UNIVERSITY OF CAPE COAST

CALENDAR EFFECT ANOMALIES AND STOCK RETURNS VOLATILITY IN AFRICAN MARKETS: EVIDENCE FROM GHANA AND NAIROBI STOCK EXCHANGES

BY

JAMES MARK GBEDA

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DECLARATION

Candidate's Declaration

I hereby declare that this thesis is the result of my own original research and that no part of it has been presented for another degree in this University or elsewhere.

Candidate's Signature.. Date..........................

Name: James Mark Gbeda

Supervisors' Declaration

We hereby declare that the preparation and presentation of the thesis were supervised in accordance with the guidelines on supervision of thesis laid down by the University of Cape Coast.

Principal Supervisor's Signature................................... Date…..............................

Name: Dr. James Atta Peprah

Co-Supervisor's Signature: .... Date……........................

Name: Dr. Ferdinand Ahiakpor

ABSTRACT

This study examines calendar effect anomalies, particularly Day-of-the-Week effect and Month-of-the-Year effect and stock returns volatility in Ghana Stock Exchange (GSE) and Nairobi Stock Exchange (NSE). Daily closing prices indices from the two stock markets for the period 2005 to 2014 was used. Using an Ordinary Least Square (OLS) regression with autoregressive term, the findings provide no evidence of day-of-the-week effect for GSE but there exist Friday effect for NSE. However, the study provides no evidence of month-of-the-year effect anomaly in either NSE or GSE. The study also documents that daily returns could be predicted but monthly returns cannot be predicted in NSE. On the contrary, the findings indicate that whiles daily returns are difficult to predict monthly returns can be predicted using past price and returns information in GSE.

Furthermore, Generalised Autoregressive Conditional Heteroskedastic GARCH (1, 1) Threshold GARCH (1, 1) and Exponential GARCH (1, 1) were employed to examine stock returns volatility. The results of the GARCH model suggest a high degree of persistent in the conditional volatility of daily and monthly stock returns in NSE. The TGARCH, and EARCH models show significant evidence for asymmetry (leverage effect) in monthly stock returns but no evidence of asymmetry in daily returns was found in NSE. However, there was no evidence of conditional volatility for Ghana Stock Exchange Composite Index (GSE-CI). The study concludes that GSE and NSE are inefficient markets. It is recommended that months are irrelevant in making investment decisions in GSE or NSE but days of the week are relevant in NSE only.

KEY WORDS

Calendar effect Anomaly

Day-of-the-week Effect

Month-of-the-year Effect

Generalised Autoregressive Conditional Heteroskedastic (GARCH)

Ghana Stock Exchange,

Nairobi Stock Exchange

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DEDICATION

To my family

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LIST OF ABBREVIATIONS

EMH	Efficient Market Hypothesis
GSE	Ghana Stock Exchange
NSE	Nairobi stock exchanges
SEC	Securities and Exchange Commissions
DJIA	Dow Jones Industrial Average
S&P 500	Standard and Poor's 500
CRSP	Center for Research in Security Prices
NASDAQ	National Association Securities Dealers Automatic Quotation System
NYSE	New York Stock Exchange
KSE	Khartoum stock exchange
BSE	Bombay Stock Exchange
EEEM	Eastern European Emerging Markets
SEM	Stock Exchange of Mauritius
FCI	Foreign Companies Index
TOM	Turn-Of-the Month
TOY	Turn-Of-the-Year
JSE	Johannesburg Stock Exchange
GJR-GARCH	Glosten-Jagannathan-Runkle
OLS	Ordinary Least Squares
DSE	Dhaka Stock Exchange
GSE-FSI	Ghana Stock Exchange Financial Stocks Index
MCSI	Morgan Stanley Capital International
CBK	Central Bank of Kenya
CHU	Complaints Handling Unit
SMS	Short Message Service
ASI	All Share Index
DGEN	Dhaka Stock Exchange General Index

KLSI	Kula Lumpur Shariah Index
ATS	Automated Trading System
ACI	All Companies Index
GSE-CI	Ghana Stock Exchange Composite Index
GCC	Gulf Cooperation Council
GDP	Gross Domestic Product
SIC	Schwarz Information Criteria
DOY	Day of the Week
MOY	Month of the Year
GED	Generalised Error Distribution
GND	Gaussian Normal Distribution
ARCH	Autoregressive Conditional Heteroskedasticity
GARCH	Generalised Autoregressive Conditional Heteroskedasticity
GARCH-M	Generalised Autoregressive Conditional Heteroskedasticity in Mean
TGARCH	Threshold Generalised Autoregressive Conditional Heteroskedasticity
EGARCH	Exponential Generalised Autoregressive Conditional Heteroskedasticity

CHAPTER ONE

INTRODUCTION

Background to the Study

In financial markets, especially in stock markets, there is evidence of seasonal effects (irregularities) that create higher or lower return on assets than their intrinsic value (Anwar & Mulyadi, 2012). Certain empirical regularities in the stock market are well known among investment professionals and documented in the literature. Size effect, calendar effect, momentum effect are regularities well documented in the finance literature. After they are documented and analysed in the academic literature, anomalies often seem to disappear, reverse, or attenuate (Schwert, 2003). Because these irregularities cannot be explained by any of the currently known asset pricing models, they are referred to as anomalies (Sharpe, Alexander & Bailey, 2005).

In fact, investors could make different return on certain day because of calendar effects. This different return is called an abnormal return which can affect investors in deciding their investment strategy, portfolio selection and profit management (Anwar & Mulyadi, 2012). Calendar effect anomalies therefore refer to the tendency of financial asset returns to display systematic patterns at certain times of the day, week, month or year. There have been many researches on calendar anomaly, such as: day-of-the week effects, January effects, and month-of-the-year effects (Anwar & Mulyadi, 2012); (Gregoriou, Kontonikas, & Tsitsianis, 2004) , (Chen, Firth, & Rui, 2001) and (Mehdian & Perry, 2001).

The Efficient Market Hypothesis (EMH) suggests that all securities are efficiently-priced to fully reflect all information of its intrinsic value (Mehdian & Perry, 2001). The presence of anomalies in stock returns violates the weak form of market efficiency because equity prices are no longer random and can be predicted based on past patterns. This facilitates market participants to devise trading strategies which could fetch abnormal returns on the basis of past patterns. For instance, if there are evidences of 'day of the week effect', investors may devise a trading strategy of selling securities on Fridays and buying on Mondays in order to make excess profits (Kuria & Riro, 2013).

Market efficiency is an important hallmark of a sophisticated market. For this reason, markets in developed countries have been able to attract greater attention from global investors. Considering the current level of interest and importance investors place on market efficiency, African stock markets have to prove that they are becoming more efficient in order to increase their share of global investment funds (Agathee, 2008 as cited in Kuria & Riro, 2013).

In the real world, it is unlikely that one would find an efficient market where there is availability of information, homogenous expectations and zero transaction cost i.e. where no investor can outperform the other and arbitrary profits are eliminated. It is therefore important to understand stock market anomalies to be able to take advantage of them. One of the main concerns of investment analysts is the predictability of stock returns and efficiency of stock markets. The more calendar effect anomalies prevail the more predictable the returns are and the market becomes inefficient. This concern gives value to the study of calendar effect anomalies (Choudhry, 2001 cited in Kuria & Riro, 2013). Knowledge of stock market anomalies is vital to investors. Through this knowledge, investors can apply the principle of "buy low and sell high" to make high profits, in perfectly efficient markets; however these arbitrage profits are not possible.

The argument is that calendar effect anomalies exist, hence make stock markets volatile and inefficient. Secondly, although these anomalies have been found to exist in the past and in some instances for long periods of time and in several foreign and African markets, there is no guarantee that they would continue to exist in the future.

Problem Statement

The Efficient Market Hypothesis developed by Fama, (1970) assumes that current stock prices reflects all available information and therefore rules out the possibility of investors making abnormal returns by taking advantage of any mispricing of asset. The tendency for stocks to generate abnormal return refers to as anomaly. Therefore, anomalies are empirical results that seem to be inconsistent with Efficient Market Hypothesis (EMH). They indicate either market inefficiency (profit opportunities) or inadequacies in the underlying asset-pricing model. Size effect, calendar effect, momentum effect are well documented in the finance literature. However, anomalies often seem to disappear, reverse, or attenuate after they are documented and analysed in the academic literature (Schwert, 2003).

Contrary to the Efficient Market Hypothesis, in the real world, stock markets are not perfect, which provide a fertile ground for stock market anomalies caused by market imperfections (Sharpe et al., 2005). According to Malkiel (2003), a market can become efficient if investors see the market as in-efficient and try to outperform it. Individual or institutional investors could make “abnormal” returns simply because the firm’s earning power has grown. Similarly, the month or day in question can also influence the investors’ returns (Chen et al., 2001).

The search for market anomalies is motivated by the concern that institutional features of a stock market may induce return behaviour that deviates from expected behaviour in an efficient market. However, Claessens, Dasgupta and Glen (1995) argued that the presence of stock return anomalies does not necessarily indicate market inefficiency. Thus, anomalies may simply reflect certain institutional features of the market such as the tax structure or the market microstructure (Ayadi, Dufrene, & Chatterjee, 1998).

Related studies investigated stock market anomalies and efficiency in Kenya and Ghana separately. For in instance in Kenya, Kamau (2003), and Oluoch (2002) examined calendar effect in Nairobi Stock Exchange (NSE). While Alagidede & Panagiotidis (2006), Asamoah (2010) and Frimpong (2008) focused on Ghana Stock Exchange (GSE). The GSE and NSE markets are inefficient at the weak form, they have the same number of trading days, both started Automated Trading System (ATS) in 2009 and each represents a major geographic locations, NSE being one of the largest in East Africa likewise GSE in West Africa. However, no study has been undertaken to compare calendar effect anomalies and stock returns volatility in these two key capital markets.

Although calendar effect anomalies have been found to exist in the past and in some instances for long periods of time and in GSE and NSE as well as other stock markets, there is no guarantee that they will continue to exist in the future.

Furthermore, Schwert (2003) argued that data-snooping phenomenon affect the findings of anomaly studies. Thus, the concern is that the process of examining data and models affects the likelihood of finding anomalies. To the extent that subsequent authors reiterate or refine the surprising results by examining the same or at least positively correlated data, there is really no additional evidence in favour of the anomaly. Lo and MacKinlay (1990) illustrated the data-snooping phenomenon and showed how the inferences drawn from such exercises are misleading.

According to Schwert (2003), one obvious solution to this problem is to test the anomaly on an independent sample. Sometimes researchers use data from other countries, and sometimes they use data from prior time periods. If sufficient time elapses after the discovery of an anomaly, the analysis of subsequent data also provides a test of the anomaly.

This study aims to investigate the existence of calendar anomalies at the NSE and GSE for a more recent period relative to the related past studies. The study looks at an expansive range of data than previous studies. By using an independent and more recent sample, the study makes a comprehensive analysis of the calendar effects and volatility of stock returns in GSE and NSE. The quality and quantity of data has been improved through the creation of computer database in the two markets. The study would also breach the literature gap and provide the basis for further comparative studies across the African financial market.

This study differs from other studies (e.g. Alagidede, 2006) in several ways. The study used different data set and different sample period (2005 to 2014). The number of trading days is 5 for the period under review (Monday to Friday) unlike the previous study by Alagidede, 2006 where there was only 3 trading days: Mondays Wednesdays and Fridays. In addition, the Databank Stock Index (DSI) was used in the previous study (daily closing prices of the period 15 June 1994 to 28 April 2004) whiles this study used the Composite Index, which is more comprehensive. Specifically, the study used daily closing price indices from two stock markets, GSE Composite Index (GSE-CI) for Ghana and NSE-20 Share Index for Kenya ranging from 4th January, 2005). Furthermore this study is a multi-anomaly study and also compares two different stock markets (i.e. GSE & NSE). The study is more comprehensive since it examines the volatility in stock returns in the markets in addition to the test for calendar anomalies.

Objectives of the Study

General Objective

The general objective of the study is to examine calendar effect anomalies and conditional volatility of stock returns in Ghana and Nairobi stock exchanges.

Specific Objectives

The specific objectives are to:

1. Test whether "Month-of-the Year Effect" and "Day-of-the-Week Effect" are present in GSE and NSE.

2. Analyse the conditional volatility of stock returns in GSE and NSE.

Research Hypotheses

Based on the objectives of the study, the following are the research hypotheses.

1. H_0: "Month-of-the-Year Effect" and "Day-of-the-Week Effect" anomalies do not exist in GSE and NSE

   H_1: "Month-of-the-Year Effect" and "Day-of-the-Week Effect" anomalies exist in GSE and NSE.

2. H_0: Stock return volatility does not persists in GSE and NSE.

   H_1: Stock return volatility persists in GSE and NSE.

Significance of the Study

The findings of the study would be beneficial to investors, stock brokers and dealers, managers, the Government and policy makers as well as Scholars.

A rational investor generally considers various parameters before making any investment decision. An investor would therefore be interested in performance of company returns in relation to month of the year or day of the week. This study would assist investors to know the best month to sell or buy stocks. For instance if January effect holds in GSE and NSE, investors in both markets can purchase stocks in late December or somewhat earlier and sell them in January. Potential investors will also gather enough information from this study to assist them in choosing which of the two African stock markets to invest at what time.

Secondly, knowledge of such crucial information on stock returns may assist the stock brokers and dealers to plan well on when to trade stocks to earn abnormal returns and when to hold stocks in order to maximise their returns. This study would provide information as to when it will be profitable for stock brokers and dealers to buy or sell stocks of firms.

Further, management of firms are responsible for the day to day running of their companies. The actions of the management may be affected either positively or negatively by the seasonality of the company stock. This study would provide management of firms with information as to when it will be most profitable to issue out new stocks.

The governments and the Security and Exchange Commissions (SEC) as regulators would be able to monitor the performance of the stock markets which will provide a signal of economic stability of Ghana and Kenya. Policy makers will benefit from policy recommendations in this study even as it will reveals potent measures in improving stock market predictability.

Finally**,** the study can be used as a basis for further research on the subject. The study would also add to the body of knowledge in the finance discipline.

Scope of the Study

This study examines calendar effect anomalies and stock returns volatility in two different geographical locations in Africa, Ghana Stock Exchange (Ghana, West Africa) and Nairobi Stock Exchange (Kenya, East Africa). The research makes use of daily closing prices from the two markets, GSE Composite Index (GSE-CI) for Ghana and NSE-20 Share Index for Kenya ranging from 4th January, 2005 to 31st December, 2014 excluding holidays. The GSE All Composite Index and NSE 20- Share Index are the most appropriate because they reflect the true barometers of the two markets.

Organisation of the Study

The remaining parts of the study are organised into Chapters two, three, four and five. Chapter two reviews theoretical and empirical literature on, efficient market hypothesis, calendar effect anomalies, and critiques of the various literature and presents a summary of the major findings in the literature. The methodology of the study is presented in chapter three. It covers the research design, model specification, estimation technique, choice and measurement of the relevant variables, database of the study and sample size. Chapter four looks at the empirical analysis of the data and discussion of the results. Finally, chapter five presents a summary, conclusion and recommendations of the study based on the results. The chapter also presents the findings as well as directions for future research and limitations of the study. The discussion includes interpretations of the findings in relation to previous findings from literature.

CHAPTER TWO

REVIEW OF RELATED LITERATURE

Introduction

This chapter focuses on review of theoretical and Empirical literature related the study. First, the chapter explored overview of Ghana Stock Exchange (GSE) and Nairobi Stock Exchange (NSE). Under theoretical literature review, the Efficient Market Hypothesis (EMH) and Behavioural Finance theories were discussed while empirical works by other authors were reviewed. Specifically, studies on Day-of-the-week effect anomaly, Month-of-the year effect anomaly and stock returns volatility were reviewed. The efficiency of the two markets was also discussed.

Overview of Ghana Stock Exchange (GSE)

The Ghana Stock Exchange (GSE) was incorporated in July 1989 with trading commencing in 1990. It currently lists 38 equities (from 36 companies) and two corporate bonds. All types of securities can be listed. Criteria for listing include capital adequacy, profitability, spread of shares, years of existence and management efficiency. The manufacturing and brewing sectors currently dominate the exchange. Followed by the banking sector while other listed companies fall into the insurance, mining and petroleum sectors (Ghana Stock Exchange, 2015). Most of the listed companies on the GSE are Ghanaian but there are some transnational companies such as Golden Star Resources and Tullow Plc. The GSE has achieved remarkable success both on the continent and in the world at large.

In 1993, the GSE was the sixth best index performing emerging stock market, with a capital appreciation of 116 percent. In 1994 it was the best index performing stock market among all emerging markets, gaining 124.3 percent in its index level (Ghana Stock Exchange, 2015). The Ghana Stock Exchange was adjudged as the world‘s best-performing market at end of 2004 with a year return of 144 percent in US dollar terms compared with 30 percent return by Morgan Stanley Capital International Global Index (Databank Group, 2004). As at November 2013, Ghana stock exchange had a market capitalisation of about US$31.5 billion. Starting from January 2011, the GSE publishes two indices, namely the GSE Composite Index (GSE-CI) and the GSE Financial Stocks Index (GSE-FSI).

The calculation of the GSE Composite Index (GSE-CI) is based on the value weighted average closing price of all listed stocks. The GSE-FSI index has its constituents as listed stocks from the financial sector including banking and insurance sector stocks (Ghana Stock Exchange, 2015). Trading on the GSE takes place every working day lasting 5 hours. The exchange has pre-market sessions from 9:30am to 10:00am and a continuous auction session from 10:00am to 3:00pm GMT on all days of the week except Saturdays, Sundays and holidays declared by the exchange in advance. Since March 2009, the GSE uses an electronic trading platform known as the GSE Automated Trading System (GATS) and settlement of trades is been done electronically using a web based application (Ghana Stock Exchange, 2015).

Overview of Nairobi Stock Exchange (NSE)

The Nairobi Stock Exchange (NSE) began in 1954 as an overseas stock exchange while Kenya was still a British colony with the permission of the London stock exchange. The NSE is a member of the African Stock Exchange Association. However, in Kenya dealing in shares and stock started in 1920'Sbut there was no formal market no rules and no regulations to govern the stock broking activities. Trading took place on govern gentleman's agreements in which standard commissions were charged with clients being obligated to honor their contractual commitments of making good delivery and settling relevant costs it incurred at that time. In 1980s the Kenyan Government realised the need to design and implement policy reforms to foster sustainable economic development with an efficient and stable financial system (Nairobi Stock Exchange, 2015).

