19-JAN-09	1236.94	11-MAR-09	1233.77	06-MAY-09	1217.31
20-JAN-09	1236.94	12-MAR-09	1232.27	07-MAY-09	1217.31
21-JAN-09	1236.94	13-MAR-09	1230.95	08-MAY-09	1217.31
22-JAN-09	1236.94	16-MAR-09	1230.95	11-MAY-09	1217.31
23-JAN-09	1236.94	17-MAR-09	1230.95	12-MAY-09	1217.31
26-JAN-09	1236.88	18-MAR-09	1231.87	13-MAY-09	1216.98
27-JAN-09	1236.88	19-MAR-09	1232.45	14-MAY-09	1216.98
28-JAN-09	1236.88	20-MAR-09	1232.45	15-MAY-09	1216.98
29-JAN-09	1236.88	23-MAR-09	1232.45	18-MAY-09	1216.98
30-JAN-09	1236.88	24-MAR-09	1230.95	19-MAY-09	1216.98
02-FEB-09	1236.88	25-MAR-09	1230.95	20-MAY-09	1216.98
03-FEB-09	1236.88	26-MAR-09	1230.95	21-MAY-09	1214.43
04-FEB-09	1235.61	27-MAR-09	1230.95	22-MAY-09	1211.88
05-FEB-09	1235.61	30-MAR-09	1230.95	25-MAY-09	1211.88
06-FEB-09	1233.06	31-MAR-09	1232.45	26-MAY-09	1210.61
09-FEB-09	1231.79	01-APR-09	1232.45	27-MAY-09	1210.61
10-FEB-09	1231.79	02-APR-09	1232.45	28-MAY-09	1210.61
11-FEB-09	1234.12	03-APR-09	1228.63	29-MAY-09	1210.52
12-FEB-09	1234.96	06-APR-09	1228.27	01-JUN-09	1210.52
13-FEB-09	1234.96	08-APR-09	1228.27	02-JUN-09	1210.52
16-FEB-09	1234.96	09-APR-09	1228.27	03-JUN-09	1210.20
17-FEB-09	1235.01	14-APR-09	1226.17	04-JUN-09	1210.20
18-FEB-09	1235.01	15-APR-09	1226.10	05-JUN-09	1210.20
19-FEB-09	1235.01	16-APR-09	1224.59	08-JUN-09	1209.69
20-FEB-09	1233.74	17-APR-09	1224.59	09-JUN-09	1210.01
23-FEB-09	1234.69	20-APR-09	1223.32	10-JUN-09	1210.01
24-FEB-09	1234.69	21-APR-09	1222.40	11-JUN-09	1210.01

Date	DSE-Index	Date	DSE-Index	Date	DSE-Index
12-JUN-09	1210.01	04-AUG-09	1220.80	24-Sep-09	1218.42
15-JUN-09	1210.52	05-AUG-09	1220.80	25-Sep-09	1218.42
16-JUN-09	1209.28	06-AUG-09	1219.44	28-Sep-09	1219.61
17-JUN-09	1236.63	07-AUG-09	1219.44	29-Sep-09	1221.51
18-JUN-09	1236.63	10-AUG-09	1218.09	30-Sep-09	1221.26
19-JUN-09	1236.63	11-AUG-09	1216.74	1-Oct-09	1222.92
22-JUN-09	1236.63	12-AUG-09	1217.59	2-Oct-09	1224.11
23-JUN-09	1236.63	13-AUG-09	1216.57	5-Oct-09	1225.30
24-JUN-09	1236.63	14-AUG-09	1217.43	6-Oct-09	1226.49
25-JUN-09	1236.63	17-AUG-09	1217.43	7-Oct-09	1226.49
26-JUN-09	1236.63	18-AUG-09	1217.43	8-Oct-09	1225.09
29-JUN-09	1234.09	19-AUG-09	1216.08	9-Oct-09	1223.79
30-JUN-09	1231.88	20-AUG-09	1214.72	12-Oct-09	1223.75
01-JUL-09	1230.53	21-AUG-09	1210.50	13-Oct-09	1222.46
02-JUL-09	1229.18	24-AUG-09	1210.50	15-Oct-09	1224.34
03-JUL-09	1230.03	25-AUG-09	1212.54	16-Oct-09	1224.34
06-JUL-09	1228.44	26-AUG-09	1211.68	19-Oct-09	1221.64
08-JUL-09	1228.44	27-AUG-09	1212.77	20-Oct-09	1221.60
09-JUL-09	1228.44	28-AUG-09	1211.58	21-Oct-09	1221.60
10-JUL-09	1228.44	31-AUG-09	1211.58	22-Oct-09	1220.20
13-JUL-09	1227.09	01-SEP-09	1212.77	23-Oct-09	1220.20
14-JUL-09	1227.09	02-SEP-09	1212.77	26-Oct-09	1219.90
15-JUL-09	1227.09	03-SEP-09	1212.77	27-Oct-09	1219.75
16-JUL-09	1227.09	04-SEP-09	1213.96	28-Oct-09	1219.71
17-JUL-09	1225.90	07-SEP-09	1213.96	29-Oct-09	1219.71
20-JUL-09	1224.71	08-SEP-09	1212.67	30-Oct-09	1219.71
21-JUL-09	1223.83	09-SEP-09	1212.67	2-Nov-09	1219.71
22-JUL-09	1223.83	10-SEP-09	1212.67	3-Nov-09	1219.71
23-JUL-09	1223.52	11-SEP-09	1212.67	4-Nov-09	1222.47
24-JUL-09	1223.52	14-SEP-09	1214.71	5-Nov-09	1222.44
27-JUL-09	1223.52	15-SEP-09	1214.71	6-Nov-09	1220.86
28-JUL-09	1223.52	16-SEP-09	1214.71	9-Nov-09	1220.86
29-JUL-09	1223.52	17-SEP-09	1216.75	10-Nov-09	1220.56
30-JUL-09	1223.50	18-Sep-09	1216.7541	11-Nov-09	1220.56
31-JUL-09	1222.15	22-Sep-09	1217.2296	12-Nov-09	1220.56
03-AUG-09	1222.15	23-Sep-09	1218.4183	13-Nov-09	1217.86

Date	DSE-Index	Date	DSE-Index	Date	DSE-Index
16-Nov-09	1217.86	8-Jan-10	1190.97	2-Mar-10	1181.86
17-Nov-09	1219.23	11-Jan-10	1190.97	3-Mar-10	1181.86
19-Nov-09	1218.92	13-Jan-10	1189.67	4-Mar-10	1181.86
19-Nov-09	1218.92	14-Jan-10	1189.67	5-Mar-10	1181.86
20-Nov-09	1218.92	15-Jan-10	1189.67	8-Mar-10	1181.86
23-Nov-09	1217.52	18-Jan-10	1189.67	9-Mar-10	1181.86
24-Nov-09	1217.63	19-Jan-10	1189.67	10-Mar-10	1181.17
25-Nov-09	1215.04	20-Jan-10	1189.59	11-Mar-10	1179.88
26-Nov-09	1215.04	21-Jan-10	1189.59	12-Mar-10	1179.88
27-Nov-09	1216.44	22-Jan-10	1189.20	15-Mar-10	1179.88
30-Nov-09	1216.44	25-Jan-10	1189.67	16-Mar-10	1177.18
1-Dec-09	1215.04	26-Jan-10	1189.67	17-Mar-10	1176.58
2-Dec-09	1215.04	27-Jan-10	1189.67	18-Mar-10	1176.28
3-Dec-09	1216.44	28-Jan-10	1189.67	19-Mar-10	1177.13
4-Dec-09	1216.92	29-Jan-10	1188.38	22-Mar-10	1177.13
7-Dec-09	1216.88	1-Feb-10	1188.38	23-Mar-10	1176.39
8-Dec-09	1215.58	2-Feb-10	1188.38	24-Mar-10	1177.76
10-Dec-09	1216.99	3-Feb-10	1187.09	25-Mar-10	1178.28
11-Dec-09	1215.58	4-Feb-10	1187.04	26-Mar-10	1177.09
14-Dec-09	1214.40	5-Feb-10	1185.95	29-Mar-10	1177.09
15-Dec-09	1215.55	8-Feb-10	1184.66	30-Mar-10	1174.89
16-Dec-09	1214.32	9-Feb-10	1184.66	31-Mar-10	1174.85
17-Dec-09	1214.32	10-Feb-10	1184.35	6-Apr-10	1174.85
18-Dec-09	1192.37	11-Feb-10	1177.88	8-Apr-10	1174.85
21-Dec-09	1192.07	12-Feb-10	1177.88	9-Apr-10	1173.45
22-Dec-09	1193.26	15-Feb-10	1177.88	12-Apr-10	1172.26
23-Dec-09	1193.26	16-Feb-10	1177.88	13-Apr-10	1169.67
24-Dec-09	1192.07	17-Feb-10	1178.19	14-Apr-10	1169.67
28-Dec-09	1192.07	18-Feb-10	1178.19	15-Apr-10	1169.76
29-Dec-09	1192.37	19-Feb-10	1181.90	16-Apr-10	1168.08
30-Dec-09	1192.37	22-Feb-10	1181.90	19-Apr-10	1168.08
31-Dec-09	1192.37	23-Feb-10	1181.90	20-Apr-10	1168.04
4-Jan-10	1190.97	24-Feb-10	1181.90	21-Apr-10	1165.03
5-Jan-10	1190.97	25-Feb-10	1181.90	22-Apr-10	1166.26
6-Jan-10	1190.97	26-Feb-10	1181.86	23-Apr-10	1167.56
7-Jan-10	1190.97	1-Mar-10	1181.86	27-Apr-10	1167.56

Date	DSE-Index	Date	DSE-Index	Date	DSE-Index
28-Apr-10	1168.85	17-Jun-10	1172.44	9-Aug-10	1171.15
29-Apr-10	1168.84	18-Jun-10	1172.74	10-Aug-10	1172.44
30-Apr-10	1167.47	21-Jun-10	1172.74	11-Aug-10	1170.85
3-May-10	1168.33	22-Jun-10	1171.44	12-Aug-10	1172.29
4-May-10	1164.86	23-Jun-10	1172.48	13-Aug-10	1172.68
5-May-10	1167.89	24-Jun-10	1172.48	16-Aug-10	1173.54
6-May-10	1167.59	25-Jun-10	1174.36	17-Aug-10	1173.62
7-May-10	1167.59	28-Jun-10	1174.02	18-Aug-10	1174.48
10-May-10	1172.08	29-Jun-10	1169.14	19-Aug-10	1174.57
11-May-10	1172.08	30-Jun-10	1170.80	20-Aug-10	1174.57
12-May-10	1172.08	1-Jul-10	1170.80	23-Aug-10	1174.57
13-May-10	1172.08	2-Jul-10	1170.69	24-Aug-10	1174.57
14-May-10	1170.63	5-Jul-10	1173.39	25-Aug-10	1174.57
17-May-10	1171.57	6-Jul-10	1170.80	26-Aug-10	1174.57
18-May-10	1171.57	8-Jul-10	1171.10	27-Aug-10	1174.57
19-May-10	1171.90	9-Jul-10	1172.06	30-Aug-10	1174.57
20-May-10	1171.90	12-Jul-10	1172.23	31-Aug-10	1174.57
21-May-10	1173.30	13-Jul-10	1171.80	1-Sep-10	1174.48
24-May-10	1173.39	14-Jul-10	1170.94	2-Sep-10	1174.48
25-May-10	1173.59	15-Jul-10	1170.94	3-Sep-10	1174.48
26-May-10	1173.06	16-Jul-10	1170.05	6-Sep-10	1174.48
27-May-10	1173.06	19-Jul-10	1169.97	7-Sep-10	1174.48
28-May-10	1173.15	20-Jul-10	1171.67	8-Sep-10	1176.86
31-May-10	1173.15	21-Jul-10	1171.26	9-Sep-10	1176.86
1-Jun-10	1173.15	22-Jul-10	1171.22	13-Sep-10	1176.77
2-Jun-10	1173.15	23-Jul-10	1171.26	14-Sep-10	1176.86
3-Jun-10	1173.15	26-Jul-10	1172.117	15-Sep-10	1176.86
4-Jun-10	1173.15	27-Jul-10	1172.33	16-Sep-10	1176.86
7-Jun-10	1173.15	28-Jul-10	1172.33	17-Sep-10	1176.86
8-Jun-10	1173.62	29-Jul-10	1172.33	20-Sep-10	1176.69
9-Jun-10	1173.62	30-Jul-10	1171.15	21-Sep-10	1174.31
10-Jun-10	1172.44	2-Aug-10	1171.53	22-Sep-10	1174.31
11-Jun-10	1172.44	3-Aug-10	1171.62	23-Sep-10	1174.31
14-Jun-10	1172.44	4-Aug-10	1172.23	24-Sep-10	1174.31
15-Jun-10	1173.29	5-Aug-10	1173.74	27-Sep-10	1174.31
16-Jun-10	1173.29	6-Aug-10	1171.15	28-Sep-10	1174.31