In 1998 the government expanded the scope for foreign investment by introducing incentives for capital markets growth including the setting up of tax-free Venture Capital Funds, removal of Capital Gains Tax on insurance companies' investments, allowance of beneficial ownership by foreigners in local stockbrokers and fund managers and the envisaged licensing of dealing firms to improve market liquidity.

In 2008, the Nairobi Stock Exchange All Share Index was introduced as an alternative index. Its measure is an overall indicator of the market performance.

The index incorporates all the traded shares of the day. Its attention is therefore on the overall market capitalisation rather than the price movements of the selected counters. The stock market is measured using three methods namely: NSE-20 Index, NSE All Share Index and MCSE Share Index. NSE-20 Index is the most widely accepted.

The Nairobi Stock Exchange marked the first day of automated trading in government bonds through the Automated Trading System (ATS) in November 2009. The automated trading in government bonds marked a significant step in the efforts by the NSE and Central Bank of Kenya (CBK) towards expanding the capital markets by providing the necessary liquidity.

In 2009, NSE marked a milestone by uploading all government bonds on the ATS and NSE launched the Complaints Handling Unit (CHU), SMS System to make it easier for investors and the general public to forward any queries or complaints to NSE.

Review of Theoretical Literature

The Efficient Market Hypothesis (EMH)

The efficient market hypothesis (EMH) asserts that share prices fully reflect all available information, any new or shock information being very rapidly incorporated into the share price (Fama, 1970). The definitive paper on the EMH was published by Fama (1970) in the form of his first of three reviews of the theoretical and empirical work on efficient markets. It is generally accepted that there exist three forms of efficiency which a market might have (i.e. weak, semi-strong and strong) depending on the type of information embedded in stock prices.

Summarizing results from weak form, semi-strong form and strong form efficiency tests, Fama (1970) concluded that almost all of the early evidence pointed towards a financial market that was efficient in at least the weak sense. Although he found some price dependencies, they never sufficed to be used in profitable trading mechanisms, making markets weak form efficient.

Fama (1970) argued that it would be impossible to ever correctly test the EMH, because no academic consensus was found on the true underlying asset-pricing model. Whenever a test of market efficiency would reject the efficiency hypothesis, there was always the possibility that it was simply due to the underlying asset pricing. The only conclusion that could be drawn from efficiency tests is that a market is efficient or not with respect to a certain underlying asset pricing model. The same conclusion could never be made independently from the underlying model.

Besides Fama (1970), other researchers have attempted to formulate a clear definition of what is meant by an efficient market. For instance, Jensen (1978, p. 96) noted that a market is efficient with respect to information set if it is impossible to make economic profits by trading on the basis of information set. Malkiel (2003) stated that a stock market is efficient whenever the prices of stocks remain unchanged, despite information being revealed to each and every market participant. Even though there is a lot of academic merit to the definitions of Jensen and Malkiel, the definition of Fama is adopted, as explained in the introduction.

Forms of Market Efficiency

Economists often define three levels of market efficiency, which are distinguished by the degree of information reflected in security prices. The definition of the information set is the reason for different versions of the EMH: weak, semi-strong and strong. They were first mentioned by Roberts (1967) and have been tested and reviewed widely by various academics since (Jensen, 1978, Dimson & Mussavian 1998 and Sewell 2011).

Weak form Market Efficiency

Under the weak form market efficiency, stock prices reflect the information contained in the record of past prices. If stock prices follow a random walk, it is not possible to make superior profits just by studying past prices. This is called the weak form of efficiency. In the Weak form efficiency, form, market prices rapidly reflect all information contained in the history of past prices. Hence, if markets are efficient in weak form, the current stock prices reflects past prices. In this case, price changes follow Random Walk, are not predictable and no one can earn abnormal returns based on historical prices and trading volume. Thus, since the market has no memory, it is not possible to use yesterday's prices to conclude about tomorrow's prices. The impact of data entry into the market on prices follows a stochastic distribution and has no affiliation, tendency and bias. Thus, price changes are stochastic and irregular and price is a function of random walk (Pele & Voineagu, 2008 as cited in Talebloo, Barghandan, & Saeedian, 2014).. In this form of efficiency, technical analysts, analysts or investors who attempt to identify over- or undervalued stocks by searching for patterns in past prices, make no superior gains. They help to make price changes random because competition in technical research ensures that current prices reflect all information in the past sequence of prices and that future price changes cannot be predicted from past prices. Some technical analysts are very successful. However, this success is more due to luck and good judgment rather than to technical trading rules because technical rules are useless when stock prices follow a random walk.

Semi-Strong Form Efficiency

The second level of efficiency requires that prices reflect not just past prices but all other published information, such as one might get from reading the financial press. This is known as the semi strong form of market efficiency. If markets are efficient in this sense, then prices will adjust immediately to public information such as the announcement of the last quarter‘s earnings, a new issue of stock, a proposal to merge two companies, and so on. Investors are not able to earn superior returns by buying or selling after the announcement. In the Semi-strong form efficiency, form market prices reflect all publicly available information (Brealey-Meyers, 2003). In this form of efficiency, fundamental analysts, analysts who attempt to find under or overvalued securities by analyzing fundamental information, such as earnings, asset values, and business prospects, are not able to earn superior returns.

Investors study the company‘s business and try to uncover information about its profitability that will shed new light on the value of the stock. They help to make price changes random because competition in fundamental research will tend to ensure that prices reflect all relevant information and that price changes are unpredictable.

Strong Form of Efficiency

In the strong form of efficiency, prices reflect all the information that can be acquired by painstaking analysis of the company and the economy. In such a market one would observe lucky and unlucky investors, but one cannot find any superior investment managers who can consistently beat the market. In the Strong-form efficiency, form market prices rapidly reflect all information that is potentially available to determine the true value. If the market is efficient in the strong form, the current stock prices reflect all existing information including both private and public types. In other words, in this market, in order to earn unusual returns, individuals must have continuous access to confidential information of the companies (Dobbins, Witt and Fielding, 1994 as cited in Talebloo et al., 2014). In such a market, prices would always be fair and no investor would be able to make consistently superior forecasts of stock prices. As an insider, you cannot hide information on gold (Brealey-Meyers, 2003).

Implications of the efficient market hypothesis are that asset prices move almost randomly over time and securities will be fairly priced, based on their future cash flows, given all information that is available to investors. Because information is reflected in prices immediately, investors should only expect to obtain a normal rate of return. Awareness of information when it is released does an investor no good because the price adjusts before the investor has time to trade on it

Limitations of the Efficient Market Hypothesis (EMH)

At a theoretical level, the EMH has many obvious limitations. The most important of these limitations stems from the fact that EMH is a pure exchange model of information in markets. What this means is that the theory makes no statements whatsoever about the supply side of the information market. That is about how much information is available, whether it comes from accounting reports or statements by managers or government statistical releases, what its reliability is, how continuous it is, the frequency of extreme events, and so forth. The theory addresses only the demand side of the market.

The EMH says that, given the supply of information, investors will trade on it until in equilibrium there are no further gains from trading. However, the EMH is silent about the shapes of return distributions and how they evolve over time. Information is modelled in the EMH as an objective commodity that has the same meaning for all investors. In reality, investors have different information and beliefs. The actions of individual investors are based not only on their own beliefs, but about the beliefs of others (i.e. their necessarily incomplete beliefs about others' motives for trading). This likely becomes most important during periods of rapid price changes. In addition, information processing is assumed in the EMH to be costless, and hence information is incorporated into prices immediately and exactly. While it seems reasonable to assume that the cost to investors of acquiring public information is negligible, information processing (or interpretation) costs are an entirely different matter. They have received little attention. However, seasoned investors have access to better information and subsequently may have lower required returns.

The EMH also is silent on the issue of investor taxes. In reality, many investors pay taxes on dividends and capital gains, with some offsets for capital losses. The effects of investor taxation on security prices and expected returns are potentially large, but not well understood.

From the above, it should be apparent that the EMH adopts a simplified view of markets. To those who take theories literally, not as useful abstractions the combined effect of these simplifications as well lead the question whether behavioural finance is the answer. Hence the emergence of behavioural finances theory.

Behavioural Finance Theory

This started when the early financial economists observed and reported anomalies within the capital market. The first discussion of an anomaly in the market reaction to public information was Philip Brown‘s study of the market reaction to earnings announcements in 1968. It was observed that the market response to the announcements persisted for several months, a phenomenon that later became known as post earnings announcement drift or earnings momentum. By the mid-1970s this pattern had been observed in several studies, including Basu, (1977) whose findings challenge the EMH and it was the first to test the notion that value-related variables might explain violations of the Capital Asset Pricing Model (CAPM) (Beechey, Gruen, Vickery, & others, 2000); (Keim, 1983).

But the genesis of the Behavioural Finance literature is generally identified as the publication of two famous papers by Rogalski and Tinic (1986) and Thaler (1987). Since then, Behavioural theory has succeeded in poking many more holes in the theory of efficient markets.

Many researchers have given several definitions to Behavioural Finance. Behavioural Finance is an attempt to explain what causes some of the anomalies that have been observed and reported in the finance literature (Fuller, 1998). Behavioural Finance also relates how stock prices are affected by investors' behaviours (Barak & Demireli, 2006). Olsen (1998) noted that advocates of Behavioural Finance recognised that the standard financial model of rational behaviour that the EMH emphasised, can only be true within a specific boundary.

Advocates of Behavioural Finance theory however assert that EMH is an incomplete model since it does not consider individual behaviour.

Furthermore, the Behavioural Finance theory argued that some financial phenomenon can be well explained using models such as that of the Behavioural finance which recognises that some investors are not fully rationale and that it is not feasible for arbitrageurs to offset all instances of mispricing (Barberis & Thaler, 2003). Behavioural Finance attempts to explain investor biases based on psychological characteristics such as belief, perseverance and anchoring (Scott, Stumpp, & Xu, 1999).

In addition, investors may also suffer representativeness bias which causes them to believe that stocks of growth companies will be good stocks. Other biases include self-attribution bias where investors have the tendency to attribute any success to their own talent while blaming any failure on bad luck. Beside this, other market developments such as the existence of noise traders could lead to either over or under reaction on the market making it quite volatile (Brown, 1999). All the above biases suffered by investors emanate purely from investor psychology (behaviour) which cannot be explained by the traditional Efficient Market Hypothesis theory.

Efficiency of Ghana Stock Exchange (GSE)

There are a number of evidence documented that Africa’s emerging markets are characterised by a relatively large number of poorly informed and unsophisticated investors, low liquidity levels, weak legal, regulatory and institutional framework, and operational bottlenecks (Osei, 2002). The lack of understanding of the operations and mechanisms of the capital markets, and the poor state of communication to facilitate information flow also makes capital markets in Africa less efficient (Eleke-Aboagye & Opoku, 2013).

Asamoah (2010) examined the effect of the dividend announcement on share price behaviour on the Ghanaian stock market and concluded that there is weak information efficiency in Ghana. Frimpong (2008), also examined the weak-form EMH in the case of the GSE. He concluded that the GSE is weakly inefficient. Osei (2002), tested the information efficiency and his conclusion was that, the GSE was inefficient with respect to annual earnings information released by the companies listed on the exchange earnings announcements of the GSE. Ayentimi, Mensah and Naa-Idar (2013) rejected the weak-form efficient market (random walk) hypothesis for the GSE, meaning that the market is inefficient and financial stock returns exhibited volatility clustering. The rejection of weak-form efficiency is not only consistent with some previous studies Osei (1998), Appiah-Kusi and Menyah (2003), Frimpong and Oteng-Abayie (2008) but also theoretically not surprising which is an indication of inefficiency in the GSE.

Efficiency of Nairobi Stock Exchange (NSE)

Jeboisho (2014) tested the weak form of efficient market hypothesis at NSE using daily data for stock prices for the period of May, 2006 to December, 2009 and Kenya power and lighting company for the period of January 2002 to December 2009. The data was subjected to Kolmogorov Smirnov goodness of fit test, run tests and Autocorrelation tests. Overall results from the analysis suggests that the Nairobi Stock Exchange is not efficient in weak form.

Maronga, Nyamosi and Onsando (2015), used data consisted of the closing prices of the stocks on the day of announcement, and on the 1st, 3rd, 7th, 14th and 28th day before and after earnings announcements. They concluded that there was evidence of the market anomalies of overreaction and under-reaction. The study concludes that the Nairobi Stock Exchange is not semi strong-form efficient.

Jefferis and Smith (2005), classified formal African stock markets into four categories: South Africa, medium-sized markets, small new markets which have experienced rapid growth, and small new markets which have yet to take off. Using a GARCH approach with time varying parameters, a test of evolving efficiency of South Africa, Egypt, Morocco, Nigeria, Zimbabwe, Mauritius and Kenya, for periods 1990 to 2001. The results shows that the Johannesburg stock market is weak form efficient throughout the period, Egypt and Morocco from 1999 and Nigeria from early 2001 became weak form efficient towards the end of the period. While Kenya and Zimbabwe stock markets which showed no tendency towards weak form efficiency, and the Mauritius market which displayed a very slow tendency to eliminate inefficiency.

These studies provide evidence that the two markets are inefficient at the same level (i.e. weak for inefficient).

Empirical Review on Calendar Effect Anomalies and Stock Returns Volatility

Studies by Coutts and Sheikh (2002), Mokua (2003), Osman (2007) and Onyuma (2009), Demirer and Karan (2002), Osazevbaru and, Gu (2006), Chandra (2009), Bundoo (2011) and Roux and Smit (2001) tested for presence of calendar effect anomalies and stock returns volatility in different markets. However, the findings vary from time to time and from country to country due to differences in methodology, difference in data set used and difference in the macroeconomic fundamentals of the countries involved is such studies.

This section is divided into five sub themes. They include review of studies related to Day-of-The-Week Effect anomaly & Stock Market Efficiency, Day-of-The-Week Effect Anomaly & Stock Returns Volatility, followed by studies that are related to Month-of-The-Year Effect Anomaly & Stock Market Efficiency, Month-of-The-Year Effect Anomaly and Stock Returns Volatility and finally plausible explanations that researchers in the financial literature provided for the existence of calendar effect anomalies.

Day-of-The-Week Effect Anomaly and Stock Market Efficiency

Gregoriou et al. (2004) used the GARCH model to test for day-of-the-week effect on returns of the UK stock market utilising the FTSE 100 index. Their results provided evidence of the day-of-the-week effect. However, when transaction costs are considered, no presence of this phenomenon was found, meaning that the UK stock market appears to be weak-form efficient.

Alagidede (2007) investigated the day-of-the-week anomaly in Africa's largest stock markets. The result shows that for Egypt, Kenya, Morocco and Tunisia there is no day-of-the-week effect. However, there is significant daily seasonality in Zimbabwe, Nigeria and South Africa. The Friday average return is found to be consistently higher than other days in Zimbabwe. The concluded that Egypt, Kenya, Morocco and Tunisia markets are weak form efficient while Zimbabwe, Nigeria and South Africa were inefficient in the weak form.

Marrett and Worthington (2011) used the regression analysis on a data covering the period from 9 September 1996 to 10 November 2006. Their findings showed no seasonality for the overall Australian stock market. On the other hand, small cap showed higher returns on Thursdays and Fridays. The analysis of different sectors of the market provided a partial supportive evidence of the day-of-the-week effect hence the market proved to be inefficient.

Demirer and Karan (2002) examined the possible existence of the calendar effects in the Istanbul Stock Exchange for the period 1988 to 1996. Although all returns seemed to be consistently high, they could not find any supporting evidence of the Day of the week effect. The only significant finding was when they tested the autoregressive model that the lag variable was consistently highly significant. This implicated that yesterday's return was a signal for today's return and therefore implicated the market inefficiency.

Onyuma (2009) conducted a study to test the existence of day-of-the-week and month-of-the-year effect on the Kenyan stock market returns. Using regression analysis, data on prices and adjusted returns derived from the NSE 20 index were analysed to identify the behaviour of stock investors in Kenya during 1980-2006. The findings indicated that Monday produces the lowest negative returns, while Friday and January produce the largest positive returns. The study therefore concluded that the Kenyan stock market was inefficient.

Al-Jafari (2012) investigated day-of the-week effect on Muscat securities market. The study used a sample that covers the period from December 2005 to November 2011. Using a nonlinear symmetric GARCH (1, 1) model and two nonlinear asymmetric models, TGARCH (1, 1) and EGARCH (1, 1), empirical results provide evidence of no presence of the day-of-the-week effect. However, according to him, unlike other developed markets, Muscat stock market seems to start positive and ends also positive with downturn during the rest of the trading days. The study concluded that Muscat securities market is an efficient market.

Hussain, Hamid, Akash, Khan, and others (2011) tested for calendar effect anomalies in the Karachi stock exchange (KSE-100) using a sample from January 2006 to December 2010 employing regression analysis. Their findings revealed that Tuesday returns were positive, significant and higher compared to other days. On the other hand, Abdullah, Baharuddin, Shamsudin, Mahmood and Sahudin (2011) examined the day-of-the-week effect on Malaysia shariah-compliant market, applying OLS on a data covering the period from 21 May 2007 to 19 September 2008, their findings show a presence of the day-of-the-week effect in Kula Lumpur shariah index (KLSI). However, no presence of this phenomenon was found for FBM Emas shariah and FBM Hijrah Emas Shariah indices. Furthermore, KLSI exhibited a significant return on Monday while positive significant return was noticed on Friday. The study was silent on the efficiency of the stock market.

Nishat and Mustafa (2002) investigated the day of the week effect in Pakistani stock market. Their analysis indicated that there was no pattern in mean return on week days, however, a pattern was found in trading volume. However, Basher and Sadorsky (2006) investigated 21 emerging stock markets around the world for the period 1992 to 2003. They documented little evidence of the time patterns. They found that there was the Day of the week effect only in three counties (Philippines, Pakistan and Taiwan) out of all 21 countries which were therefore referred to as inefficient markets. Taiwan had a positive Friday effect, Pakistan had a negative Tuesday effect and the Philippines had a positive Tuesday effect.