Date	DSE-Index	Date	DSE-Index	Date	DSE-Index
29-Sep-10	1174.22	22-Nov-10	1174.3941	13-Jan-11	1165.765
30-Sep-10	1174.18	23-Nov-10	1174.3941	14-Jan-11	1167.1674
1-Oct-10	1172.99	24-Nov-10	1162.0169	17-Jan-11	1168.4611
4-Oct-10	1172.99	25-Nov-10	1162.0169	18-Jan-11	1170.6103
5-Oct-10	1172.99	26-Nov-10	1162.0169	19-Jan-11	1170.6103
6-Oct-10	1172.99	29-Nov-10	1162.0169	20-Jan-11	1171.0858
7-Oct-10	1171.53	30-Nov-10	1162.0169	21-Jan-11	1173.6731
8-Oct-10	1171.53	1-Dec-10	1162.4924	24-Jan-11	1173.6731
11-Oct-10	1172.95	2-Dec-10	1162.4924	25-Jan-11	1173.6731
12-Oct-10	1172.99	3-Dec-10	1162.4924	26-Jan-11	1173.6731
13-Oct-10	1172.99	6-Dec-10	1162.4924	27-Jan-11	1173.6731
15-Oct-10	1172.99	7-Dec-10	1161.3036	28-Jan-11	1173.6731
18-Oct-10	1172.99	8-Dec-10	1161.3036	31-Jan-11	1173.7501
19-Oct-10	1172.99	10-Dec-10	1161.3036	1-Feb-11	1173.7501
20-Oct-10	1172.99	13-Dec-10	1161.3036	2-Feb-11	1173.7501
21-Oct-10	1172.99	14-Dec-10	1161.3036	3-Feb-11	1173.7501
22-Oct-10	1172.99	15-Dec-10	1161.3036	4-Feb-11	1173.7501
25-Oct-10	1172.99	16-Dec-10	1161.3036	7-Feb-11	1173.7501
26-Oct-10	1172.99	17-Dec-10	1161.3036	8-Feb-11	1172.5614
27-Oct-10	1172.99	20-Dec-10	1161.3036	9-Feb-11	1175.0438
28-Oct-10	1172.99	21-Dec-10	1161.3036	10-Feb-11	1175.0823
29-Oct-10	1172.99	22-Dec-10	1161.3036	11-Feb-11	1175.0823
1-Nov-10	1172.99	23-Dec-10	1161.3036	14-Feb-11	1175.0823
2-Nov-10	1172.99	24-Dec-10	1161.3036	15-Feb-11	1175.0823
3-Nov-10	1172.99	27-Dec-10	1161.3036	17-Feb-11	1175.0823
4-Nov-10	1172.99	28-Dec-10	1163.891	18-Feb-11	1176.376
5-Nov-10	1172.99	29-Dec-10	1163.891	21-Feb-11	1176.376
8-Nov-10	1172.99	30-Dec-10	1163.891	22-Feb-11	1176.376
9-Nov-10	1172.99	31-Dec-10	1163.891	23-Feb-11	1176.376
10-Nov-10	1172.99	3-Jan-11	1163.891	24-Feb-11	1176.376
11-Nov-10	1172.99	4-Jan-11	1163.891	25-Feb-11	1178.6979
12-Nov-10	1172.99	5-Jan-11	1166.4783	28-Feb-11	1181.0198
15-Nov-10	1172.99	6-Jan-11	1166.4783	1-Mar-11	1181.0198
16-Nov-10	1172.99	7-Jan-11	1165.2896	2-Mar-11	1181.0198
18-Nov-10	1172.99	10-Jan-11	1165.2896	3-Mar-11	1181.0543
19-Nov-10	1174.39	11-Jan-11	1165.2896	4-Mar-11	1184.6063

Date	DSE-Index	Date	DSE-Index	Date	DSE-Index
7-Mar-11	1184.60	2-May-11	1183.09	21-Jun-11	1264.28
8-Mar-11	1186.89	3-May-11	1181.98	22-Jun-11	1264.28
9-Mar-11	1186.93	4-May-11	1181.98	23-Jun-11	1264.28
10-Mar-11	1188.09	5-May-11	1182.74	24-Jun-11	1263.12
11-Mar-11	1172.39	6-May-11	1184.05	27-Jun-11	1263.12
14-Mar-11	1173.56	9-May-11	1184.05	28-Jun-11	1264.28
15-Mar-11	1173.56	10-May-11	1184.09	29-Jun-11	1264.49
16-Mar-11	1175.78	11-May-11	1184.09	30-Jun-11	1264.49
17-Mar-11	1185.43	12-May-11	1184.09	1-Jul-11	1264.49
18-Mar-11	1187.94	13-May-11	1184.09	4-Jul-11	1264.49
21-Mar-11	1191.49	16-May-11	1186.22	5-Jul-11	1264.49
22-Mar-11	1195.25	17-May-11	1187.29	6-Jul-11	1266.03
23-Mar-11	1202.00	18-May-11	1190.19	8-Jul-11	1266.03
24-Mar-11	1206.25	19-May-11	1190.19	11-Jul-11	1266.73
25-Mar-11	1214.28	20-May-11	1190.19	12-Jul-11	1266.80
28-Mar-11	1221.47	23-May-11	1261.62	13-Jul-11	1266.80
29-Mar-11	1216.83	24-May-11	1261.62	14-Jul-11	1266.80
30-Mar-11	1209.86	25-May-11	1261.62	15-Jul-11	1266.80
31-Mar-11	1216.04	26-May-11	1261.62	18-Jul-11	1267.87
1-Apr-11	1216.04	27-May-11	1261.62	19-Jul-11	1267.87
4-Apr-11	1215.91	30-May-11	1261.76	20-Jul-11	1267.94
5-Apr-11	1215.91	31-May-11	1262.83	21-Jul-11	1269.15
6-Apr-11	1192.98	1-Jun-11	1262.79	22-Jul-11	1269.57
8-Apr-11	1192.98	2-Jun-11	1262.82	25-Jul-11	1269.57
11-Apr-11	1192.98	3-Jun-11	1262.82	26-Jul-11	1269.57
12-Apr-11	1190.66	6-Jun-11	1262.82	27-Jul-11	1269.57
13-Apr-11	1187.64	7-Jun-11	1261.66	28-Jul-11	1269.57
14-Apr-11	1186.57	8-Jun-11	1262.43	29-Jul-11	1269.57
15-Apr-11	1186.57	9-Jun-11	1262.43	1-Aug-11	1270.12
18-Apr-11	1186.57	10-Jun-11	1263.59	2-Aug-11	1270.12
19-Apr-11	1185.41	13-Jun-11	1263.59	3-Aug-11	1271.40
20-Apr-11	1186.57	14-Jun-11	1264.14	4-Aug-11	1271.56
21-Apr-11	1185.41	15-Jun-11	1264.14	5-Aug-11	1272.92
27-Apr-11	1185.41	16-Jun-11	1262.98	9-Aug-11	1272.92
28-Apr-11	1185.41	17-Jun-11	1264.14	10-Aug-11	1273.26
29-Apr-11	1185.41	20-Jun-11	1264.14	11-Aug-11	1273.26