Yakob, Beal, and Delpachitra (2005) studied the day-of-the-week, month-of-the-year, monthly and holiday effects in ten Asia Pacific countries over the period January 2000 to the March 2005. The day-of-the-week effect, in particular, was documented in five countries, namely India Indonesia, Taiwan, Australia and China. However, patterns of daily seasonality differed from one country to another. No evidence was found to suggest the existence of the day-of-the-week effect in Hong Kong, Japan, Malaysia, Singapore, and South Korea, which implies that the stock markets were efficient

Bashir, Ahmad, Ilyas, and Malik (2011) refuted efficient market hypothesis in banking sector of Pakistan. In their studies of the Chinese stock market, Cai, Li and Qi (2006) found the presence of the day-of-the-week effect with negative returns on Mondays and Tuesday. Similarly, Roux and Smit (2001) refuted efficient market hypothesis by providing empirical evidence of the day-of-the-week seasonal pattern on the Johannesburg Stock Exchange (JSE) over the period 1978 through to 1989. The JSE All Share Index, JSE All Gold Index and JSE Industrial Index had the lowest and negative average return on Mondays. The JSE All Share Index and JSE All Gold Index exhibited abnormal return on Wednesdays and JSE Industrial Index on Tuesdays.

However, in the period 1990 – 1998 the JSE All Share Index and JSE Industrial Index had the lowest but non-negative returns on Mondays. The JSE Financial Index had the lowest and negative returns on Mondays. The JSE All Gold Index had the lowest returns on Tuesdays. The highest return for the JSE All Share Index, JSE Financial Index and JSE Industrial Index was documented on Wednesdays and for JSE All Gold Index on Thursdays. However, the null hypothesis of equal means across different days of the week was rejected for all indices for the period 1978 through 1989 but was not rejected for the period 1990 through 1998 for all indices except for JSE Financial Index. The study showed that day-of-the-week pattern which existed on the JSE in 1980s started to disappear in 1990s, hence the conclusion was that the market was gaining efficiency.

Hui (2005) using the nonparametric test, examines the effect of the day of the week for four markets of the Asia-Pacific and two developed markets. The empirical results show that Hong Kong, Taiwan, and Singapore show higher average returns on Fridays and of the weak influence of Monday in the average returns, but for the United States, Japan, and South Korea we can show the existence of a mixed model. As a whole, it is only in Singapore that one day ago of the week which has an important effect.

Kamaly and Tooma (2009) investigated the day-of-the-week effect in twelve major Arab stock markets in eleven different countries (Bahrain, Egypt, Jordan, Kuwait, Lebanon, Morocco, Oman, Palestine, Qatar, Saudi Arabia and UAE (Abu Dhabi and Dubai) from 2002 to 2005. The results reveal that Egypt, Jordan and Kuwait have a day-of-the-week effect for both the opening and closing days of the trading week, an indication of market inefficiency. In addition, Azizan and Saad- Mohamed (2009) examined the seasonality effect in the Saudi Arabian stock market for the period 2003–2007. Their study suggests the existence of seasonality in stock returns in the Saudi Arabian stock market for both daily and monthly data. The maximum average return (positive) was found on Tuesdays and the lowest (negative) return on Thursdays. Furthermore, the maximum average returns were found in the months of February, June and August and the minimum average returns (negative) in the months of April and October. The study therefore rejects the efficient market hypothesis.

Bundoo (2011) investigated existence day-of-the-week effect and the January effect anomalies in the Stock Exchange of Mauritius (SEM) over the period January 2004 to December 2006. The study documented negative Tuesday returns but positive returns for other days of the week. However, after controlling for the size effect and the value premium as per the Fama and French (1993) three-factor model, only the Friday effect remains significant. The possible profit opportunities on the SEM in terms of both economic and statistical significance were also investigated. The study further investigated investment strategies based on momentum in returns on the Stock Exchange of Mauritius and how robust these strategies are after controlling for size and value. The mean excess returns were statistically significant at the one percent (1%) level for momentum portfolios. The study also revealed strong support for the Carhart (1997)'s model where the momentum factor was priced. The explanatory power of the momentum factor dominates that of size and value.

Brooks and Persand (2001) researched on day-of-the week effects in emerging markets. They studied the five Southeast Asian stock markets namely Taiwan, South Korea, The Philippines, Malaysia and Thailand. The sample period was from 1989 to 1996. They found that neither South Korea nor the Philippines has significant calendar effects. However, Malaysia and Thailand showed significant positive return on Monday and significant negative return on Tuesday.

Bayar and Kan (2012) sampled returns from nineteen countries and found that for the majority of the markets the day-of-the-week effects in the stock market returns existed on Tuesday and Wednesday. They found a weaker effect in the returns for Thursday and Friday. They also concluded that markets was inefficient.

Similarly, Rodriguez (2012) examined the Day of the Week Effect for the main stock markets in Latin using a sample period of 1993 to 2007. Undertaking three different analyses, including GARCH models for the returns and volatility of daily returns by day of the week for the major stock market indexes in the region, he found significant evidence of a Monday Effect (lower than expected returns) or a Friday Effect (higher than expected returns) in many cases in the region and confirmed the inefficiency of the market.

On the other hand, Shamshir and Mustafa (2014) establish Monday is the best day in which high returns are obtained but Friday reflected losses. Their study was based on the arrival of the new public information. The study supports the Monday effect because the time between closing day of the week and opening day of the next week has three days of accumulated information which have a greater impact on Monday.

Steeley (2001) stated that the UK weekend effect was not persistent and appeared stronger during market downswings. The same conclusion was made by Sullivan and Liano (2003). The periods when the Monday seasonal in stock returns was the most pronounced were also the periods with the largest difference in the percentage of declining issues for Mondays compared with other weekdays. On the other hand, Ajayi, Mehdian, and Perry (2004) conducted an investigation into the day-of-the-week anomaly using major market stock indices in eleven Eastern European emerging markets (EEEM) during the period from the mid-1990s through to 2002. The empirical results showed negative Monday stock returns in six of the EEEMs, namely Czech Republic, Estonia, Latvia, Lithuania, Romania, and Slovakia. However, these negative returns were significant in only two of the markets, in Estonia and Lithuania. Positive Monday returns were documented in the remaining five markets but were significantly positive in only one of the countries (Russia).

Mokua (2003) tested whether or not stock returns at the Nairobi Stock Exchange (NSE) were affected by the weekend effect variation. In his study he used the daily stock return and equality of means to test for the seasonality in some stocks quoted in the NSE for the period April 1, 1996 to March 31, 2001. He found out that Monday returns neither were significantly lower than the other days nor are Friday returns significantly higher than the other days of the week. His findings show the absence of weekend effect in the NSE for the period under study.

Rasugu (2006) in his study, evaluated the impact of the holiday effect on the common share returns of companies listed on the Nairobi Stock Exchange (NSE) during the period 1st Jan 1998 to 1st December 2002. Daily mean returns of the days preceding holidays and other non-pre-holiday days were compared. Results showed that on a trading day prior to public holidays, mean returns were 1.6 times returns of other days. However, the results were not significant. The findings did not support the existence of the holiday effect in the NSE.

Mehdian and Perry (2001) examined the Monday effect in five major US equity indices. In the full sample period from 1964 to 1998 and a sub-sample period from 1964 to 1987, they confirmed that Monday returns were significantly negative and were lower than returns during the rest of the week. They found that the average Monday percentage return was -0.15 percent for the RUSSELL index and -0.06 percent for the SP500 index. The study concluded that US stock market is inefficient.

Boudreaux, Rao, and Fuller (2010) examined weekend effect in the Dow Jones Industrial Average (DJIA), the S&P500 and the NASDAQ. Data used for the

DJIA and S&P500 was for the period 1976–2002, whereas for the NASDQ it was for the period 1984–2002. This study examined the distribution of daily stock returns during bear and non-bear markets in an attempt to determine the robustness of the weekend effect. In a bear market, the study compared the average daily return for weekends with that for non-weekends. Contrary to prior expectations, no significant difference was found between the weekend and non-weekend average daily returns in any of the three indices. This study then tested the average percent daily returns for weekends against non-weekends during non-bear markets. The results show that there is no significant difference between average percent daily returns for non-weekends and weekends during non-bear markets, except for the NASDAQ. The study therefore concluded that market is efficient

Brusa, Liu, and Schulman (2003) investigated Monday returns for four major US stock markets: the Dow Jones Industrial Average (DJIA), the Standard and Poor's 500 (S&P 500), the CRSP (Center for Research in Security Prices) value- weighted, and the NASDAQ stock indexes over a period of eleven years from 1988 to 1998. They presented evidence of a 'reverse' weekend effect where Monday returns were significantly positive and higher than the returns on any other day of the week. They found that the degree of the 'reverse' weekend effect was directly related to firm size. Small firms showed 'diminishing' weekend effect, while large firms had strong 'reverse' weekend effect. They also found during the sub period 1966 to 1987 that the average Monday return for the DJIA was -0.130 percent and for the NYSE Composite was -0.15 percent. On the other hand, the average Monday return for the DJIA and the NYSE Composite indexes were 0.130

percent and 0.083 percent during the sub period 1988 to 1996. They confirmed that while the "traditional" weekend effect exists during the pre-1988 sub period, the effect was reversed during the post-1988 sub period. This implies a rejection of the efficient market hypothesis for both sub periods.

Kamath and Chusanachoti (2002) using the OLS and the GARCH model. They found conflicting results where a strong evidence of the day-of-the-week effect was found during the 1980's, however, the presence of this phenomenon disappeared in the 1990's. Similarly, Al-Loughani and Chappell (2001) utilised the GARCH model on Kuwait stock market and found that returns were higher on Friday and Lower on Monday providing supportive evidence of the day-of-the-week effect. Similarly, Choudhry (2001) analysed this phenomenon on seven emerging Asian stock markets to include India, Indonesia, Malaysia, Philippine, South Korea, Taiwan, and Thailand. His findings proved a presence of the day-of-the-week effect on both returns and volatility. Again, similar results were concluded by Poshakwale (1996) regarding the Bombay stock exchange (BSE) in India. The findings showed that returns on Fridays were significantly higher compared with other days of the week, hence rejects of the efficient market hypothesis.

Osman (2007) in his study of holiday effect attempted to find out if stocks listed at NSE exhibit higher returns on average on the days preceding holidays. His study covered a period of nine years January 1998 to December 2006 taking into account the eight day window, being four days before and four days after the holidays. His population of study consisted of all the company's constituting the AIG index, 20 of them constituting the NSE-20 share index. He used regression and correlation analysis in his study. Correlation analysis was used to test for multicollinearity between an indicator and the index. He found no holiday effect on stock returns at the NSE and hence a strategy of investing around holidays cannot be used by investors.

Gharaibeh and Al Azmi (2015) examined the day-of-the-week effect on the available data of daily returns on the weighted index in the Kuwait stock exchange during the period from January 2002 to September 2011. Their empirical findings show that the Kuwait stock exchange exhibits positive returns on the first and the last day of the week with significant negative returns on the second day of the trading week. They documented that the Kuwait stock exchange was inefficient.

McGowan and Ibrihim (2009), using ARCH/GARCH models found a presence of the day-of-the-week effect in the Russian stock market. They concluded that returns were positive in every day except on Wednesday where they were the lowest; the highest returns were observed on Friday. Similarly, Al-Barrak (2009) tested the day-of-the-week effect in some of the Gulf Cooperation Council (GCC) stock markets including the markets of Saudi Arabia, Kuwait and UAE (Dubai). He concluded that this anomaly is existed in Kuwait stock market only and the highest returns were observed on Saturday while the lowest returns were achieved on Sunday. The efficient market hypothesis was rejected. Also, Rahman (2009) employed the regression analysis and the GARCH (1, 1) model to examine the anomaly of Dhaka stock exchange (DSE). His results showed that returns were negative and significant on Sunday and Monday while positive significant returns were achieved on Thursday. (Ho, 1990), using daily returns for the period 1975–

1987, found that six out of eight Asia Pacific stock markets exhibit significantly higher daily returns in January than in other months.

Bhana (2002) evaluated the impact of the public holiday effect on the share returns of the companies listed on the Johannesburg Stock Exchange (JSE) during the period 1975-1990. He used the analysis of variance (ANOVA) technique and 9 pre-holiday periods to determine whether or not the holiday effect has an influence on share returns of companies listed on the JSE. His study finds high mean returns accruing to the JSE Overall Actuaries Index on the trading day prior to holidays which is statistically significant. The presence of calendar anomaly (day of the week effect) confirms inefficiency of the Johannesburg Stock Exchange (JSE).

Day-of-The-Week Effect Anomaly and Stock Returns Volatility

Kiymaz and Berument (2003), investigated the day-of-the-week effect and the volatility of major stock market indexes for the period of 1988 through 2002. They found that the day-of-the-week effect was present in both return and volatility equations. They found volatility occurs highest on Monday for Germany and Japan and on Friday for Canada and the United States, while on Thursday for the United Kingdom (UK).

Berument and Kiymaz (2001) tested the presence of the day of the week effect on stock market volatility by using the S&P 500 market index during the period of January 1973 and October 1997. The findings show that the day of the week effect is present in both volatility and return equations. While the highest and lowest returns are observed on Wednesday and Monday, the highest and the lowest volatility are observed on Friday and Wednesday, respectively. Further investigation of sub-periods reinforces the findings that the volatility pattern across the days of the week was statistically different and persists for a long time.

Abdalla (2012) used ordinary least squares (OLS) and Generalised Autoregressive Conditional Heteroskedasticity (GARCH) models to investigate the day-of-the-week effect on stock market returns and volatility of Khartoum stock exchange (KSE). His findings reveal no evidence of day-of-the-week effect in KSE. Similarly, Mbululu and Chipeta (2012) analysed the day-of-the-week effect on a nine listed sector indices of South Africa stock market (i.e. Johannesburg Stock Exchange (JSE). Their findings exhibited also no evidence of the day-of-the-week effect for eight of the nine sector indices of JSE. However, Monday effect was found in the materials sector only.

Al-Jafari (2012) using a nonlinear symmetric GARCH (1, 1) model and two nonlinear asymmetric models, TGARCH (1, 1) and EGARCH (1, 1) to examine day of the week effect and stock returns volatility in Muscat securities market, empirical results provide evidence that parameter estimates of the GARCH model suggested a high degree of persistent in the conditional volatility of stock returns. Furthermore, the asymmetric EGARCH, and TGARCH models show no significant evidence for asymmetry effect in stock returns.

Derbali and Hallara (2016) examined day-of-the-week effect on the Tunisian stock exchange index (TUNINDEX) return and volatility. They used three multi-variate general autoregressive conditional heteroskedasticity models GARCH (1,1), EGARCH (1,1), and TGARCH (1,1) to examine the presence of daily anomalies in the TUNINDEX returns and volatilities during the period from 31 December 1997 to 07 April 2014. The empirical results of GARCH (1, 1), EGARCH (1, 1), and TGARCH (1, 1) model indicate the existence of a significance and positive effect for Thursdays and for the return at $(t - 1)$ on the return and volatility of TUNINDEX in a threshold of 1 percent. In addition, they found the presence of a significant and negative Tuesday effect on the TUNINDEX return and volatility. Also, the study showed the persistence of volatility in the case of Tunisian stock market index.

Ulussever, Yumusak and Kar (2011) also studied the Saudi stock exchange using the GARCH model. Their findings provide evidence of the presence of the day-of-the-week effect in the daily return of the Saudi stock market.

Dumitriu and Stefanescu (2013) investigated the presence of the day of the week effects in returns and volatility for 32 indices from advanced and emerging markets. They analysed the seasonality for two periods of time: a relative quiet period, from January 2000 to December 2006, and a more turbulent period, from January 2007 to September 2012. A GJR-GARCH model was used to identify, for the two periods, various forms of day of the week effects in returns and volatility. However, only for few indices, they found the stability in time of the daily seasonality. Furthermore, the study showed that for many of the advanced markets indices, the day of the week effects in returns identified for the quiet period disappeared during the turbulent period. A less radical decline occurred for the day of the week effects in volatility. In the case of indices from the emerging markets, the persistence in time of the daily seasonality in returns was more consistent in comparison with advanced markets indexes. Regarding the volatility of emerging markets, findings show that during the turbulent period many day of the week effects in volatility disappeared, while new others appeared. Also, Baker, Rahman, and Saadi (2008) investigated the day-of-the-week effect and the conditional volatility on the S&P/TSX Canadian returns index. They found that the day-of-the-week effect is sensitive in both the mean and the conditional volatility and that using of the regression analysis is a better way to investigate this effect.

Chukwuogor-Ndu (2007) investigated the presence of the day-of- the-week effect, returns volatility and the annual returns of five African stock markets. The results show that the markets in Ghana and Nigeria have no negative returns during the trading days of the week. On the other hand, Botswana and Egypt have negative returns on Tuesday while the South African Securities Exchange has a negative return on Wednesday. Botswana, Ghana and Nigeria experienced their highest return on Wednesday while Egypt and South Africa experienced their highest return on Monday. Botswana and Egypt recorded the lowest return on Tuesday, Ghana on Monday, Nigeria on Thursday and South Africa on Wednesday. The highest standard deviation of return occurred mostly on Friday for Ghana and Nigeria. The lowest standard deviation also occurred on Friday for Botswana and Egypt. There is also high volatility in returns. These results do not support the existence of the day-of-the-week effect on stock returns in the Botswana, Egypt, Ghana, Nigeria and South Africa stock markets as observed from an analysis of the daily returns for the period 1997 to 2004. It was also observed that in the markets of Botswana, Nigeria, and in South Africa's JSE All Share Index, the daily return seasonalities were not accompanied by any volatility seasonality and investing on low (high) return weekday does not necessarily mean that risk is also low or high.

Shamshir and Mustafa (2014) investigated the day-of-the week effect and volatility in Karachi Stock Exchange from 2009 to 2013 using all four indices (i.e. KSE-100, KSE-all share, KSE-30 and KMI-30) in the stock exchange. Using OLS and autoregressive technique, they documented Tuesday effect for KSE-100 index and Thursday effect in case of KSE-all share index. For KSE-30 and KMI-30 indices there was no evidence of day of the week effect. Using GARCH (1, 1) technique with student's t distribution, the study established highly persistent volatility in KSE-100 index whiles less persistent shocks in KSE- all share and KSE-30 index and a rapid decay in KMI-30. However, the study failed to examine the normal Gaussian distribution and Generalised Error Distribution of the GARCH (1, 1).