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12-Aug-11	1273.26	5-Oct-11	1297.27	25-Nov-11	1303.76
15-Aug-11	1273.49	6-Oct-11	1297.27	28-Nov-11	1303.84
16-Aug-11	1273.49	7-Oct-11	1297.27	29-Nov-11	1303.84
17-Aug-11	1273.77	10-Oct-11	1296.50	30-Nov-11	1303.84
18-Aug-11	1273.77	11-Oct-11	1296.50	1-Dec-11	1303.84
19-Aug-11	1274.38	12-Oct-11	1296.50	2-Dec-11	1303.84
22-Aug-11	1274.45	13-Oct-11	1305.91	5-Dec-11	1303.84
23-Aug-11	1274.45	17-Oct-11	1305.91	6-Dec-11	1303.84
24-Aug-11	1274.45	18-Oct-11	1304.64	7-Dec-11	1303.84
25-Aug-11	1275.29	19-Oct-11	1303.57	8-Dec-11	1303.84
26-Aug-11	1275.79	20-Oct-11	1304.45	12-Dec-11	1303.84
29-Aug-11	1275.79	21-Oct-11	1305.99	13-Dec-11	1303.84
30-Aug-11	1278.94	24-Oct-11	1307.25	14-Dec-11	1303.84
2-Sep-11	1279.01	25-Oct-11	1307.18	15-Dec-11	1303.42
5-Sep-11	1279.55	26-Oct-11	1306.18	16-Dec-11	1303.42
6-Sep-11	1279.82	27-Oct-11	1304.92	19-Dec-11	1302.80
7-Sep-11	1279.82	28-Oct-11	1303.69	20-Dec-11	1302.80
8-Sep-11	1282.51	31-Oct-11	1303.69	21-Dec-11	1303.23
9-Sep-11	1283.77	1-Nov-11	1303.69	22-Dec-11	1303.23
12-Sep-11	1284.77	2-Nov-11	1303.69	23-Dec-11	1303.23
13-Sep-11	1286.03	3-Nov-11	1303.69	27-Dec-11	1303.23
14-Sep-11	1286.46	4-Nov-11	1303.84	28-Dec-11	1303.23
15-Sep-11	1286.69	7-Nov-11	1303.56	29-Dec-11	1303.23
16-Sep-11	1286.69	8-Nov-11	1302.69	30-Dec-11	1303.23
19-Sep-11	1286.69	9-Nov-11	1302.69	2-Jan-12	1303.23
20-Sep-11	1286.69	10-Nov-11	1303.76	3-Jan-12	1302.62
21-Sep-11	1285.80	11-Nov-11	1303.70	4-Jan-12	1302.62
22-Sep-11	1285.80	14-Nov-11	1303.76	5-Jan-12	1300.83
23-Sep-11	1285.80	15-Nov-11	1303.76	6-Jan-12	1300.83
26-Sep-11	1285.80	16-Nov-11	1303.76	9-Jan-12	1300.51
27-Sep-11	1285.87	17-Nov-11	1302.69	10-Jan-12	1300.55
28-Sep-11	1285.87	18-Nov-11	1302.69	11-Jan-12	1301.17
29-Sep-11	1285.87	21-Nov-11	1302.69	13-Jan-12	1301.17
30-Sep-11	1286.71	22-Nov-11	1302.69	16-Jan-12	1301.17
3-Oct-11	1286.71	23-Nov-11	1302.69	17-Jan-12	1301.17
4-Oct-11	1286.71	24-Nov-11	1302.69	18-Jan-12	1299.95

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19-Jan-12	1299.95	9-Mar-12	1319.05	4-May-12	1318.17
20-Jan-12	1300.61	12-Mar-12	1315.07	7-May-12	1314.34
23-Jan-12	1301.27	13-Mar-12	1315.07	8-May-12	1315.00
24-Jan-12	1300.61	14-Mar-12	1319.05	9-May-12	1322.36
25-Jan-12	1301.42	15-Mar-12	1319.28	10-May-12	1322.36
26-Jan-12	1298.30	16-Mar-12	1319.28	11-May-12	1322.36
27-Jan-12	1298.34	19-Mar-12	1319.84	14-May-12	1322.36
30-Jan-12	1298.24	20-Mar-12	1316.65	15-May-12	1322.36
31-Jan-12	1298.28	21-Mar-12	1320.70	16-May-12	1322.36
1-Feb-12	1298.28	22-Mar-12	1324.02	17-May-12	1323.24
2-Feb-12	1298.97	23-Mar-12	1324.02	18-May-12	1323.20
3-Feb-12	1298.97	26-Mar-12	1324.02	21-May-12	1323.20
6-Feb-12	1299.67	27-Mar-12	1324.63	22-May-12	1323.20
7-Feb-12	1299.67	28-Mar-12	1325.20	23-May-12	1323.20
8-Feb-12	1299.67	29-Mar-12	1325.69	24-May-12	1322.58
9-Feb-12	1301.00	30-Mar-12	1325.69	25-May-12	1322.58
10-Feb-12	1303.65	2-Apr-12	1327.48	28-May-12	1320.01
13-Feb-12	1306.97	3-Apr-12	1327.48	29-May-12	1320.01
14-Feb-12	1306.97	4-Apr-12	1327.48	30-May-12	1320.09
15-Feb-12	1310.29	5-Apr-12	1331.47	31-May-12	1317.22
16-Feb-12	1310.29	10-Apr-12	1333.26	1-Jun-12	1318.35
17-Feb-12	1310.29	11-Apr-12	1333.26	4-Jun-12	1315.19
20-Feb-12	1310.19	12-Apr-12	1333.92	5-Jun-12	1315.76
21-Feb-12	1310.19	13-Apr-12	1334.49	6-Jun-12	1316.82
22-Feb-12	1310.19	16-Apr-12	1330.60	7-Jun-12	1314.38
23-Feb-12	1312.18	17-Apr-12	1329.74	8-Jun-12	1309.73
24-Feb-12	1312.18	18-Apr-12	1329.74	11-Jun-12	1309.82
27-Feb-12	1312.18	19-Apr-12	1327.29	12-Jun-12	1310.44
28-Feb-12	1310.19	20-Apr-12	1327.29	13-Jun-12	1310.44
29-Feb-12	1314.24	23-Apr-12	1327.29	14-Jun-12	1312.89
1-Mar-12	1314.24	24-Apr-12	1326.67	15-Jun-12	1312.17
2-Mar-12	1314.91	25-Apr-12	1326.67	18-Jun-12	1320.04
5-Mar-12	1314.91	27-Apr-12	1326.75	19-Jun-12	1321.06
6-Mar-12	1314.91	30-Apr-12	1326.14	20-Jun-12	1313.14
7-Mar-12	1314.28	2-May-12	1326.14	21-Jun-12	1433.54
8-Mar-12	1314.32	3-May-12	1314.85	22-Jun-12	1433.60