Anwar and Mulyadi (2012) researched day-of-the-week effects and volatility in Indonesia, Singapore and Malaysia stock markets in order to find out the existence of anomaly in the three countries. The study employed EGARCH econometric models. The result shows that there was Friday positive abnormal return in Indonesia and Malaysia. In Singapore, there was no Friday positive abnormal return. The study also concluded that, there was no Monday negative abnormal return in the three countries and stock returns volatility do not persist.

Olowe (2009) also investigated day-of-the-week effects in the Nigerian foreign exchange market using the GARCH and GJR-GARCH models under the normal error distributional assumption for period of January, 2002 to March, 2009.

Although the results failed to support the presence of the day-of-the-week in the FOREX rate returns, but there was evidence of the effects in the volatility. The GARCH model was found to fit better than the GJR-GARCH model for the data used. Berument and Dogan (2012) also examine the stock market returns and volatility relationship using US daily returns from May 26, 1952 to September 29, 2006. The empirical evidence reported did not support the proposition that the return-volatility relationship is present and the same for each day of the week.

Osarumwense (2015) assessed the influence of error distributional assumption on appearance or disappearance of day-of-the-week effects in returns and volatility using the Nigerian stock exchange (NSE-30). The Gaussian, Student-t, and the Generalised error distribution were incorporated in the GARCH (2, 1) and EGARCH (2, 1) models. The study revealed that day-of-the-week effects were sensitive to error distribution. The finding also indicated that evidence of good or bad news in volatility does not only depend on the asymmetric model but also the choice of the error distribution.

Chukwuogor-Ndu (2007) investigated the presence of the day-of-the-week effect and return volatility in ten East-Asian financial markets in the post Asian financial crisis period, after 1998. A set of parametric and non-parametric tests were used to test the equality of mean returns and standard deviations of returns. The results indicate the presence of the day-of-the-week effect and insignificant daily returns volatility in most markets.

Osazevbaru and Oboreh (2014) also investigated the Nigerian stock market anomalies using the OLS methods and the GARCH model under the normal error distribution assumption with data spanning from January 1995 to December 2009. They found anomaly in the Nigerian stock market for Monday effect. Using one hundred and sixty-seven (167) stocks all share index listed on the Nigerian stock market between the period of 2004 and 2014, the January and Monday effects found no significant evidence in January and day-of the-week effects.

These results differ from those documented by Brooks and Persand because they did not document any anomaly for the Philippines. (Chen et al., 2001) studied the Day of the week anomaly in the stock markets of China over a period from 1992 to 1997. Their results showed only a negative Tuesday effect after 1995.

Mlambo and Biekpe (2006) investigated stock market seasonal effects on 17 indexes from nine African stock markets. Using regression analysis, significant Monday effects were found on two of Botswana's indices, the Foreign Companies Index (FCI) and the All Companies Index (ACI), and on the Morocco index. Significant turn-of-the-month effects were also found on the FCI and ACI, on the Egyptian and Mauritian indexes. The Turn-Of-the Month effects (TOM) effects disappeared for Egypt and Mauritius after removing the Turn-Of-the-Year (TOY) effects, suggesting that the TOM effects on these markets could be TOY effects. However, the TOY effects are significant only for Egypt and Zimbabwe's Industrial Index, but not for Mauritius. The results indicated that Mondays give the lowest mean daily returns for Botswana's FCI and ACI, and for Zimbabwe's Industrial and Mining indexes, consistent with the literature. However, only the Monday returns for the FCI are significant at the 5 percent level. The lowest mean daily returns were observed on a Tuesday for Mauritius' SEMTRI, Morocco's index, Namibia's Local Index, and Tunisia's indexes, consistent with evidence from the Australian and Asian markets. The largest mean daily returns are observed on a Friday for the FCI and ACI (significant at the 1% level), Zimbabwe's Mining Index, Egypt's indices, and Mauritius' SEMTRI and Semdex. Although not all of them are significant, the evidence supports the literature that Fridays offer the highest mean daily returns compared with the other days of the week.

Al-Mutairi (2010) finds an evidence of the presence of the day-of-the-week effect in the stock exchange of Kuwait. The empirical results show that the outputs of Saturday have a positive and higher impact than other days of the week except Wednesday, which suggests that the Kuwaiti stock exchange market is ineffective.

Aly, Mehdian and Perry (2004) found that returns on Mondays were significant and positive but they were not significantly different from the other days of the week. Therefore, they concluded that no evidence of any daily seasonality is present in the Egyptian stock market. Contrary results were obtained by where he investigated this anomaly in Amman stock exchange. He found that returns on Thursday, the end of the week, were positive and the highest, while returns on Monday were negative and the lowest.

Tachiwou (2010) developed an analysis on the effect of the day of the week on regional stock market in West Africa over the period 1998–2007. Their empirical results show that the returns are the lowest on Tuesday and Wednesday and they are higher on Friday. On the other hand, Agathee (2008) found the stock exchange of Mauritius exhibited support of this phenomenon and returns were higher on Friday. However, the mean returns of the five week days were jointly insignificant and differ from zero

Umar (2013) investigated the day-of-the-week effects for the Nigerian and South African equity markets for over pre-liberalization and post-liberalization periods. The exponential generalised autoregressive conditional heteroskedasticity (EGARCH) model was used to estimate the day-of-the-week effect both in the mean and variance equations. Evidence of day-of-the-week effect was found in both the mean and variance equation for the Nigeria and South African equity markets.

Lean and Tan (2010) investigated the day of the week effect for ten FTSE Bursa Malaysia indices. Following standard procedure of determining calendar anomaly with additional GARCH related models employed, the findings suggest that the day of the week effect exist only for the FTSE Bursa MESDAQ Index. Further, they noted that the effect might be due changing volatility since the negative and lowest Monday return does not appear to be significant in the EGARCH model.

Month-of-The-Year Anomaly and Stock Market Efficiency

Rahman and Amin (2011) examined the presence of monthly anomaly in the premier stock exchange of Bangladesh, Dhaka Stock Exchange (DSE). The study used daily closing prices data of DSE indices such as DSE all Share Index (DSI), DSE general index (DGEN) and DSE 20 index for a period of January, 2001 to June, 2010. Applying dummy variable regression the study established that May and June returns were positive and statistically significant. It also revealed that the mean daily returns between two consecutive months differ significantly for the pairs April-May, June-July and December-January. Further, the study showed that the average monthly returns of every month of the year were not statistically equal. The study concluded that significant month of the year effect was present in DSE which is a denial of efficient market hypothesis.

Azab (2002) and Mecagni and Sourial (1999) concluded that the index returns at the Egyptian market displayed a degree of time dependence and volatility clustering. This suggests serial correlation of returns, which can be used to predict the market based on past performance. These findings are inconsistent with efficient markets theory. Furthermore, Deev and Linnertová (2013) examined intraday and intraweek market returns on the Czech stock market for the search of time and seasonal anomalies. Their results confirmed the presence of time-varying effect in the index of the Czech stock market which has implication for changing the efficiency of the market. Additionally, they found that there was significant hour-of-the day effect that is open jump effect in this market index, which contradicts the efficient market hypothesis.

Mehdian and Perry (2001) investigated monthly patterns in five major US equity indices from 1964 to 1998 and a sub-sample period from 1964 to 1987. For the full sample period the found that January returns were positive and significant in all three indices. In the first sub-period (1964-1987) the returns in January were also significantly positive, but in the second sub-period (1987-1998) there did not appear any significant January effect and therefore it had disappeared.

Kamau (2003) examined the January effects at the NSE during the period July 1995 through June 2003. He made use of the NSE daily closing prices. Average daily returns were computed by applying the holding period return method. In his findings, the January effect was not a prevalent phenomenon in the period covered.

Smith (2008) tested the hypothesis that a stock market price index follows a random walk in African stock markets of Botswana, Ivory Coast, Egypt, Ghana, Kenya, Mauritius, Morocco, Nigeria, South Africa, Tunisia and Zimbabwe using joint variance ratio tests with finite-sample critical values, over the period beginning in January 2000 to September 2006. The author rejected the hypothesis in all the markets. Stock markets of Egypt, Nigeria, Tunisia and South Africa showed weekly returns that were a martingale difference.

Ayadi et al. (1998) found the absence of month of the year effect in the Nigerian and Zimbabwean stock markets but confirmed the presence of seasonality in stock returns for Ghana. Furthermore, using the dummy variable regression analysis approach, showed the presence of the January effect for Ghana but not for Nigeria and Zimbabwe. Chen et al. (2001) examined the possible January effect on some Asian stock markets (Singapore, Taiwan and Hong Kong) using daily data for the period 1990–2007. The results supported the existence of month of the year effects in these Asian markets, indicating a denial of the efficient market hypothesis. Similarly, Guidi, Gupta and Maheshwari (2011) employed the autocorrelation analysis, runs test and variance ratio test to test the weak form of the efficient market hypothesis for Central and Eastern Europe (CEE) equity market over 1999-2009 periods and discovered that the stocks in these markets did not follow the pattern of a random walk.

Choudhry (2001) reported January effect on the UK and US returns but not in German returns. Fountas and Segredakis (2002) tested for seasonal effects in stock returns (the January effect anomaly) using monthly stock returns in 18 emerging stock markets for the period 1987 to 1995. They found very little evidence in favour of this effect in the emerging markets. Maghayereh (2003) finds no evidence of monthly seasonality or the January effect in the Amman Stock Exchange (Jordan).

Alagidede (2008) investigated calendar effect for African stock returns through the month-of-the-year and the pre-holiday effects. He found high and significant returns in days preceding a public holiday for South Africa, but not for the other stock markets in the sample. The month-of-the-year effect was found to be prevalent in African stock market returns. However, he noted that due to liquidity and round-trip transactions cost the anomalies uncovered may not necessarily violate the no-arbitrage condition.

Gonzalez-Perez and Guerrero (2013) utilised data belonging to S&P 500 during the period from 2004 to 2011. Their empirical findings are supportive of US market efficiency with the absence of DOW effect in the daily S&P 500 returns. Therefore, they conclude that designing a trading strategy without taking any risk will not lead to attaining abnormal returns as there is no deterministic seasonal pattern. Confirmative findings that were opposite to the DOW effect were also documented by Carlucci, Junior, and Lima (2013) for the main stock exchange indices of Canada and US over the period from 2002 to 2012. Another research conducted by Puja (2010) shows insignificant results for S&P 500 during the period from January 1990 to November 2014.

Month-of-The-Year Effect Anomaly and Stock Returns Volatility

Chiang and Doong (2001) investigated the time-series behaviour of stock returns for seven Asian stock markets. They found that in most cases, higher average returns appeared to be associated with a higher level of volatility. Testing the relationship between stock returns and unexpected volatility, their results showed that four out of seven Asian stock markets had significant results. Further, analyzing the relationship between stock returns and time-varying volatility by using Threshold Autoregressive GARCH (1, 1) in mean specification indicates that the null hypothesis of no asymmetric effect on the conditional volatility was rejected for the daily data. However, the null was not rejected for the monthly data.

Chandra (2009) examined the calendar effect anomalies and stock return volatility in Bombay Stock Exchange (BSE) and showed that the turn of the month and time of the month effects were significant in the return of the BSE 30 securities. The study also concluded that volatility was persistence in the Bombay Stock Exchange.

Guidi, Gupta and Maheshwari (2010) also applied the Generalised Autoregressive Conditional Heteroskedasticity in Mean (GARCH-M) model for Central and Eastern Europe (CEE) equity market over 1999-2009 periods and concluded that stock returns were highly persistence volatility. Therefore, according to them, an informed investor could make abnormal profits by studying the past prices of the securities in these markets. Also, Nassir and Mohammad, (1987) and Balaban (1995) provided evidence that in Malaysia and Turkey the average January returns were significantly positive and higher than in other months.

Jacobsen, Mamun, and Visaltanachoti (2005) studied the interaction between Halloween effect - anomaly and January effect and other well-known anomalous findings on portfolios formed on Size, Dividend Yield, Book to Market ratios, Earnings Price ratios and Cash Flow Price ratios in equally but also value weighted portfolios for the US market. They found out that contrary to the January effect, the Halloween effect seems a market wide phenomenon unrelated to these well-known anomalies. Their study showed that all portfolios have higher average winter returns than summer returns. They further confirmed results which suggest that the January effect plays an important role not only in explaining the small firm effect but also together with size in explaining the Book to Market ratio anomaly. In addition, the findings shows that the stock markets were highly volatile.

Ajibola, Prince, and Lenee (2014) presented robust analyses of the Nigerian equity market using weekly stock prices of 140 listed companies in Nigeria over the period of 2006 to 2012. They adopted two sets of tests. The first set comprises Lilliefors, Cramer-Von-Mises, Anderson-Darling and Ljung-Box which confirmed that stock prices are not normally distributed. But the second set includes size/rank variance ratio tests and TGARCH in mean technique. The tests jointly revealed strong presence of inefficiency as anomalies can be traced to persisted volatility, lack of randomity, significant effects of information and heteroskedasticity/

leptokurtic nature of stock prices. They therefore conclude that information plays significant role in Nigerian stock market.

Al-Saad and Moosa (2005) investigated the general index of the Kuwait Stock Exchange. Monthly return data used for the period 1984–2000. The results indicate that seasonality takes the form of a ‘July effect’ rather than a ‘January effect’ that was widely observed in other studies. One possible explanation for the July seasonal effect was the summer holiday effect. Since the majority of investors take their holidays during August, they exploit the month of July to invest idle cash and rebalance their portfolios. Thus July witnesses abnormal stock market activity, pushing stock prices higher. Furthermore, Al-Deehani (2006) investigated the general index of the Kuwait Stock Exchange and its various sectors for the period 1996–2004. The results indicate the existence of positive pre-summer seasonal factors for the market and most of the sectors, which can be explained by the summer holiday effect. In addition, the study also concluded that volatility was persistence in the Kuwait Stock Exchange.

In addition, Koutianoudis and Wang (2003) found January effects in the Greek stock market during the period from January 1992 to December 2001. Furthermore, this was not the case when the market was going down. On the other hand, they examined whether the January effect can be utilised as a profitable investment strategy, and they found that the January strategy clearly outperforms the ‘buy-and-hold’ strategy, even after the transaction costs. However, the study could not provide evidence for persistent volatility in the Greek stock market.

Gu (2006) studied the January effect in major equity indices of Canada, France, Germany, Japan and the United Kingdom for the sample 1970-2000. His results confirmed January anomaly for all market returns before the 1990. After the 1990 there was a declining trend in every country. He also reported that the anomaly was weaker during the period of weak real GDP and vice versa. The effect was also less apparent for the years of high inflation and more apparent for the years with lower inflation.

Alpteki (2014) studied Stock return seasonality in emerging markets. He employed parametric and non-parametric methods to test for seasonality in the monthly stock market returns of the countries that make up the MSCI Emerging Markets Index over the period 1983-2013. The findings provided that month of the year effects are present in the stock returns of all countries. However, very little proof was found for the existence of the January effect. According to the results of the parametric tests, evidence in favour of the anomaly is available for Malaysia, Brazil and Turkey. On the other hand, the nonparametric test results only provided evidence for the existence of the anomaly in the Philippines. Further, it was noted that tax-loss-selling and seasonal patterns in the risk-return relationship do not explain the January effect in these countries. However, the study could not provide evidence for persistent volatility in any of the stock markets.

Explanations to Calendar Effect Anomalies

According to literature, a number of explanations have been put forward to justify the presence of calendar effect anomalies and volatility in stock markets. The information release hypothesis is one of them. According to the information release hypothesis, information released during the week tends to be positive, whereas information released over the weekend tends to be negative. A firm with good news will release it quickly so that investors can bid the stock price up, but bad news is released after the Friday close. This suggests that delay in the announcement of bad news might cause the negative Monday effect. However, the evidence tends to indicate that delaying the announcement of bad news on Friday can only explain a small proportion of the weekend effect.

Pettengill (2003) provides a similar explanation which arises also from the behaviour of individual investor. He suggests that investors avoid buying securities on Mondays because they are afraid of the potential loss from trading with well-informed traders who might be selling based on unfavorable information they have received during the weekend. Miller (1988) attributes the negative returns over weekends to a shift in the broker– investor balance in decisions to buy and sell. During the week, Miller argues that investors, too busy to do their own research, tend to follow the recommendations of their brokers, recommendations that are skewed to the buy side. However, weekend investors, free from their own work as well as from brokers, do their own research and tend to reach decisions to sell. The result is a net excess supply at Monday's opening. Miller's hypothesis is supported by evidence showing that brokers do tend to make buy recommendations.

Another explanation for the negative weekend effect is that the delay between the trade date and the settlement date create an interest-free loan until settlement. Friday buyers get two extra days of free credit, creating an incentive to buy on Fridays and pushing Friday prices up. The decline over the weekend reflects the elimination of this incentive. This hypothesis is supported by the intra-week behaviour of volume and returns: Friday is the day with the greatest volume and the most positive stock returns.

Keef and McGuinness (2001) proposed that the settlement procedures might cause the negative Monday effect. They discovered this when they studied weekday returns. This explanation is later supported also by e.g. (Raj and Kumari, 2006). However, it is good to bear in mind that this suggestion overlooks the fact that settlement procedures may differ across the countries. Lakonishok and Levi (1982) attributed the effect to the delay between trading and settlement in stocks and in clearing cheques. However, they reported that only about 17 percent of the abnormally low Monday returns can be explained by the settlement period.

Other explanations have been put forward to account for the existence of month of the year anomalies. Examples include tax-motivated transactions (e.g., Branch, 1977; Dyl, 1977), seasonal patterns in the risk-return tradeoff (e.g., Rogalski and Tinic, 1986; Keim and Stambaugh, 1986), window dressing actions by institutional managers (for example, (Lakonishok, Shleifer, Thaler, & Vishny, 1991) new information releases (for example, Merton, 1987; Chen and Singal, 2004), insider trading activity for example, (Glosten and Milgrom, 1985; Seyhun 1988) and cash-flow effects (e.g., Ogden (1990).

Chapter Summary

From the various researches done on the day of the week and month of the year effect, different empirical results have come up both internationally and locally where different researches actually prove the existence of calendar effect anomalies while others show that the day of the week effect and month of the year effect did not exist. For instance, Coutts and Sheikh (2002), Mokua (2003) and Osman (2007) documented no evidence of the calendar effect anomalies. While Onyuma (2009), Demirer and Baha Karan (2002), Osazevbaru and Gu (2006), Chandra and Islmia (2009), Bundoo (2011) and Roux and Smit (2001) found evidence of calendar effect anomalies. However, a number of explanations have been put forward to justify the existence of calendar effect anomalies. They include tax-motivated transactions, seasonal patterns in the risk-return tradeoff, new information releases, cash-flow effects trading and settlement in stocks and in clearing cheque.

Regardless of the extensive research, however, there is no consensus view on the causes of stock market anomalies and for that matter calendar effect anomalies in particular. Secondly, although these regularities have been found to exist in the past and in some instances for long periods of time and in several foreign markets and few African market, there is no guarantee that they will continue to exist in the future. This study therefore aims to investigate as to whether the calendar effect anomalies are prevalent at the GSE and NSE and for a more recent period relative to the related past studies.

CHAPTER THREE

RESEARCH METHODOLOGY

Introduction

The purpose of this chapter is to elaborate on the systematic procedures and methodology that is employed in this study. The chapter therefore explains the research design adopted for the study, data sources and description, model specification, definition of variables, estimation techniques, a priori expectations and post estimation tests.

Research Design

This study adopts the positivist philosophy. In the frameworks of positivist philosophy, the study used quantitative research design; by using econometric techniques to analyse stock returns volatility and test the existence of calendar effect anomalies. The positivist paradigm helps to operationalises concepts so that they can be measured, formulate hypotheses and then test them rigorously. This paradigm is deemed appropriate for the study due to its rational proof/disproof of scientific assertions, assumption of a knowable and objective reality. It allows quantitative study of economic phenomena. Objectivity, replicability and generalisability of findings are its key strengths.

Data type and Sources

The study used secondary data. Specifically, daily closing price indices from the two stock markets, GSE Composite Index (GSE-CI) for Ghana and NSE-20 Share Index for Kenya ranging from 4th January, 2005 to 31st December, 2014 excluding holidays. Therefore GSE Composite Index (GSE-CI) gives a sample of 2424 days while NSE-20 gives a sample of 2491 days. The choice of sample period was informed by the fact that Alagidede (2006) conducted a similar study using stock prices in the GSE ranging from 1994 to 2004. In order to test the calendar effect anomalies on an independent sample and to avoid the problem of data snooping, it was prudent to choose a sample period that allow for sufficient time after his study. Since the study compares two different stock market, the same sample period was used for NSE. Because comparing two markets using different sample periods could lead to wrong conclusions. The study considered only GSE and NSE excluding other African markets due to time and data constraints.

For the monthly series, the sample size is 120 months in both markets. The GSE Composite Index and NSE 20- Share Index are the most appropriate in these two markets because they reflect the true barometers of the markets. Again, these indices are chosen because they hold the most important stocks in the markets which are preferred by the investors. They also represents high market capital and function as a benchmark of the market movements (downside or upside).

According to Annaert et al., (2011), such indices are known as Blue-chip indices and have been proven to be an efficient empirical proxy for all-shares market indices. Investors are well aware of the market information of these stocks and, along with the market makers, continuously adjust valuation models. The data was obtained from Nairobi Stock Exchange website and Ghana stock Exchange website.

Model Specification

For the model specification, two important issues must be considered. First, as it has been long pointed that the autocorrelation problem resulted from the violation of the assumption of no autocorrelation, which may result in misleading inferences. This problem can be addressed by including the lagged values of returns as independent variables. The second issue is that the error variances may not be constant over time (heteroskedasticity problem). This can be addressed by allowing variances of errors to be time dependent to include a conditional heteroskedasticity. Thus, error terms will have a mean of zero and a time-varying variance.

From the literature, several models like Autoregressive Conditional Heteroskedastic Model (q), (ARCH (q)) developed by Engle (1982), the generalised version of ARCH (q) suggested by Bollerslev (1986) also known as the GARCH (p, q) model, Threshold GARCH or TGARCH proposed by Zakoian (1994) and the Exponential GARCH or EGARCH proposed by Nelson (1991) models based on different distributional assumptions were used to examine returns volatility. The distributional assumptions include Gaussian Normal Student's t and Generalised Error distribution. However, the study employs all three models (GARCH, TGARCH and EGARCH) under Gaussian Normal Distributional assumption to examine volatility of stock returns. This is because according to

Engle (2001) the GARCH (1, 1) models are the simplest and most robust of the family of volatility models. Using Schwarz Bayesian Information Criteria (SIC), TGARCH (1, 1) and EGARCH (1, 1) are more appropriate to absorb all the possible asymmetry effect of the stock market behaviour. The study could not consider Power GARCH (PGARCH) because is less efficient and very complicated.

Models for Day of the Week Effect Anomaly

To test for day of the week effect, Ordinary least squares (OLS) regressions with daily return as the dependent variable and four daily dummies (explanatory variables) and an intercept was estimated. Each dummy takes the value of 1 on the respective trading day of the week and 0 otherwise. The intercept represents the mean daily return on first day of the week (Monday), while the other dummy variables represent the average deviations of the return on a certain day from the average Monday return. As suggested by Berument and Kiymaz (2001), including the intercept in the model, dummy variable trap is avoided. In addition, due to the possibility of autocorrelation in the returns, autoregressive (AR) term was included as explanatory variable. This model can be referred to as OLS AR model. The model for Day of the Week Effect is specified as:

$$R_t = \Phi_1 + \sum_{i=2}^{5} \Phi_i D_{it} + \sum_{j=1}^{p} \phi_j R_{t-j} + \varepsilon_t \qquad (1)$$

Where R_t = Daily index Returns, and Φ_1 is the Monday return (intercept). D_{it} are daily dummies for *i* = 2, 3…5. Thus if *i* = 2, D_{2t} is Tuesday, through to *i*=5, D_{5t} being Friday, and Φ_2 to Φ_5 are the coefficients of daily dummies. R_{t-j} is the

Autoregressive (AR) term for returns and consequently, ϕ_j represents the coefficients for lagged return values where *j* is the lag length (*j*=1, 2…*p)* and ε_t is the error term which is normally distributed and time dependent $\varepsilon_t \sim N(0,h_t)$. From equation (1), the error term has a mean of zero and a time-varying variance (h_t). Expanding equation (1) gives us equation (2).

$$R_t = \Phi_1 + \Phi_2 D_{2t} + \Phi_3 D_{3t} + \Phi_4 D_{4t} + \Phi_5 D_{5t} + \phi R_{t-1} + \varepsilon_t \text{.................}(2)$$

In the finance literature, to test whether there are day-of-the-week effects in the markets, we compare the individual coefficients of the days (i.e. the mean returns for Monday through Friday) to zero. Thus, we test the null hypothesis that mean returns of all the days of a week are equal to each other and are equal to zero which means that there is no day of the week anomaly effect, against the alternative, presence of daily anomaly. Hence the study adopted F- test and t-test to assess the significance of coefficient restrictions.

$H_0 : \Phi_1 = \Phi_2 = \Phi_3 = \Phi_4 = \Phi_5 = 0$ Against the alternate that at least a day's mean returns is not equal to zero. A rejection of the null hypothesis implies the stock returns exhibit day of the week anomaly and vice versa.

Models for Month of the Year Effect Anomaly

To test for presence of month of the year effect anomaly, Ordinary least squares (OLS) regressions with eleven monthly dummies and an intercept are estimated. Each dummy takes the value of 1 on the respective month of the year and 0 otherwise. The intercept represents the mean monthly return in January, while the other dummy variables represent the average deviations of the return on a certain months from the average January return. Due to the possibility of autocorrelation in the returns, autoregressive (AR) terms are included as explanatory variables. Model for months of the year effect is therefore specified as follows

$$R_t = \alpha_1 + \sum_{i=2}^{12} \alpha_{it} M_{it} + \sum_{j=1}^{p} \delta_j R_{t-j} + \varepsilon_t \text{...(3)}$$

Expanding equation (3) gives us equation (4)

$$R_t = \alpha_1 + \alpha_2 M_{2t} + \alpha_3 M_{3t} + .. + \alpha_{12} M_{12t} + \delta_1 R_{t-1} + \delta_2 R_{t-2} + ... + \delta_p + \varepsilon_t \text{...(4)}$$

Where $\varepsilon_t \sim N(0, h_t)$ R_t = Monthly stock Return α_1 is the January returns, M_{it} are monthly dummies from M_{2t} being February, to M_{12t} being December, and α_2 to α_{12} are the coefficients of monthly dummies. R_{t-j} are Autoregressive terms and consequently, $\delta_j \ldots \delta_p$ represents the coefficients for lagged return values. ε_t is the errors which has a mean of zero and a time-varying variance (h_t). As suggested by Berument and Kiymaz (2001), dummy variable trap is avoided by including the constant (α_1 = January returns) in the model.

Again, the null hypothesis that mean returns of all months of the year are equal and equal to zero was tested. Whiles the alternative hypothesis is that, month of the year effect anomaly is present. i.e.

$$H_0 : \alpha_1 = \alpha_2 = \alpha_3 = ...\alpha_{12}$$

Against the alternate that at least a month's mean returns is not equal to zero. A rejection of the null hypothesis implies the stock returns exhibit monthly seasonality and vice versa.

Volatility Models

Since Stock returns are characterised by high-time-varying volatility, the assumption of constant variance is inappropriate hence linear models are unable to explain a number of important features of stock market behaviour. It is therefore appropriate to use models that allow the variance to depend upon its history to examine the stock returns volatility. The study considers Generalised Autoregressive Conditional Heteroskedastic (GARCH) models which allow variances of errors to be time dependent. The GARCH (p, q) model developed by Bollerslev (1986) the Exponential GARCH (EGARCH) model introduced by Nelson (1991) and the Threshold GARCH (TGARCH) model introduced by Zakoian (1994) were adopted.

EGARCH and TGARCH used because positive and negative residuals may have different impact on future volatilities, these two methods allow the asymmetric effect of good and bad news on conditional variances. The estimate of these models give the necessary knowledge about the predictability of future stock prices and returns. Price predictability implies rejection of the random walk hypothesis (market efficiency). Furthermore, the parameters in the variance equation determine the nature of volatility in the stock markets; whether volatility persists or otherwise.

In this section, first, the GARCH (1, 1) model for estimating volatility in NSE-20 Daily and monthly returns are discussed. Subsequently, the TGARCH and EGARCH models for daily and monthly volatility are discussed.

GARCH (1, 1) Models

A GARCH model includes a mean and variance equation. The mean equation is the OLS regression with Autoregressive term(s), while the variance equation includes a constant, ARCH and GARCH terms which account for volatility. Both the mean and variance equation are jointly estimated using the Bollerslev-Wooldridge (1992) Quasi-maximum likelihood. The study adopts GARCH (1, 1) and the mean equation and variance equation are specified as (1) and (5) respectively.

$$R_t = \Phi_1 + \sum_{i=2}^{5} \Phi_i D_{it} + \sum_{j=1}^{p} \phi_j R_{t-j} + \varepsilon_t \quad \text{..........(1)}$$

$$h_t = \omega + \beta h_{t-1} + \alpha \varepsilon_{t-1}^2 \quad \text{..........(5)}$$

In the mean equation, the variables are same as defined in the OLS modeled in equation above. The variance equation has one ARCH term (i.e. ε_{t-1}^2) and one GARCH term (h_{t-1}) the variance equation, h_t represents the conditional variance, α and β represent the lagged squared error term (ARCH Effect) and conditional volatility (GARCH Effect) respectively. In the variance equation, both α and β measure the market volatility. A large error coefficient α indicates that volatility reacts intensely to market movements, while a large GARCH coefficient β

indicates that shocks to conditional variance take a long time to die out, which means that volatility is persistent (Dowd, 2002). If ($\alpha + \beta$) in the variance equation is very close to one, that means high persistence in volatility and implies inefficiency in the market. In order to satisfy the non-explosiveness conditional variance, $\alpha + \beta$ <1. Secondly, to satisfy the non-negativity of the conditional variance ($h_{t-1} \geq 0$), $\omega > 0$, $\alpha \geq 0$, $\beta \geq 0$ (i.e. ω , α , β) should be positive (Alagidede, 2008).

As mentioned above, a GARCH model includes a mean and variance equation. For the month of the monthly volatility, both the mean and variance equation are jointly estimated using the Bollerslev-Wooldridge (1992) Quasi-maximum likelihood. The GARCH (1, 1) with the mean equation and variance equation for estimating volatility in monthly returns are specified as (2) and (6) respectively.

$$R_t = \alpha_1 + \sum_{i=2}^{12} \alpha_{it} M_{it} + \sum_{j=1}^{p} \delta_j R_{t-j} + \varepsilon_t \qquad (2)$$

$$h_t = \omega + \beta h_{t-1} + \alpha \varepsilon_{t-1}^2 \qquad (6)$$

With $\varepsilon_t \sim N(0, h_t)$. Where R_t is the monthly return, α_1 is constant (i.e. January returns), and $M_{2t} \ldots M_{12t}$ are the eleven dummy variables representing the months from February to December. The considered month is February, if M_{2t} =1 and otherwise 0 and the month is March if M_{3t} =1 and otherwise 0 and so on. $\alpha_2 \ldots \alpha_{12}$ are coefficients to be estimated and they reflect the average monthly returns. R_{t-1} $\ldots R_{t-p}$ are Autoregressive terms and consequently, $\delta_j \ldots \delta_p$ represents the coefficients for lagged return values. ε_t is the errors which is time, has a mean of zero and a time-varying variance (h_t). Similar to the day of the week effect, dummy variable trap is avoided by including the constant (α_1 = January returns) in the model as suggested by (Kiymaz & Berument, 2003). And $\alpha + \beta < 1$, $\omega > 0$, $\alpha \geq 0$, $\beta \geq 0$, should hold.

From the variance equation (6) the definitions of the variables remain unchanged as described in equation (5). Again, to be able to jointly estimate equation (2) and (6), Bollerslev-Wooldridge (1992) Quasi-maximum likelihood was used.

The GARCH model is symmetric and does not capture the asymmetry effect (leverage effect). Threshold GARCH or TGARCH proposed by Zakoian (1994) and the Exponential GARCH or EGARCH proposed by Nelson (1991) models are more appropriate to absorb the possible asymmetry effect of the stock market behaviour.

TGARCH (1, 1) Models

TGARCH is an extension of the GARCH model with an additional term that accounts for asymmetries (asymmetry Effect). As mentioned earlier the asymmetry effect refers to the tendency that bad news tends to increase stock returns volatility more than good news. Generally, the variance equation for the TGARCH model is given as

$$h_t = \omega + \sum_{j=1}^{p} \beta_j h_{t-j} + \sum_{i=1}^{q} \alpha_i \varepsilon_{t-i}^2 + \sum_{k=1}^{r} \gamma_k \varepsilon_{t-k}^2 I_{t-k} \quad (7)$$

Where I_{t-1} is the indicator function (for asymmetric Effect) and I_t =1 if $\varepsilon_t < 0$ and 0 otherwise. Good news is represented by $\varepsilon_{t-k} > 0$, and bad news is represented by $\varepsilon_{t-k} < 0$, and they have different impacts on conditional variance (volatility). The impact of good news is measured by α_i , while bad news has an impact of $\alpha_i + \gamma_k$. The news impact is asymmetric if $\gamma_k \neq 0$ implying that good news have the same impact on stock returns volatility. If $\gamma_k > 0$, bad news increases volatility, hence there exist leverage effect in the stock market. The study adopts TGARCH (1, 1).

The TGARCH (1, 1) to the daily volatility, the mean equation and the variance equation are specified in equation (1) and (8) respectively. Where the mean equation is the same as the OLS model equation testing day of the week effect.

$$R_t = \Phi_1 + \sum_{i=2}^{5} \Phi_i D_{it} + \sum_{j=1}^{p} \phi_j R_{t-j} + \varepsilon_t \quad (1)$$

$$h_t = \omega + \beta h_{t-1} + \alpha \varepsilon_{t-1}^2 + \gamma \varepsilon_{t-1}^2 I_{t-1} \quad (8)$$

Where ω is a constant representing the Monday dummy, D_{it} are exogenous dummy variables for Tuesday through Friday, and I_{t-1} is the indicator function (for asymmetric Effect). $\Phi_2 \ldots \Phi_5, \gamma, \phi_1 \ldots \phi_p$, are the parameters to be estimated. The mean equation (1) and the variance equation (8) were estimated jointly.

The TGARCH (1, 1) for monthly return volatility (i.e. the mean equation and the variance equation are specified in equation (2) and (9) respectively.

$$R_t = \alpha_1 + \sum_{i=2}^{12} \alpha_{it} M_{it} + \sum_{j=1}^{p} \delta_j R_{t-j} + \varepsilon_t \qquad (2)$$

$$h_t = \omega + \beta h_{t-1} + \alpha \varepsilon_{t-1}^2 + \gamma \varepsilon_{t-1}^2 I_{t-1} \qquad (9)$$

The mean equation (2) and the variance equation (9) were estimated jointly.

EGARCH Models

The Exponential GARCH (EGARCH) was first proposed by Nelson (1991). The specification for the conditional variance is the following:

$$\log h_t = \omega + \sum_{j=1}^{p} \beta_j \log h_{t-j} + \sum_{i=1}^{q} \alpha_i \left(\left| \frac{\varepsilon_{t-i}}{\sqrt{h_{t-i}}} \right| - E\left[\left| \frac{\varepsilon_{t-i}}{\sqrt{h_{t-i}}} \right| \right] \right) + \sum_{k=1}^{r} \gamma_k \frac{\varepsilon_{t-k}}{\sqrt{h_{t-k}}} \qquad (10)$$

Where the dependent variable is the log of the conditional variance ($\log h_t$), $\frac{\varepsilon_{t-i}}{\sqrt{h_{t-i}}}$ is the standardised residual, γ_k represent the asymmetric component. Parameters, $\alpha_i ... \alpha_q$ (i.e. coefficients of the absolute values of the difference between the standardised residual and its expected value) and $\beta_j h_{t-j} ... \beta_q h_{t-q}$ represents the GARCH term (lagged values of the conditional variance), ω is a constant or intercept. Since the log of the conditional variance is the dependent variable, the leverage (asymmetric effect) is exponential rather than quadratic. This ensures that the forecasts of the variance are positive even if the parameters are negative. Hence, there isn't the need to impose non-negative constraints on the variance parameters, unlike the case of the GARCH (1, 1) model.