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25-Jun-12	1431.51	15-Aug-12	1440.80	8-Oct-12	1457.93
26-Jun-12	1439.12	16-Aug-12	1442.18	9-Oct-12	1457.93
27-Jun-12	1438.71	17-Aug-12	1442.38	10-Oct-12	1457.93
28-Jun-12	1438.45	21-Aug-12	1442.38	11-Oct-12	1457.93
29-Jun-12	1437.84	22-Aug-12	1443.04	12-Oct-12	1457.84
2-Jul-12	1438.45	23-Aug-12	1444.88	15-Oct-12	1457.23
3-Jul-12	1438.45	24-Aug-12	1444.32	16-Oct-12	1457.84
4-Jul-12	1437.84	27-Aug-12	1444.88	17-Oct-12	1457.84
5-Jul-12	1438.45	28-Aug-12	1446.72	18-Oct-12	1457.84
6-Jul-12	1437.35	29-Aug-12	1446.72	19-Oct-12	1457.84
9-Jul-12	1438.51	30-Aug-12	1446.86	22-Oct-12	1457.84
10-Jul-12	1439.42	31-Aug-12	1449.11	23-Oct-12	1457.84
11-Jul-12	1440.72	3-Sep-12	1448.07	24-Oct-12	1457.84
12-Jul-12	1441.33	4-Sep-12	1451.96	25-Oct-12	1457.84
13-Jul-12	1441.33	6-Sep-12	1451.96	29-Oct-12	1457.84
16-Jul-12	1441.33	7-Sep-12	1454.62	30-Oct-12	1458.27
17-Jul-12	1440.67	10-Sep-12	1452.77	31-Oct-12	1458.27
18-Jul-12	1441.74	11-Sep-12	1452.77	1-Nov-12	1458.27
19-Jul-12	1441.12	12-Sep-12	1452.15	2-Nov-12	1458.27
20-Jul-12	1441.12	13-Sep-12	1454.81	5-Nov-12	1458.27
23-Jul-12	1441.12	14-Sep-12	1452.15	6-Nov-12	1457.66
24-Jul-12	1441.12	17-Sep-12	1452.15	7-Nov-12	1458.27
25-Jul-12	1441.12	18-Sep-12	1453.12	8-Nov-12	1458.39
26-Jul-12	1441.20	19-Sep-12	1454.42	9-Nov-12	1461.30
27-Jul-12	1441.26	20-Sep-12	1453.81	12-Nov-12	1458.47
30-Jul-12	1441.80	21-Sep-12	1454.42	13-Nov-12	1461.27
31-Jul-12	1442.46	24-Sep-12	1454.42	14-Nov-12	1459.18
1-Aug-12	1441.24	25-Sep-12	1453.20	15-Nov-12	1459.18
2-Aug-12	1441.34	26-Sep-12	1455.55	16-Nov-12	1464.97
3-Aug-12	1440.06	27-Sep-12	1457.61	19-Nov-12	1466.04
6-Aug-12	1438.84	28-Sep-12	1457.61	20-Nov-12	1466.65
7-Aug-12	1439.50	1-Oct-12	1457.61	21-Nov-12	1466.65
9-Aug-12	1440.16	2-Oct-12	1457.61	22-Nov-12	1471.76
10-Aug-12	1440.57	3-Oct-12	1457.61	23-Nov-12	1472.58
13-Aug-12	1439.91	4-Oct-12	1457.61	26-Nov-12	1471.96
14-Aug-12	1439.99	5-Oct-12	1457.61	27-Nov-12	1473.48

Date	DSE-Index	Date	DSE-Index	Date	DSE-Index
28-Nov-12	1475.10	22-Jan-13	1,488.85	14-Mar-13	1,516.29
29-Nov-12	1473.98	23-Jan-13	1,489.16	15-Mar-13	1,516.52
30-Nov-12	1474.59	24-Jan-13	1,491.41	18-Mar-13	1,518.99
3-Dec-12	1474.72	28-Jan-13	1,488.62	19-Mar-13	1,519.32
4-Dec-12	1474.72	29-Jan-13	1,487.40	20-Mar-13	1,522.59
5-Dec-12	1475.34	30-Jan-13	1,487.40	21-Mar-13	1,522.15
6-Dec-12	1475.34	31-Jan-13	1,488.53	22-Mar-13	1,522.15
7-Dec-12	1474.82	1-Feb-13	1,488.53	25-Mar-13	1,522.15
10-Dec-12	1475.18	4-Feb-13	1,488.14	26-Mar-13	1,522.15
11-Dec-12	1475.12	5-Feb-13	1,488.14	27-Mar-13	1,520.24
12-Dec-12	1475.12	6-Feb-13	1,487.53	28-Mar-13	1,521.48
13-Dec-12	1475.12	7-Feb-13	1,488.34	2-Apr-13	1,523.38
14-Dec-12	1475.12	8-Feb-13	1,490.14	3-Apr-13	1,524.45
17-Dec-12	1476.34	11-Feb-13	1,490.80	4-Apr-13	1,526.31
18-Dec-12	1479.36	12-Feb-13	1,490.14	5-Apr-13	1,527.58
19-Dec-12	1479.76	13-Feb-13	1,499.74	8-Apr-13	1,529.42
20-Dec-12	1479.76	14-Feb-13	1,499.74	9-Apr-13	1,529.38
21-Dec-12	1480.37	15-Feb-13	1,499.82	10-Apr-13	1,526.01
24-Dec-12	1475.93	18-Feb-13	1,499.82	11-Apr-13	1,526.01
27-Dec-12	1476.54	19-Feb-13	1,501.08	12-Apr-13	1,524.77
28-Dec-12	1478.99	20-Feb-13	1,501.80	15-Apr-13	1,524.90
31-Dec-12	1485.63	21-Feb-13	1,501.80	16-Apr-13	1,527.52
2-Jan-13	1,486.86	22-Feb-13	1,499.53	17-Apr-13	1,527.67
3-Jan-13	1,481.44	25-Feb-13	1,499.86	18-Apr-13	1,530.74
4-Jan-13	1,489.53	26-Feb-13	1,506.34	19-Apr-13	1,532.98
7-Jan-13	1,490.76	27-Feb-13	1,506.34	22-Apr-13	1,534.21
8-Jan-13	1,491.37	28-Feb-13	1,506.34	23-Apr-13	1,533.59
9-Jan-13	1,491.37	1-Mar-13	1,505.76	24-Apr-13	1,533.14
10-Jan-13	1,490.76	4-Mar-13	1,506.42	25-Apr-13	1,533.88
11-Jan-13	1,485.02	5-Mar-13	1,505.20	29-Apr-13	1,537.26
14-Jan-13	1,487.01	6-Mar-13	1,505.12	30-Apr-13	1,535.99
15-Jan-13	1,485.78	7-Mar-13	1,510.16	2-May-13	1,533.72
16-Jan-13	1,486.91	8-Mar-13	1,512.14	3-May-13	1,535.66
17-Jan-13	1,491.56	11-Mar-13	1,513.37	6-May-13	1,533.64
18-Jan-13	1,492.17	12-Mar-13	1,516.29	7-May-13	1,533.50
21-Jan-13	1,491.51	13-Mar-13	1,516.29	8-May-13	1,535.22