EGARCH (1, 1) models

The EGARCH (1, 1) model has the same mean equation as equation (1) in the TGARCH (1, 1) model. The mean and variance equations for estimating volatility in daily returns are specified as (1) and (11) respectively.

$$R_t = \Phi_1 + \sum_{i=2}^{5} \Phi_i D_{it} + \sum_{j=1}^{p} \phi_j R_{t-j} + \varepsilon_t \text{...(1)}$$

$$\log h_t = \omega + \beta \log h_{t-1} + \alpha \left[\left| \frac{\varepsilon_{t-1}}{\sqrt{h_{t-1}}} \right| - \sqrt{\frac{2}{\pi}} \right] + \gamma \frac{\varepsilon_{t-1}}{\sqrt{h_{t-1}}} \text{....................(11)}$$

Where γ_1 is the coefficient of the asymmetric term. Employing conditionally normal errors implies that $E(|\varepsilon_{t-i} / \sqrt{h_{t-i}}|) = \sqrt{2/\pi}$. We can test for presence of leverage effects, where $H_0 : \gamma_1 = 0$. If $\gamma_1 \neq 0$ means asymmetric behaviour exists.

The EGARCH (1, 1) model for estimating volatility in monthly returns are specified as (2) and (10) respectively.

$$R_t = \alpha_1 + \sum_{i=2}^{12} \alpha_{it} M_{it} + \sum_{j=1}^{p} \delta_j R_{t-j} + \varepsilon_t \text{..(2)}$$

$$\log h_t = \omega + \beta \log h_{t-1} + \alpha \left[\left| \frac{\varepsilon_{t-1}}{\sqrt{h_{t-1}}} \right| - \sqrt{\frac{2}{\pi}} \right] + \gamma \frac{\varepsilon_{t-1}}{\sqrt{h_{t-1}}} \text{....................(11)}$$

Where the coefficient of the asymmetric term is γ_1, ϖ is a constant representing the intercept (January returns). Employing conditionally normal errors, just as in the case of the day of the year effect implies that $E(\left|\varepsilon_{t-i} / \sqrt{h_{t-i}}\right|) = \sqrt{2/\pi}$. We can also can test for presence of leverage effects, where $H_0 = \gamma_1 < 0$. If $\gamma_1 \neq 0$ again means asymmetric behaviour exists.

Diagnostic and Post Estimation Tests

There is the need to conduct various tests to ensure efficient, reliable, unbiased, consistent and precise prediction of the model to be estimated. The presence of serial correlation was tested using Breusch-Godfrey Serial Correlation LM Test, heteroscedasticity was tested using the Breusch-Pagan-Godfrey tests and Wald Test was used to test for the joint significance of the estimated parameters of the OLS models.

The ARCH test was also used to test for conditional variance in the residuals of the GARCH models. Schwarz Bayesian Information Criteria (SIC/SBIC/BIC) is required to choose the best model from the three GARCH models discussed. The desire is to select more parsimonious models (i.e. models that accomplishes a desired level of explanation or prediction with as few predictor variables as possible). That is the model with the smallest criterion value for each GARCH specification was used.

Computation of Stock Returns

In computing stock return, the study uses the formula in equation (1) as proposed by Brooks (2008)

$$R_t = \ln\left(\frac{I_t}{I_{t-1}}\right) * 100 \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (11)$$

Where: t =present day, R_t = Continuously compounded returns at time t. t = present day

I_t = Stock index at period t

I_{t-1} = Stock index in previous period

ln = Natural logarithm

Unit Root Test

Since the study is dealing with time series data, it is essential to check the stationarity of the variables in order to avoid the spurious regression. Hence, Augmented Dickey Fuller (ADF) test (Dickey & Fuller, 1981)is employed to test the stationarity of the data. The theoretical background of the ADF test has been explained using the following model.

$$\Delta R_t = \alpha R_{t-1} + x_t'\delta + \beta_1 \Delta R_{t-1} + \beta_2 \Delta R_{t-2} + ... + \beta_p \Delta R_{t-p} + v_t \ldots\ldots\ldots\ldots (12)$$

Where R_t is the stock returns (time series variable) at time t, x_t' are optional exogenous regressors which may contain constant and trend, ($\alpha = \rho - 1$), δ, β are parameters to be estimated and p is the lag length, v_t is the error term which is assumed to be white noise. According to the above model, the null hypothesis for testing unit root (stationarity) can be expressed as follows

$H_0 : \alpha = 0$, $H_1 : \alpha < 0$ where $\alpha = \rho - 1$

The null hypothesis is that the series is non-stationary or the series contains unit root while the alternative hypothesis indicates the series is stationary and no unit root problem exists. If the null hypothesis is rejected, it means R_t is stationary and it is known as I (0) variable. If the series is non-stationary, then the series should be differenced and tested for higher integration.

Chapter Summary

The chapter explained the research design adopted for the study, data sources and description, model specification, estimation techniques, a priori expectations and post estimation tests. Ordinary Least Square with Autoregressive terms, Generalised Autoregressive Conditional Heteroskedastic (GARCH), Threshold GARCH and Exponential GARCH were discussed. The OLS was used to test the both day of the week effect and month of the year effect anomalies, whiles the GARCH family models are used to examine the persistence of stock returns volatility in the two markets. The Schwarz Bayesian Information Criteria (SIC) was used to determine the model that is most suitable to examine stock returns volatility in Ghana Stock Exchange and Nairobi Stock Exchange. The next chapter focused on data analysis and detailed discussions of estimation results.

CHAPTER FOUR

RESULTS AND DISCUSSIONS

Introduction

This chapter focuses on discussing the empirical results of the study. The results are presented in tables and in some cases graphs are used. Firstly, results of Augmented Dickey Fuller (ADF) tests, which examines the time series properties of the data are presented and discussed, followed by the summary statistics on daily and monthly series. OLS and GARHC family regression results are also presented and discussed in relation to the objectives of the study and connection with the literature.

The Augmented Dickey-Fuller (ADF) test was used to test for unit root in both daily and monthly return data in both stock markets. The null hypothesis of a unit root was tested against the alternative hypothesis of stationarity. The results in Table 1 suggests that the GSE-CI and NSE-20 series (both daily and monthly) are stationary at level. The series do not contain a unit root at level hence stationary at 1 percent level of significance. In other words, the GSE-CI and NSE-20 returns series are integrated of order zero, I (0) and therefore can be used for regression analysis.

Table 1: Augmented Dickey-Fuller (ADF) Unit Root Test Results

Variables (series)	Country	Frequency of series	P-values	Stationary
Returns (NSE)	Kenya	Daily	0.000***	I(0)
Returns (GSE-CI)	Ghana	Daily	0.000***	I(0)
Returns NSE-20	Kenya	Monthly	0.000***	I(0)
Returns (GSE-CI)	Ghana	Monthly	0.000***	I(0)

Source: Author's Computation, using EVIEWS 9
Note: *** implies 1 % level of significance

Table 2 reports the summary statistics for the entire periods in both markets as well as the returns for each day of the week. In GSE, the average return on Composite Index for the entire study period is -0.045 percent. The maximum return is 5.7 percent and a minimum return of -200.215 percent with a standard deviation 4.132. Whiles Thursday recorded the maximum average return of 0.046 percent, closer look at each day's statistics shows that out of the five days only Tuesday has negative mean return (-0.339 percent). In comparison to the remaining weekdays, Tuesday has the highest return (5.7 percent) and the highest standard deviation, 9.227.

On the other hand, in the case of the NSE, average return for the entire study period is 0.022 percent. The maximum return is 6.948 percent and a minimum return of -5.234 percent with a standard deviation 0.863. Unlike the All- Share index, out of the five days of the week, two days (Tuesday and Wednesday) recorded negative average returns. Similar to GSE, the average return on Tuesday is also negative, (i.e. -0.002 percent). In comparison to the remaining weekdays, Friday has the highest return (6.438 percent) and the highest standard deviation of 0.862.

Table 2: Descriptive Statistics on Daily Returns in Ghana and Nairobi Stock Exchanges (2005-2014)

	Sample	Mean	Maximum	Minimum	Std. Dev
GSE-CI					
Monday	477	0.0182321	4.830235	-4.38369	0.732859
Tuesday	474	−0.339864	5.700865	-200.215	9.227126
Wednesday	510	0.0381803	5.142638	-2.83142	0.647977
Thursday	480	0.0457167	3.980008	-4.68213	0.692749
Friday	483	0.0017393	4.062437	-8.75404	0.858756
All Days	**2424**	−0.045452	5.700865	−200.2152	4.132429
NSE-20 Index					
Monday	486	0.003881	4.880332	-3.451008	0.8163124
Tuesday	501	-0.00223	5.408058	-5.017785	0.9483619
Wednesday	509	-0.03098	6.947677	-5.233974	0.8615194
Thursday	507	0.024002	3.843019	-3.650584	0.8115022
Friday	488	0.115514	6.437992	-3.784541	0.8623825
All Days	**2491**	0.0219945	6.947677	−5.233974	0.8623705

Source: Author's Computation, using EVIEWS 9

Figure 1 provides further descriptions to the distribution of daily average returns in the two stock markets. The Figure confirms that Tuesdays recorded negative returns for GSE-CI while for NSE-20, negative returns are recorded on Wednesdays. The figure further shows that the highest positive average returns are associated with Fridays and Thursdays in Nairobi and Ghana respectively. However, the daily average return for all days of the entire study period is negative for GSE-CI but positive for NSE-20. In short, the highest returns found on Friday for NSE-20, revealing typical Friday effect, which can call the investor to buy on Monday and sell on Friday to acquire above average returns.

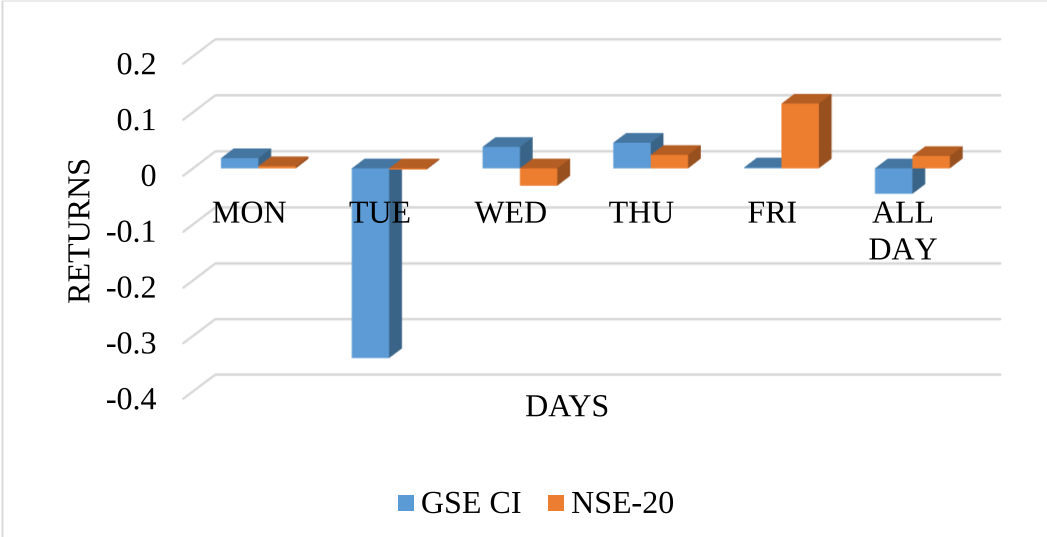

Figure 1: **Daily Average Returns in GSE and NSE Source: Author's Computation, using EVIEWS 9**

Table 3 presents the descriptive statistics for the entire period and each month. There are wide variations across months. Out of the twelve months, three months, June, July and October have negative average returns. While January, February, March, April, May, August September, November and December are positive for GSE-CI. For NSE-20, the average returns for the months of January, March, April, May, June, July, and December are positive and the five months have negative mean returns. The maximum NSE-20 average return occurs in the month of April and minimum average returns result in the month of February. The highest average return is 2.25 percent and the lowest average return is -2.14 percent with a standard deviation of 3.64 and 9.31 respectively.

The average returns for the entire period was 0.69 percent and 0.46 percent for GSE-CI and NSE-20 monthly returns respectively. Considering the raw values of monthly returns, the month of June recorded a maximum return of 14.41percent and a minimum of -25.67 percent was recorded in February for NSE-20. The maximum monthly return for GSE-CI was recorded in April (17.41 percent) and a minimum of -32.31 percent recorded in the month of June. It is interesting to note that the average returns in GSE-CI was higher than that of NSE-20 during the entire study period.

Table 3: Descriptive Statistics on Monthly Returns in Ghana and Nairobi Stock Exchanges (2005-20014)

	Sample	Mean	Maximum	Minimum	Std. Dev
GSE-CI					
January	10	1.033462	5.749547	-2.040005	2.51064
February	10	2.465243	15.39843	-3.830893	5.725868
March	10	2.4503	15.65572	-7.076296	7.514058
April	10	2.347282	17.40986	-5.504481	6.510932
May	10	0.9794243	9.549313	-16.29795	7.035213
June	10	-3.080194	5.332298	-32.31239	10.9332
July	10	-2.074629	2.936371	-15.52549	5.321347
August	10	1.672897	12.05169	-4.452211	4.985359
September	10	1.248755	6.42794	-4.167307	2.573349
October	10	-1.082513	6.33764	-15.68508	6.416029
November	10	0.9849153	8.905081	-2.097635	3.264105
December	10	1.337494	5.680447	-1.863786	2.521326
All Months	**120**	0.690203	17.40986	-32.31239	5.929765
NSE-20					
January	10	0.4186169	9.33756	-14.44035	7.373922
February	10	-2.1375	7.35525	-25.66706	9.314108
March	10	1.405867	12.52766	-8.695006	12.52766
April	10	2.250276	9.691231	-2.213465	3.634074
May	10	1.882369	8.256606	-3.875765	4.174948
June	10	2.041259	14.40508	-8.51729	6.846481
July	10	0.1099444	4.036472	-6.313947	3.690904
August	10	-0.8875181	5.205098	-7.595536	4.141592
September	10	-0.6949677	8.413978	-10.61995	5.525156
October	10	0.3776981	8.529686	-21.0565	8.30802
November	10	-0.2986035	5.506325	-10.57236	4.983491
December	10	1.011388	5.23833	-3.469014	2.447186
All Months	**120**	0.4565691	14.40508	-25.66706	5.848396

Source: Author's Computation, using EVIEWS 9

Table 4 shows evidence of Friday effect in Kenya but no evidence of day of the week effect in Ghana. Results in Table 4 show positive and negative returns across five days in NSE-20 index with highest on Friday. Friday returns are significant at 5 percent level for NSE-20 but no single day returns is statistically significant for GSE-CI. Thus, the results show that at 5 percent level of significance, holding all other factors constant, investors make a daily returns of approximately 0.10 percent higher on Fridays compared to Mondays in Kenya.

The test for day-of-the-week effect in specific market, F- tests and T-test for coefficient restrictions are carried out. The null hypothesis for F-test is that the average daily returns are equal across the week. With F-statistics of 0.609 and P-value of (0.693>0.05), we fail to reject the null hypothesis in the case of Ghana. This means that statistically, daily average returns are the same throughout the week in Ghana. In other words, there is no statistically significant difference between daily returns in Ghana stock Exchange. For NSE, based on F- statistics of 114.814 and P-value of 0.000<0.05, the null hypothesis that average daily returns are equal across the week is rejected. Furthermore, the coefficient of Friday is statistically significant (at 5 percent level of significance) in the case of NSE while none of the coefficients are statistically significant for GSE. The implication is that a day-of-the-week effect (Friday effect) is present in Kenya but day of the week effect is absent in Ghana. These results are useful in providing evidence of deviation from the efficient markets theory and in drawing conclusions about anomalies Nairobi stock market. Finding highest return on Friday and lowest on Wednesday might be due to several economic news announcements released on Thursdays and Fridays, and is consistent with informed trader argument.

Day-of-the-week effect patterns in return and volatility might enable investors to take advantage of relatively regular shifts in the market by designing trading strategies, which accounts for such predictable patterns. In other words, these findings have important implications for the financial managers, financial analysts and investors. The understanding of seasonality would help them to develop appropriate investment strategies.

On one hand, these results in Table 4 are consistent with the findings of other researchers like Onyuma (2009) and Mokua (2003) whose findings indicated that Monday produces the lowest negative returns, while Friday produce the largest positive returns, using regression analysis, data on prices and adjusted returns derived from the NSE 20 index in Kenya during 1980-2006. On the other hand, the results contradict sthe findings of Poterba and Weisbenner (2001). Ali & Mustafa (2001) who documented typical highest Monday and lowest Friday and Basher and Sadorsky (2006) found negative Tuesday during 1992-2003. The fact that the day-of-the-week changes with different settlement periods was noted by Nishat and Mustafa (2002).

However, results in Table 4 shows GSE composite index reveal no day-of-week effect. Absence of day-of-the-week effect anomaly in GSE Composite index can be credited to the free-floating nature of the stocks. Consequently, it is unlikely to earn abnormal returns on any predetermined specific day in the week by an investor in GSE Composite index and all days can be regarded as equally good from the perspective of the investor. The results in the case of Ghana are consistent with some others studies like Abdalla (2012) who found no evidence of day-of-the-week effect in Khartoum stock exchange (KSE) using ordinary least squares (OLS) and Generalised Autoregressive Conditional Heteroskedasticity (GARCH) models to investigate the day-of-the-week effect on returns and volatility. The result is also similar to other results found on the African continent like Mbululu and Chipeta (2012) who analysed the day-of-the-week effect on a nine listed sector indices of South Africa stock market (i.e. Johannesburg Stock Exchange). Their findings exhibited also no evidence of the day-of-the-week effect for eight of the nine sector indices of JSE.