Date	DSE-Index	Date	DSE-Index	Date	DSE-Index
9-May-13	1,535.98	28-Jun-13	1,582.51	21-Aug-13	1,606.99
10-May-13	1,536.58	1-Jul-13	1,587.23	22-Aug-13	1,606.33
13-May-13	1,536.37	2-Jul-13	1,587.23	23-Aug-13	1,607.45
14-May-13	1,537.05	3-Jul-13	1,581.77	26-Aug-13	1,612.41
15-May-13	1,537.66	4-Jul-13	1,587.33	27-Aug-13	1,611.41
16-May-13	1,538.21	5-Jul-13	1,582.43	28-Aug-13	1,611.49
17-May-13	1,539.34	8-Jul-13	1,585.91	29-Aug-13	1,612.15
20-May-13	1,538.06	9-Jul-13	1,589.49	30-Aug-13	1,611.49
21-May-13	1,538.06	10-Jul-13	1,590.56	2-Sep-13	1,613.94
22-May-13	1,538.20	11-Jul-13	1,590.54	3-Sep-13	1,615.07
23-May-13	1,540.39	12-Jul-13	1,592.85	4-Sep-13	1,614.51
24-May-13	1,541.97	15-Jul-13	1,592.85	5-Sep-13	1,616.86
27-May-13	1,542.56	16-Jul-13	1,596.60	6-Sep-13	1,616.86
28-May-13	1,543.68	17-Jul-13	1,597.77	9-Sep-13	1,626.45
29-May-13	1,545.95	18-Jul-13	1,599.17	10-Sep-13	1,629.25
30-May-13	1,548.39	19-Jul-13	1,600.30	11-Sep-13	1,629.25
31-May-13	1,549.00	22-Jul-13	1,599.28	12-Sep-13	1,617.42
3-Jun-13	1,550.28	23-Jul-13	1,606.64	13-Sep-13	1,613.90
4-Jun-13	1,551.50	24-Jul-13	1,605.42	16-Sep-13	1,609.41
5-Jun-13	1,552.83	25-Jul-13	1,606.34	17-Sep-13	1,585.85
6-Jun-13	1,552.83	26-Jul-13	1,607.57	18-Sep-13	1,585.75
7-Jun-13	1,553.49	29-Jul-13	1,607.09	19-Sep-13	1,579.76
10-Jun-13	1,560.00	30-Jul-13	1,609.44	20-Sep-13	1,611.85
11-Jun-13	1,561.22	31-Jul-13	1,611.15	23-Sep-13	1,613.24
12-Jun-13	1,561.97	1-Aug-13	1,611.15	24-Sep-13	1,616.87
13-Jun-13	1,562.56	2-Aug-13	1,611.15	25-Sep-13	1,621.97
14-Jun-13	1,563.48	5-Aug-13	1,610.62	26-Sep-13	1,636.26
17-Jun-13	1,563.48	6-Aug-13	1,610.62	27-Sep-13	1,653.32
18-Jun-13	1,564.70	7-Aug-13	1,611.48	30-Sep-13	1,670.73
19-Jun-13	1,567.16	12-Aug-13	1,612.06	1-Oct-13	1,705.91
20-Jun-13	1,567.00	13-Aug-13	1,613.19	2-Oct-13	1,687.14
21-Jun-13	1,569.71	14-Aug-13	1,610.50	3-Oct-13	1,714.91
24-Jun-13	1,573.38	15-Aug-13	1,609.25	4-Oct-13	1,714.91
25-Jun-13	1,574.05	16-Aug-13	1,606.96	7-Oct-13	1,724.88
26-Jun-13	1,575.83	19-Aug-13	1,605.74	8-Oct-13	1,745.66
27-Jun-13	1,579.49	20-Aug-13	1,609.44	9-Oct-13	1,786.88

Date	DSE-Index	Date	DSE-Index	Date	DSE-Index
10-Oct-13	1,768.03	3-Dec-13	1,909.89	30-Jan-14	1,932.34
11-Oct-13	1,768.43	4-Dec-13	1,894.79	31-Jan-14	1,923.57
15-Oct-13	1,728.43	5-Dec-13	1,880.29	3-Feb-14	1,870.09
17-Oct-13	1,726.31	6-Dec-13	1,863.34	4-Feb-14	1,885.17
18-Oct-13	1,733.74	10-Dec-13	1,844.66	5-Feb-14	1,889.47
21-Oct-13	1,751.50	11-Dec-13	1,833.26	6-Feb-14	1,890.41
22-Oct-13	1,776.01	12-Dec-13	1,847.02	7-Feb-14	1,881.24
23-Oct-13	1,791.55	13-Dec-13	1,839.27	10-Feb-14	1,881.24
24-Oct-13	1,802.32	16-Dec-13	1,835.05	11-Feb-14	1,894.82
25-Oct-13	1,809.04	17-Dec-13	1,831.60	12-Feb-14	1,901.28
28-Oct-13	1,790.67	18-Dec-13	1,836.06	13-Feb-14	1,906.29
29-Oct-13	1,783.20	19-Dec-13	1,833.86	14-Feb-14	1,938.39
30-Oct-13	1,779.15	20-Dec-13	1,835.17	17-Feb-14	1,930.85
31-Oct-13	1,838.07	23-Dec-13	1,832.81	18-Feb-14	1,906.78
1-Nov-13	1,841.92	24-Dec-13	1,835.05	19-Feb-14	1,882.84
4-Nov-13	1,845.30	27-Dec-13	1,847.02	20-Feb-14	1,891.13
5-Nov-13	1,849.91	30-Dec-13	1,864.97	21-Feb-14	1,901.44
6-Nov-13	1,855.74	31-Dec-13	1,866.57	24-Feb-14	1,931.70
7-Nov-13	1,873.65	2-Jan-14	1,870.18	25-Feb-14	1,967.26
8-Nov-13	1,870.52	3-Jan-14	1,876.07	26-Feb-14	1,978.70
11-Nov-13	1,856.47	6-Jan-14	1,895.04	27-Feb-14	1,970.95
12-Nov-13	1,849.80	7-Jan-14	1,903.12	28-Feb-14	1,995.32
13-Nov-13	1,851.40	8-Jan-14	1,913.39	3-Mar-14	1,972.99
14-Nov-13	1,846.50	9-Jan-14	1,919.73	4-Mar-14	1,991.71
15-Nov-13	1,834.86	10-Jan-14	1,916.67	5-Mar-14	1,976.45
18-Nov-13	1,856.76	15-Jan-14	1,904.20	6-Mar-14	1,993.57
19-Nov-13	1,862.06	16-Jan-14	1,898.50	7-Mar-14	2,018.97
20-Nov-13	1,863.81	17-Jan-14	1,903.34	10-Mar-14	1,999.76
21-Nov-13	1,827.48	20-Jan-14	1,909.33	11-Mar-14	2,010.98
22-Nov-13	1,841.12	21-Jan-14	1,911.19	12-Mar-14	1,943.88
25-Nov-13	1,850.05	22-Jan-14	1,912.90	13-Mar-14	1,950.04
26-Nov-13	1,888.57	23-Jan-14	1,910.91	14-Mar-14	1,949.19
27-Nov-13	1,909.91	24-Jan-14	1,949.14	17-Mar-14	1,947.33
28-Nov-13	1,929.23	27-Jan-14	1,940.84	18-Mar-14	1,965.10
29-Nov-13	1,940.37	28-Jan-14	1,934.13	19-Mar-14	1,965.10
2-Dec-13	1,927.44	29-Jan-14	1,928.25	20-Mar-14	1,964.74

Date	DSE-Index	Date	DSE-Index	Date	DSE-Index
21-Mar-14	1,962.54	16-May-14	1,955.91	8-Jul-14	2,229.79
24-Mar-14	1,959.62	19-May-14	1,942.58	9-Jul-14	2,234.51
25-Mar-14	1,901.62	20-May-14	1,998.62	10-Jul-14	2,242.90
26-Mar-14	1,963.62	21-May-14	1,993.69	11-Jul-14	2,247.37
27-Mar-14	1,962.42	22-May-14	1,990.51	14-Jul-14	2,242.08
28-Mar-14	1,952.83	23-May-14	1,989.40	15-Jul-14	2,242.28
31-Mar-14	1,958.09	26-May-14	1,984.82	16-Jul-14	2,266.93
1-Apr-14	1,980.86	27-May-14	1,978.74	17-Jul-14	2,379.86
2-Apr-14	1,976.22	28-May-14	1,975.10	18-Jul-14	2,284.20
3-Apr-14	1,982.72	29-May-14	1,991.19	21-Jul-14	2,329.40
4-Apr-14	1,977.61	30-May-14	2,019.68	22-Jul-14	2,330.58
8-Apr-14	1,959.23	2-Jun-14	2,026.61	23-Jul-14	2,342.79
9-Apr-14	1,955.02	3-Jun-14	2,067.14	24-Jul-14	2,339.73
10-Apr-14	1,964.85	4-Jun-14	2,055.77	25-Jul-14	2,342.62
11-Apr-14	1,967.83	5-Jun-14	2,066.05	28-Jul-14	2,342.10
14-Apr-14	1,972.26	6-Jun-14	2,067.62	31-Jul-14	2,353.06
15-Apr-14	1,975.42	9-Jun-14	2,076.04	1-Aug-14	2,378.16
16-Apr-14	1,982.13	10-Jun-14	2,091.74	4-Aug-14	2,398.44
17-Apr-14	1,998.03	11-Jun-14	2,102.42	5-Aug-14	2,432.23
22-Apr-14	2,010.01	12-Jun-14	2,103.54	6-Aug-14	2,450.06
23-Apr-14	2,005.41	13-Jun-14	2,096.79	7-Aug-14	2,434.25
24-Apr-14	2,009.16	16-Jun-14	2,117.33	11-Aug-14	2,424.07
25-Apr-14	2,017.23	17-Jun-14	2,135.44	12-Aug-14	2,438.81
28-Apr-14	2,021.10	18-Jun-14	2,142.15	13-Aug-14	2,443.25
29-Apr-14	2,031.83	19-Jun-14	2,138.09	14-Aug-14	2,422.68
30-Apr-14	2,043.56	20-Jun-14	2,155.98	15-Aug-14	2,434.98
2-May-14	2,040.68	23-Jun-14	2,150.67	18-Aug-14	2,422.56
5-May-14	2,044.21	24-Jun-14	2,152.99	19-Aug-14	2,416.31
6-May-14	2,041.66	25-Jun-14	2,148.24	20-Aug-14	2,401.57
7-May-14	2,045.43	26-Jun-14	2,173.23	21-Aug-14	2,410.51
8-May-14	2,033.64	27-Jun-14	2,173.73	22-Aug-14	2,411.48
9-May-14	2,028.41	30-Jun-14	2,172.71	25-Aug-14	2,417.04
12-May-14	2,028.52	1-Jul-14	2,191.00	26-Aug-14	2,396.00
13-May-14	2,038.62	2-Jul-14	2,205.72	27-Aug-14	2,405.67
14-May-14	2,023.90	3-Jul-14	2,224.95	28-Aug-14	2,411.55
15-May-14	2,027.82	4-Jul-14	2,238.31	29-Aug-14	2,417.52