It is also worth noting that, GSE Composite Index returns were directly related to Mondays, Wednesdays and Thursdays returns but inversely related to Tuesdays and Fridays while in the overall period, 2005 to 2014, the estimated ordinary least-squares (OLS) regression results indicate that the NSE 20 Index returns are inversely related to Tuesdays, Wednesdays and Thursdays returns but directly related to the Tuesdays, Wednesdays and Thursdays returns. Put differently, in Ghana, positive returns were recorded on Mondays, Wednesdays and Thursdays while negative returns were recorded on Tuesdays and Fridays. On the other hand, in the Nairobi stock market (Kenya), positive returns were associated with only Mondays and Fridays while the remaining days i.e. Tuesdays, Wednesdays and Thursdays recorded negative returns.

The evidence of some negative returns on Tuesdays in both markets is not in line with the traditional view of the day-of-the-week effect. This may be caused by international factors which have considerable influence on emerging markets in most developing countries including Ghana and Kenya. The bad news of the weekend affecting markets in UK and USA may influence negatively some markets lagged one day. Movements in stock prices and the announcement of information from major international stock markets like the NYSE, NASDAQ and LSE are usually observed by local investors after a delay due to the different time zones. Therefore, stock price movement and any information announced in such markets on Monday would have an effect on the stock exchange of Ghana and Kenya on Tuesdays.

Statistically significant coefficient of lag variable of dependent variable (RT-1) indicates existence short run relationships and short run future daily returns can be predicted in the NSE. And statistically insignificant coefficient of lagged returns indicates no evidence of short run relationships hence future daily returns cannot be easily predicted in the GSE using past price and returns information.

The F-statistic with a P-value of 0.693 indicates that the return on each day is not statistically different from each other. On the other hand, for NSE, F-statistic with a P-value of 0.000 means that at 1percent level of significance, the days of the week jointly explain returns. Implying that the daily returns are statistically different from zero and different from each other. The R-Square indicates the level of explanatory power the independents variable have on the dependent variable. From Table 4, the daily dummies explains about 0.1 percent of the variations in the dependent variable (returns), meaning the daily dummies have lower explanatory power on the daily returns in GSE. Again, this confirms the fact that there is no day of the week effect in the GSE. However, in the case of NSE-20, about 18.7 percent of the variations in return is attributable to the days on the week.

Table 4: OLS Results for Day-of-the-week Effect anomaly in GSE and NSE

Dependent Variable: Returns (R_t)

	GSE-CI	NSE-20 Index
Monday		
Coefficients	**0.018299**	**0.014867**
t-statistics	0.096856	0.421186
SD	0.188933	0.035298
P-value	0.9228	0.6737
Tuesday Φ_2		
Coefficients	**-0.357986**	**-0.005521**
t-statistics	-1.336306	-0.111435
SD	0.267893	0.049542
P-value	0.1816	0.9113
Wednesday Φ_3		
Coefficients	**0.020009**	**-0.060231**
t-statistics	0.096856	-1.219683
SD	0.262957	0.049382
P-value	0.9394	0.2227
Thursday Φ_4		
Coefficients	**0.027547**	**-0.042853**
t-statistics	0.103154	-0.866373
SD	0.267050	0.049463
P-value	0.9178	0.3864
Friday Φ_5		
Coefficients	**-0.017861**	**0.100870****
t-statistics	-0.067022	2.022776
SD	0.266490	0.04986
P-value	0.9466	0.0432
RT(-1)		
Coefficients	**-0.003370**	**0.430321*****
t-statistics	-0.165669	23.74668
SD	0.020344	0.018121
P-value	0.8684	0.0000
R-squared	0.001259	0.187723
F-statistic	**0.609605**	**114.8139**
Prob (F-statistic)	**0.692587**	**0.000000**
Akaike info criterion	5.679300	2.338560
Schwarz criterion	5.693644	2.352584
Durbin-Watson stat	1.999710	2.085774

Note: *** and ** imply 1 and 5 % level of significance respectively.

Source: Author's Computation, using EVIEWS 9

Results of the OLS regression to test for month of the year effect anomalies in GSE from 2005 to 2014 are presented in Table 5 above. When the return in any of the month is statistically significant and higher than the return in other months, this anomaly is called as month effect (Poterba & Weisbenner, 2001). The regression was performed with the full set of periodic dummies excluding one dummy (i.e. January as benchmark month) to avoid dummy variable trap. It is evidenced from the analysis that monthly effect do not exist in GSE.

The results of the study, provide no evidence for a month-of- the-year effect in Ghana stock market. From Table 5, the coefficients for the intercept term, which represents the benchmark month of January is statistically insignificant. Similarly, the coefficients of dummy variable for all remaining eleven months (February to December) are insignificant. This clearly indicates that the presence of monthly anomaly cannot be confirmed for GSE Composite index returns. Overall, the estimates do not provide evidence of month of the year effect in GSE.

Contrary to evidence from global stock markets that monthly returns tend to be higher in January than other months, the study do not confirm this for Ghana. It can be clearly observed that the month of January, June, July and October recorded negative coefficients while the other months recorded positive coefficient value for GSE-CI during the study period. The hypothesis that returns for all months are equal cannot be rejected for Ghana. The implication is that there are insignificant variation between monthly returns in GSE and the market exhibits no month of the year anomaly. Therefore, all things being equal, well informed investors cannot make abnormal returns by considering the months of the year in making investment decisions.

However, the significant coefficient of lagged return (RT-1), indicates existence of short run relationships and short run future monthly returns can be predicted in the GSE using past price and returns information .The results are inconsistent with the findings of Alagidede (2006) who examined month of the year effects for Ghana and found April effect.

Table 5: OLS Results for Month-of-the-Year Effect in GSE

Dependent Variable: Returns (R_t)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-0.119981	1.691220	-0.070943	0.9436
FEB	1.438772	2.372966	0.606318	0.5456
MAR	1.472029	2.372987	0.620327	0.5364
APR	2.009008	2.376388	0.845404	0.3998
MAY	2.540573	2.420198	1.049738	0.2962
JUN	-1.989531	2.404724	-0.827343	0.4099
JUL	-2.737367	2.373939	-1.153091	0.2515
AUG	1.208608	2.375260	0.508832	0.6119
SEP	1.875224	2.392410	0.783822	0.4349
OCT	-1.423357	2.376363	-0.598964	0.5505
NOV	0.479107	2.374938	0.201734	0.8405
DEC	1.162330	2.441184	0.476134	0.6350
RT(-1)	0.467882***	0.085801	5.453092	0.0000
Adjusted R-squared	0.205841	Durbin-Watson stat		1.862438
F-statistic	3.548732	Akaike info criterion		6.278399
Prob (F-statistic)	0.000191	N=120		

Source: Author's Computation, using EVIEWS 9 Note: *** implies 1 % level of significance.

Table 6 shows the results for testing month of the year effect anomalies in NSE from 2005 to 2014. The null hypothesis is that average return is equal across all months of the year. It is evidenced from the analysis that monthly effect do not exist in NSE. The results reveals that March, April, May, June and December recorded positive returns but not statistically significant for NSE-20 index. The rest of the months have negative coefficients but are statistically insignificant. Except for few months, returns are higher for all months as compared to the benchmark month of January. The relatively higher returns of about 1.58 percent occur in the month of April. Excepting March, April, May, June and December, returns are lower for February, July, August, September, October and November as compared to the benchmark month of January. The relatively lowest return of -1.398 percent occurs in the month of August. Since no single month returns is statistically significant for NSE-20 index, the null hypothesis that average return is equal across all months of the year cannot be rejected.

The statistically insignificant coefficients for the intercept term, which represents the benchmark month of January, and eleven other months, February, March, April, June, July, August, September, October, November and December clearly indicate the absence of monthly seasonality in the NSE-20 returns in Kenya.

The value of the R-squared of 0.052 was low, and the F-statistic of 0.488 with *p*-value of 0.918 indicates that the overall fit was not very strong. The insignificant F-statistic did not confirm "month of the year effect" during the period under study. The statistically insignificant coefficient of lagged returns indicates no evidence of short run relationships hence future returns cannot be easily predicted in the both markets using past price and returns information. The hypothesis that returns for all months are equal cannot be rejected for Kenya. Therefore, there is no evidence of month of the year effect anomaly in NSE.

Table 6: OLS Results for Month-of-the-Year Effect in NSE
Dependent Variable: Returns (R_t)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.554006	1.918457	0.288777	0.7733
FEB	-2.780553	2.719043	-1.022622	0.3088
MAR	0.709328	2.730636	0.259767	0.7955
APR	1.577041	2.725288	0.578669	0.5640
MAY	1.199070	2.727542	0.439616	0.6611
JUN	1.480289	2.705994	0.547041	0.5855
JUL	-0.387846	2.699906	-0.143652	0.8860
AUG	-1.397505	2.700812	-0.517439	0.6059
SEP	-1.272897	2.708216	-0.470013	0.6393
OCT	-0.157394	2.703082	-0.058228	0.9537
NOV	-0.916671	2.714460	-0.337699	0.7363
DEC	0.667022	2.778539	0.240062	0.8107
RT(-1)	0.063340	0.097127	0.652135	0.5157
Adjusted R-squared	0.054954	Durbin-Watson stat		2.004957
F-statistic	0.487766	Akaike info criterion		6.534528
Prob(F-statistic)	0.917985	N=120		

Source: Author’s Computation, using EVIEWS 9

Since Stock returns are characterised by high-time-varying volatility, the assumption of constant variance is inappropriate hence linear models are unable to explain a number of important features of stock market behaviour. It is therefore appropriate to use models that allow the variance to depend upon its history to examine the stock returns volatility. The study considers Generalised Autoregressive Conditional Heteroskedastic (GARCH) models which allow variances of errors to be time dependent. However, it is important to test for the presence of time varying effect (ARCH Effect). If the test results show evidence of heteroskedasticity, then (GARCH) models are appropriate for estimating the series and if the results prove that there are no Arch Effect, then (GARCH) models cannot be used.

In the case of GSE-CI, the ARCH test results shown in Table 7 indicate that there is no conditional heteroskedasticity in the residuals of the model. This is confirmed by the insignificant coefficients of squared residuals for both daily and monthly series. Also a very low R-squared of 0.000 and 0.007 for daily and monthly series respectively coupled with high P-values (0.985) for daily series and (0.931) for monthly series confirms that the null hypothesis of no ARCH Effect cannot be rejected.

On the other hand, the results provides evidence of ARCH Effect in the NSE-20 series. The coefficient of the squared residuals for both daily and monthly series are significant at 1 percent and 5 percent respectively. The implication of this results is that the NSE-20 index contain time varying effect, hence linear models cannot explain its behavioural pattern. There is therefore a justification for adopting GARCH) models for estimating the volatility of returns in Kenya but volatility cannot be examined in GSE-CI.

Table 7: **ARCH Test Results**

SERIES	ARCH (RESID^2)	F-statistic	R-squared	P-value
GSE-CI (DAILY)	-0.000391	0.000370	0.000370	0.9847
GSE-CI (MONTHLY)	-0.008086	0.007585	0.007715	0.9307
NSE-20 DAILY	0.219512***	125.9043	119.9339	0.000
NSE-20 (MONTHLY)	0.154543*	2.841494	2.821374	0.0945

Note: ***and * imply 1 and 10 % level of significance respectively.
Source: Author’s Computation, using EVIEWS 9

Table 8 shows the regression results for the variance equation that examines volatility in daily stock returns in Kenya. It shows results for GARCH (1, 1) model which follows a Normal Gaussian Distribution. From the estimation above, the variance equation has one ARCH term (i.e. ε_{t-1}^{2}) and one GARCH term (h_{t-1}). The dependent variable (h_t) represents the conditional variance, α and β represent the lagged squared error term (ARCH effect) and conditional volatility (GARCH effect) respectively. Both α and β measure the market volatility. A large error coefficient α indicates that volatility reacts intensely to market movements, while a large GARCH coefficient, β indicates that shocks to conditional variance take a long time to die out, which means that volatility is persistent (Dowd, 2002). If (α + β) in the variance equation is very close to one, that means high persistence in volatility and implies inefficiency in the market.

The results provide evidence of high and persistent volatility for the NSE-20 daily returns in Kenya. The coefficient β , which captures the influence of new shocks on volatility, and parameter α , which measures the persistence of volatility shocks, are both significant at 1 percent. The sum coefficients of α and β is close to one in the Nairobi stock markets (0.903), indicating that the volatility is highly persistent. This creates a trend in the market that participants can follow in order to make excessive profit in a violation of market efficiency hypothesis.

A similar conclusions have been reached by Derbali and Hallara (2016) as they used three multi-variate general autoregressive conditional heteroskedasticity models (GARCH (1,1), EGARCH (1,1), and TGARCH (1,1) to examine the presence of daily anomalies in the TUNINDEX returns they found the presence of a significance and negative Tuesday effect on the TUNINDEX return and persistence of volatility in the Tunisian stock market index.

Similar findings were documented by Shamshir and Mustafa (2014) who investigated the day-of-the week effect and volatility in Karachi Stock Exchange, from 2009 to 2013. Using GARCH (1, 1) technique with student's t distribution, the study established highly persistent volatility in KSE-100 index whiles less persistent shocks in KSE- all share and KSE-30 index and a rapid decay in KMI-30. Furthermore, the results are consistent with the results of Olowe (2009) whose investigation into day-of-the-week effects in the Nigerian foreign exchange market using the GARCH and GJR-GARCH models under the normal error distributional assumption for period of January, 2002 to March, 2009 provided evidence for persistent volatility in returns.

Osarumwense (2015) assessed the influence of error distributional assumption on appearance or disappearance of day-of-the-week effects in returns and volatility using the Nigerian stock exchange (NSE-30). The study revealed that day-of-the-week effects were sensitive to error distribution. The finding also indicated that evidence of good or bad news in volatility does not only depend on the asymmetric model but also the choice of the error distribution.

Table 8: GARCH (1, 1) Results for Volatility in NSE-20 Daily Returns

Variable	Coefficient	Robust Std. Error	z-Statistic	Prob.
CONS	0.073***	0.007	9.702	0.000
ARCH (α)	0.301***	0.022	13.430	0.000
GARCH (β)	0.602***	0.026	22.883	0.000
($\alpha + \beta$)	0.903			
Adjusted R-squared	0.000	Akaike info criterion		2.129
Log likelihood	-2649.894	Schwarz criterion		2.137
Durbin-Watson stat	2.142	Hannan-Quinn criterion.		2.133

Note: *** implies 1 % level of significance.
Source: Author's Computation, using EVIEWS 9

Table 9 shows results of volatility in monthly returns using Normal Gaussian Distribution GARCH (1, 1) model. As noted earlier in the case of the day of the week effect, the variance equation here also has one ARCH term (i.e. ε_{t-1}^2) and one GARCH term (h_{t-1}) in the month of the year effect as well. A gain, the dependent variable (h_t) represents the conditional variance, α and β represent the lagged squared error term (ARCH effect) and conditional volatility (GARCH effect) respectively. Furthermore, α and β measure the market volatility. A large error coefficient α indicates that volatility reacts intensely to market movements, while a large GARCH coefficient, β indicates that shocks to conditional variance take a long time to die out, which means that volatility is persistent. If ($\alpha + \beta$) in the variance equation is very close to one, that means high persistence in volatility and implies inefficiency in the market.

Similar to the result in the daily analysis, there is also an evidence of high persistence in volatility for the NSE-20 monthly returns in Kenya. The coefficient

β, which captures the influence of new shocks on volatility, and parameter α, which measures the persistence of volatility shocks, are both significant at 1 percent level. In the Nairobi stock markets the sum coefficients of (ARCH and GARCH terms), α and β is 0.97, close to one indicating that the volatility is highly persistent. This creates a trend in the market that participants can follow in order to make excessive profit in a violation of market efficiency hypothesis.

One limitation of GARCH model is it's symmetric and does not capture the asymmetry effect (leverage effect). In finance literature, the asymmetry effect (leverage effect) refers to the tendency that bad news tends to increase stock returns volatility more than good news (Black, 1976). Threshold GARCH or TGARCH proposed by Zakoian (1994) and the Exponential GARCH or EGARCH proposed by Nelson (1991) models are more appropriate to absorb the possible asymmetry effect of the stock market behaviour. Therefore, asymmetrical TGARCH (1, 1) and EGARCH (1, 1) models were estimated and the results are presented below.

Table 9: GARCH (1, 1) Results for Volatility in NSE-20 Monthly Returns

Variable	**Coefficient**	**Std. Error**	**z-Statistic**	**Prob.**
CONS	1.345043	0.923014	1.457229	0.1451
ARCH (α)	0.092025***	0.029630	3.105778	0.0019
GARCH (β)	0.878678***	0.046223	19.00955	0.0000
($\alpha + \beta$)	0.970703			
Adjusted R-squared	0.002239	Akaike info criterion		6.230294
Log likelihood	-370.8177	Schwarz criterion		6.299982
Durbin-Watson stat	1.839492	Hannan-Quinn criterion.		6.258595

Note: *** implies % level of significance.
Source: Author's Computation, using EVIEWS 9

From Table 10, the coefficient of the ARCH variable, (α) is positive and statistically significant at 1 percent significant level, in the TGARCH model. This means that the returns on a particular day are affected by the returns on the previous day. Therefore, high return in day t is followed by high return in day t+1. The estimated GARCH term, β is also positive and significant at 1 percent significant level. Furthermore, the sum of the coefficients of the lag of squared residuals and lag of the conditional variance ($\alpha + \beta = 0.924$) close to unity implying that the shocks to the conditional variance will be highly persistent.

In relation to the literature, a similar conclusion was reached by Ajibola et al. (2014) who presented robust analyses of the Nigerian equity market using weekly stock prices of 140 listed companies in Nigeria over the period of 2006 to 2012, using size/rank variance ratio tests and TGARCH in mean technique he revealed strong presence of inefficiency as anomalies can be traced to persisted volatility.