Date	DSE-Index	Date	DSE-Index	Date	DSE-Index
1-Sep-14	2,431.89	22-Oct-14	2,695.64	12-Dec-14	2,562.93
2-Sep-14	2,440.84	23-Oct-14	2,634.56	15-Dec-14	2,523.39
3-Sep-14	2,421.37	24-Oct-14	2,668.18	16-Dec-14	2,515.05
4-Sep-14	2,423.13	27-Oct-14	2,632.93	17-Dec-14	2,516.18
5-Sep-14	2,421.67	28-Oct-14	2,602.19	18-Dec-14	2,457.69
8-Sep-14	2,432.60	29-Oct-14	2,605.90	19-Dec-14	2,406.71
9-Sep-14	2,471.50	30-Oct-14	2,627.19	22-Dec-14	2,439.18
10-Sep-14	2,513.12	31-Oct-14	2,632.05	23-Dec-14	2,457.40
11-Sep-14	2,498.37	3-Nov-14	2,612.81	24-Dec-14	2,493.29
12-Sep-14	2,522.38	4-Nov-14	2,616.88	29-Dec-14	2,508.54
15-Sep-14	2,524.64	5-Nov-14	2,608.91	30-Dec-14	2,516.34
16-Sep-14	2,530.31	6-Nov-14	2,586.01	31-Dec-14	2,519.64
17-Sep-14	2,525.56	7-Nov-14	2,596.17	2-Jan-15	2,548.90
18-Sep-14	2,549.41	10-Nov-14	2,586.97	5-Jan-15	2,527.32
19-Sep-14	2,516.25	11-Nov-14	2,599.64	6-Jan-15	2,552.42
22-Sep-14	2,516.88	12-Nov-14	2,602.46	7-Jan-15	2,554.99
23-Sep-14	2,494.57	13-Nov-14	2,581.14	8-Jan-15	2,553.65
24-Sep-14	2,485.94	14-Nov-14	2,586.32	9-Jan-15	2,568.71
25-Sep-14	2,506.93	17-Nov-14	2,590.93	13-Jan-15	2,599.76
26-Sep-14	2,538.15	18-Nov-14	2,561.01	14-Jan-15	2,579.89
29-Sep-14	2,528.70	19-Nov-14	2,587.87	15-Jan-15	2,592.08
30-Sep-14	2,576.48	20-Nov-14	2,582.67	16-Jan-15	2,640.91
1-Oct-14	2,595.03	21-Nov-14	2,591.00	19-Jan-15	2,650.33
2-Oct-14	2,611.85	24-Nov-14	2,594.81	20-Jan-15	2,669.33
3-Oct-14	2,651.22	25-Nov-14	2,588.54	21-Jan-15	2,676.23
6-Oct-14	2,631.56	26-Nov-14	2,606.67	22-Jan-15	2,710.38
7-Oct-14	2,646.11	27-Nov-14	2,589.88	23-Jan-15	2,710.38
8-Oct-14	2,686.80	28-Nov-14	2,606.72	26-Jan-15	2,681.53
9-Oct-14	2,697.58	1-Dec-14	2,607.35	27-Jan-15	2,686.18
10-Oct-14	2,681.09	2-Dec-14	2,605.61	28-Jan-15	2,723.98
13-Oct-14	2,701.64	3-Dec-14	2,616.68	29-Jan-15	2,700.99
15-Oct-14	2,693.14	4-Dec-14	2,605.53	30-Jan-15	2,671.89
16-Oct-14	2,715.93	5-Dec-14	2,614.02	2-Feb-15	2,716.25
17-Oct-14	2,701.82	8-Dec-14	2,609.92	3-Feb-15	2,725.93
20-Oct-14	2,688.39	10-Dec-14	2,554.70	4-Feb-15	2,695.42
21-Oct-14	2,629.35	11-Dec-14	2,598.77	5-Feb-15	2,712.98

Date	DSE-Index
6-Feb-15	2,717.45
9-Feb-15	2,699.25
10-Feb-15	2,699.80
11-Feb-15	2,714.59
16-Feb-15	2,747.60
17-Feb-15	2,754.95
18-Feb-15	2,744.05
19-Feb-15	2,753.57
20-Feb-15	2,774.19
23-Feb-15	2,766.86
24-Feb-15	2,779.10
25-Feb-15	2,751.73
26-Feb-15	2,750.55
27-Feb-15	2,701.28
2-Mar-15	2,694.83
3-Mar-15	2,702.60
4-Mar-15	2,677.88
5-Mar-15	2,677.20
6-Mar-15	2,660.78
9-Mar-15	2,733.54
10-Mar-15	2,629.29
11-Mar-15	2,606.78
12-Mar-15	2,605.04
13-Mar-15	2,598.35
16-Mar-15	2,592.85
17-Mar-15	2,593.53
18-Mar-15	2,614.08
19-Mar-15	2,649.65
20-Mar-15	2,655.59
23-Mar-15	2,668.84
24-Mar-15	2,690.39
25-Mar-15	2,699.28
26-Mar-15	2,693.31
27-Mar-15	2,673.30

Appendix III: Monthly DSE Index

Date	DSE-Index	Date	DSE-Index	Date	DSE-Index
30-JAN-09	1236.88	31-Jan-12	1298.28	30-Jan-15	2,671.89
27-FEB-09	1234.50	29-Feb-12	1314.24	27-Feb-15	2,701.28
31-MAR-09	1230.95	30-Mar-12	1325.69	27-Mar-15	2,673.30
30-APR-09	1217.31	30-Apr-12	1326.14		
29-MAY-09	1210.52	31-May-12	1317.22		
30-JUN-09	1231.88	29-Jun-12	1437.84		
31-JUL-09	1222.15	31-Jul-12	1442.46		
31-AUG-09	1211.58	31-Aug-12	1449.11		
30-Sep-09	1221.26	28-Sep-12	1457.61		
30-Oct-09	1219.71	31-Oct-12	1458.27		
30-Nov-09	1216.44	30-Nov-12	1474.59		
31-Dec-09	1192.37	31-Dec-12	1485.63		
29-Jan-10	1188.38	31-Jan-13	1488.53		
26-Feb-10	1181.86	28-Feb-13	1506.34		
31-Mar-10	1174.85	28-Mar-13	1521.48		
30-Apr-10	1167.47	30-Apr-13	1535.99		
31-May-10	1173.15	31-May-13	1549.00		
30-Jun-10	1170.80	28-Jun-13	1582.51		
30-Jul-10	1171.15	31-Jul-13	1611.15		
31-Aug-10	1174.57	30-Aug-13	1611.49		
30-Sep-10	1174.18	30-Sep-13	1670.73		
29-Oct-10	1172.99	31-Oct-13	1838.07		
30-Nov-10	1162.02	29-Nov-13	1940.37		
31-Dec-10	1163.89	31-Dec-13	1866.57		
31-Jan-11	1173.75	31-Jan-14	1923.57		
28-Feb-11	1181.02	28-Feb-14	1995.32		
31-Mar-11	1216.04	31-Mar-14	1958.09		
29-Apr-11	1185.41	30-Apr-14	2043.56		
31-May-11	1262.82	30-May-14	2019.68		
30-Jun-11	1264.49	30-Jun-14	2172.71		
29-Jul-11	1269.57	31-Jul-14	2353.06		
30-Aug-11	1278.94	29-Aug-14	2417.52		
30-Sep-11	1286.71	30-Sep-14	2576.48		
31-Oct-11	1303.69	31-Oct-14	2632.05		
30-Nov-11	1303.84	28-Nov-14	2606.72		
30-Dec-11	1303.23	31-Dec-14	2519.64		