The significance of ARCH and GARCH coefficients indicate that news about volatility from the previous period have an explanatory power on current volatility. The news impact is asymmetric if $\gamma \neq 0$ implying that good and bad news do not have the same impact on stock returns volatility. If $\gamma_k > 0$, bad news increases volatility, hence there exist asymmetric (leverage effect) in the stock market. The asymmetric (leverage) term, (γ) is positive but statistically insignificant in TGARCH model, hence the null hypothesis of no asymmetric effect on the conditional volatility cannot be rejected. This indicates that negative and positive news have the same impact on volatility. In other words, the results of the daily data show that there is no asymmetric effect in NSE-20 stock returns.

This results contradicts the findings of Chiang and Doong (2001) who analysed the relationship between stock returns and time-varying volatility by using Threshold Autoregressive GARCH (1, 1) in mean specification for seven Asian stock markets and concluded that the null hypothesis of no asymmetric effect on the conditional volatility was rejected for the daily data.

Table 10: TGARCH (1, 1) Results for Volatility in NSE-20 Daily Returns

Variable	**Coefficient**	**Robust Std. Error**	**z-Statistic**	**Prob.**
CONS	0.047***	0.006	8.032	0.000
GARCH (β)	0.703***	0 .020	34.485	0.000
ARCH (α)	0.221***	0.019	11.331	0.000
LEVERAGE (γ)	0.012	0.023	0.514	0.607
($\alpha + \beta$)	0.924			
Adjusted R-squared	0.178	Akaike info criterion		2.035
Log likelihood	-2523.569	Schwarz criterion		2.058
Durbin-Watson stat	1.902	Hannan-Quinn criterion		2.043

Note: *** implies 1 % level of significance. Source: Author's Computation, using EVIEWS 9

Table 11 shows TGARCH (1, 1) results for Month-of-the-year Effect for NSE-20. The ARCH and GARCH coefficients α and β are significant at 5 percent and 1 percent level respectively. The significance of ARCH and GARCH coefficients indicate that news about volatility from the previous month can explain current month's volatility or has some effect on the volatility in returns of the following months. Hence returns in a particular month are affected by the returns in the previous month. Therefore, high return in month t is followed by high return in the month t+1. The extent to which volatility in the market persists is measured by the sum of the coefficients of the lag of squared residuals and lag of the conditional variance, ($\alpha + \beta$). From the results in Table 11, the sum of α and β is 1.09, which exceeds unity implying that the shocks to the conditional variance will be highly persistent, meaning volatility is highly persistent in the Nairobi Stock Exchange.

The asymmetric (leverage) effect is captured by γ. The news impact is asymmetric if $\gamma \neq 0$ implying that good and bad news do not have the same impact on stock returns volatility. If $\gamma > 0$, bad news increases volatility, hence there exist leverage effect in the stock market. From Table 11, the asymmetric (leverage) term, (γ) is negative and statistically significant. Hence there is leverage effect, implying that good news increases volatility in monthly returns. Therefore, an informed investor could make abnormal profits by studying the past prices of the Nairobi Stock Exchange, which contradicts the efficient market hypothesis.

These results are in consonance with the findings of Kiymaz and Berument (2003) who investigated the day-of-the-week effect on the volatility of major stock market indices for the period of 1988 through 2002 and found that volatility was high and persists in Germany and Japan, Canada and the United States stock markets.

On the other hand, the results of the study contradict the work of Al-Jafari (2012) who used a nonlinear asymmetric EGARCH, and TGARCH models to examined volatility in stock returns in Muscat securities market, documented no significant evidence for asymmetry in stock returns and concluded that Muscat securities market is an efficient market.

Table 11: TGARCH (1, 1) Results for Volatility in NSE-20 Monthly Returns

Variable	Coefficient	Robust Std. Error	z-Statistic	Prob.
CONS	0.588254	0.528658	1.112730	0.2658
GARCH (β)	0.929227***	0.042597	21.81414	0.0000
ARCH (α)	0.163586**	0.064389	2.540593	0.0111
LEVERAGE (γ)	-0.181167**	0.071327	-2.539951	0.0111
($\alpha + \beta$)	1.092813			
Adjusted R-squared	0.002239	Akaike info criterion		6.191135
Log likelihood	-367.4681	Schwarz criterion		6.284051
Durbin-Watson stat	1.839492	Hannan-Quinn criterion		6.228869

Note: ***, **and * imply 1, 5 &10 % level of significance respectively.
Source: Author's Computation, using EVIEWS 9

Table 12 shows the daily data results for EGARCH (1, 1). The results shows that the asymmetric (leverage) term, measured by (γ) is positive and statistically significant at one percent implying presence of leverage effect. This suggests that negative unanticipated changes in the NSE-20 increases volatility more than positive unanticipated change does. Thus the daily stock returns exhibits asymmetric behaviour. The findings contradicts the results of Lean and Tan (2010) who used the EGARCH (1, 1) model to investigate the day of the week effect and stock return volatility for ten FTSE Bursa Malaysia indices and concluded that there was no leverage or asymmetric effect in returns volatility.

The coefficients of the lag of squared residuals (α) and lag of the conditional variance β are all less than one, and this satisfies the non-explosiveness of the conditional variance condition. Furthermore, the ARCH and coefficients α

is insignificant suggesting that shocks (news) from previous day's returns do not explains current day's returns volatility. However, coefficient of the GARCH term, β is significant at one percent level. The implication is that previous day's volatility explains today's volatility and today's return is affected by yesterday's returns. Therefore, holding all other factors constant, high return on say Monday would be followed by high return on the following day (Tuesday) and vice-versa. The results also confirms that the sum of α and β exceeds unity (1.931>1). This implies that shocks to the conditional variance are highly persistent in the Nairobi Stock Exchange. The results do not support the findings of Anwar and Mulyadi (2012) who employed EGARCH model to examine day-of-the-week effects and volatility in Indonesia, Singapore and Malaysia stock markets and concluded that stock return volatility do not persist.

Table 12: EGARCH (1, 1) Results for Volatility in NSE-20 Daily Returns

Variable	Coefficient	Robust Std. Error	z-Statistic	Prob.
CONS	-0.316***	0.016	-19.635	0.000
GARCH (β)	0.936***	0.008	113.147	0.000
ARCH (α)	-0.005	0.010	-0.514	0.609
LEVERAGE (γ)	0.356***	0.017	20.772	0.000
($\alpha+\beta$)	1.931			
Adjusted R-squared	0.181	Akaike info criterion		2.037
Log likelihood	-2525.691	Schwarz criterion		2.060
Durbin-Watson stat	1.934	Hannan-Quinn criterion.		2.045

Note: *** implies 1 % level of significance.
Source: Author's Computation, using EVIEWS 9

Table 13 shows the results for EGARCH (1, 1) month of the year effect. The non-explosiveness of the conditional variance requires that coefficients ARCH (α) and GARCH (β) term should be less than1, and this is satisfied. Furthermore, both GARCH (β) ARCH (α) coefficients are statistically significant at 1 percent and 10 percent level respectively. This implying that previous period volatility affect current volatility. Hence current month's return is affected by last month's returns and high returns. For instance, a high returns in February would be followed by high return in the subsequent months and vice versa. Just as in the case of the daily returns, the EGARCH results of the NSE-20 monthly returns show that the sum of α and β exceeds unity (0.115+0.967=1.08>1). This indicates that volatility is highly persistent in NSE-20 monthly returns for Nairobi Stock Exchange.

The results of the study confirms the findings of Chandra and Islmia (2009) who examined the calendar effect anomalies and stock return volatility in Bombay Stock Exchange (BSE) and showed that the turn of the month and time of the month effects were significant and concluded that volatility was persistence in the Bombay Stock Exchange. On the contrary, Alpteki (2014) in his study that examined Stock return seasonality in emerging markets, employed parametric and non-parametric methods to test for seasonality in the monthly stock market returns of the countries that make up the MSCI Emerging Markets Index over the period 1983-2013, his findings could not provide evidence for persistent volatility in any of the stock markets.

Results in Table 13 shows that the asymmetric (leverage) term, (γ) is positive and statistically significant at 1 percent. Hence the conclusion here is that leverage effect exists in the monthly NSE-20 returns. This suggests that the impact of bad news about NSE-20 index on volatility differ from the impact of good news on volatility. Hence there is leverage effect, implying that bad news increases volatility in monthly returns. Guidi, Gupta, and Maheshwari (2011) also applied the Generalised Autoregressive Conditional Heteroskedasticity in Mean (GARCH-M) model for Central and Eastern Europe (CEE) equity market over 1999-2009 periods and came to a similar conclusion that there was leverage effect and stock returns volatility highly persists.

Given these findings, all other things being equal, an informed investor in Nairobi Stock Exchange could make abnormal profits by studying the past prices of the securities in the market.

Table 13: EGARCH (1, 1) Results for Volatility in NSE-20 Monthly Returns

Variable	Coefficient	Robust Std. Error	z-Statistic	Prob.
CONS	0.029119	0.086039	0.338435	0.7350
GARCH (β)	0.967260***	0.020897	46.28617	0.0000
ARCH (α)	0.115208*	0.067303	1.711774	0.0869
LEVERAGE (γ)	0.127621***	0.048950	2.607185	0.0091
($\alpha + \beta$)	1.082468			
Adjusted R-squared	0.002239	Akaike info criterion		6.208062
Log likelihood	-368.4837	Schwarz criterion		6.300979
Durbin-Watson stat	1.839492	Hannan-Quinn criterion.		6.245796

Note: ***and * imply 1% and 5% level of significance respectively.
Source: Author's Computation, using EVIEWS 9

Table 14 shows the results for diagnostic tests that were conducted to assess the reliability and stability of the OLS models used to examine day of the week and month of the year effect anomalies in GSE. Both models passed serial correlation and heteroscedasticity tests. The Breusch-Godfrey Serial Correlation LM test with F-statistic of 0.108 and probability value of 1.000 suggests that the null hypothesis of no serial correlation cannot be rejected for the Day-of-the-Week model. Similarly, the Breusch-Pagan-Godfrey Heteroskedasticity test with F-statistic of 0.827 and p-value of 0.530 shows that the null hypothesis that residuals are homoskedatic cannot be rejected, implying that the model is free from heteroscedasticity problem.

The model for Month-of-the-Year also does not suffer from either serial correlation or heteroscedasticity problem. The Breusch-Godfrey Serial Correlation LM test recorded F-statistic to be 1.253 with a corresponding p-value of 0.208. The Breusch-Pagan-Godfrey Heteroskedasticity test with F-statistic and p-value of 0.970 and 0.481 respectively prove that the month of the year model is equally free from heteroskedaticity problem.

In both models, the Wald Tests results show that the estimated parameters are jointly insignificant, which confirms that Day-of-the-Week and Month-of-the year effects are absent in GSE.

Diagnostic and Post Estimation Tests

Table. 14: Diagnostic and Post Estimation Tests for OLS Models (GSE)

Model	DIAGNOSTIC	STATISTICS	CONCLUSION
OLS for DOW			
	Wald Test	F-statistic 0.753895 (0.5553)	Parameters are jointly insignificant
	Breusch-Godfrey Serial Correlation LM Test	F-statistic 0.108442 (1.0000)	No serial Correlation
	Breusch-Pagan-Godfrey Heteroskedasticity Test	0.827279 (0.5301)	Residuals are homoskedastic
OLS for MOY			
	Wald Test	F-statistic 1.022016 (0.4324)	Parameters are jointly insignificant
	Breusch-Godfrey Serial Correlation LM Test	F-statistic 1.252937 (0.2080)	No serial Correlation
	Breusch-Pagan-Godfrey Heteroskedasticity Test	0.970101 (0.4819)	Residuals are homoskedastic

DOY= Day of the Week MOY= Month of the Year. P-values in parenthesis

Table 15 shows the results for diagnostic tests that were conducted to assess the reliability and stability of the OLS models used to examine Day of the week and month of the year effect anomalies in NSE. The models passed serial correlation and heteroscedasticity tests.

The Breusch-Godfrey Serial Correlation LM test with F-statistic 15.15581 and probability value of 1.000 indicates that the null hypothesis of no serial correlation cannot be rejected for the Day-of-the-Week model. Furthermore, Breusch-Pagan-Godfrey Heteroskedasticity test with F-statistic of 1.380 and p-value of 0.229 shows that the null hypothesis that residuals are homoskedatic cannot be rejected, implying that the model is free from heteroskedasticity problem.

The model for Month-of-the-Year also does not suffer from either serial correlation or heteroscedasticity problem. The Breusch-Godfrey Serial Correlation LM test recorded F-statistic to be 0.204 with a corresponding p-value of 0.816. The Breusch-Pagan-Godfrey Heteroskedasticity test with F-statistic and p-value of 0.970 and 0.442 respectively prove that the month of the year model is equally free from heteroskedaticity problem.

In the Day-of-the-Week model, the Wald Test results shows that the estimated parameters are jointly significant, which confirms that returns are not equal to zero across all days of the week. On the other hand, the Wald Test for Month-of-the year effects indicates that Month of the year effect anomaly is absent in NSE.

Table. 15: Diagnostics and Post Estimation Tests for OLS Models (NSE)

Model	DIAGNOSTIC	STATISTICS	CONCLUSION
OLS for DOW			
	Wald Test	F-statistic 3.193467 (0.0126)	Parameters are jointly significant
	Breusch-Godfrey Serial Correlation LM Test	F-statistic 15.15581 (1.0000)	No serial Correlation
	Breusch-Pagan-Godfrey Heteroskedasticity Test	F-statistic 1.380002 (0.2286)	Residuals are homoskedastic
OLS for MOY			
	Wald Test	F-statistic 0.478680 (0.9128)	Parameters are jointly insignificant
	Breusch-Godfrey Serial Correlation LM Test	F-statistic 0.203590 (0.8161)	No serial Correlation
	Breusch-Pagan-Godfrey Heteroskedasticity Test	1.013543 (0.4420)	Residuals are homoskedastic

DOY= Day of the Week MOY= Month of the Year. P-values in parenthesis

Chapter Summary

The chapter presented analysis and detailed discussions of the results. The Augmented Dickey-Fuller (ADF) unit root test results that all series were stationary at level. The summary statistics on daily and monthly series for both markets were also discussed. An Ordinary Least Square (OLS) regression with autoregressive term was used to test for Day-of-the-Week effect and Month-of-the-Year effect anomalies. The GARCH (1, 1), TGARCH (1, 1) and EGARCH (1, 1) models under the Gaussian Normal Distributional assumptions were subsequently employed to examine volatility in the daily and monthly NSE-20 stock returns.

The conclusions drawn from the study was that Friday effect was documented in NSE but there was no evidence of month of the year effect and volatility was highly persistence coupled with asymmetric effect. While in GSE, there was no evidence of either day of the week or month of the year effect. The efficient market hypothesis was rejected for both stock markets.

CHAPTER FIVE

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

Introduction

This chapter of the study presents a summary of the entire research process, the conclusions drawn based on the findings in relation to the research objectives. Some recommendations are then made followed by the limitations of the study as well as directions for further studies are suggested.

Summary

The study provides evidence that day-of-the-week effect is present in Nairobi Stock Exchanges, Kenya but absent in Ghana Stock Exchanges. For daily data, the empirical results provide evidence of Friday effect in Kenya but no evidence of day of the week effect in Ghana. Thus, the study revealed that at 5 percent level of significance, holding all other factors constant, investors in Kenya can make a daily returns of approximately 0.10 percent higher on Fridays compared to other week days.

Furthermore, the study documented short run relationships between present day returns and previous day returns and a short run future daily returns can be predicted in the NSE. On the contrary, no evidence of short run relationships exist between present day returns and previous day returns hence future daily returns cannot be easily predicted in the GSE using past price and returns information.

The hypothesis that returns for all months are equal cannot be rejected for Kenya and Ghana. However, significant coefficient of lag of returns indicates that short run future monthly returns can be predicted in GSE using past price and returns information. For NSE, the coefficient of lag of returns was insignificant implying that using past price and returns information, short run future monthly returns cannot be predicted. The study provides no evidence of month of the year effect anomaly in either Nairobi Stock Exchange (NSE), Kenya or Ghana Stock Exchanges (GSE). The study concludes that GSE and NSE are inefficient markets.

The study confirmed that volatility is highly persistence in daily and monthly NSE-20 return. This implies that previous period volatility affects current volatility in the market. In other words, in NSE, current month’s (day’s) return is affected by last month’s (day’s) returns and high returns volatility follows high volatility and vice versa. However, there was no evidence of conditional volatility for Ghana Stock Exchange Composite Index (GSE-CI).

The study also revealed that leverage effect exists in the monthly NSE-20 returns but absent in daily NSE-20 returns. This suggests that there exist asymmetric effect and bad news increases volatility in monthly returns.

Conclusions

Contrary to the Efficient Market Hypothesis, in the real world, stock markets are not perfect, which provide a fertile ground for stock market anomalies caused by market imperfections. The first objective was to test whether "Day-of-the-Week Effect" and "Month-of-the-Year Effect" (calendar anomalies) exist in Ghana and Nairobi Stock Exchanges.

An Ordinary Least Square (OLS) regression with autoregressive term was used to test for Day-of-the-Week effect and Month-of-the-Year effect anomalies. The study provides evidence that day-of-the-week effect is present in Nairobi Stock Exchanges, Kenya but absent in Ghana Stock Exchanges and no monthly anomaly was found in neither of the markets.

An ARCH test results showed that the NSE-20 returns has conditional heteroscedasticity in the residuals. Conditional heteroskedasticity was not found in the residuals for GSE-CI. The GARCH (1, 1), TGARCH (1, 1) and EGARCH (1, 1) models under the Gaussian Normal Distributional assumptions were subsequently employed to examine volatility in the daily and monthly NSE-20 stock returns. The study confirmed that volatility is highly persistence in daily and monthly NSE-20 return. On the other hand, there was no evidence of conditional volatility for Ghana Stock Exchange Composite Index (GSE-CI).

The study concludes that although GSE and NSE are inefficient markets, volatility is persistent in NSE but GSE does not exhibit volatility clustering.

Recommendations

Based on the findings of the study, the following recommendations are made:

The study recommends that in the case of Kenya, financial managers, financial analysts and investors adjust their portfolios by taking into account day of the week variations in the Nairobi stock exchange market. It is recommended that in Ghana, financial managers, financial analysts and investors should not adopt investment strategies that are solely based on days of the week variations.

Secondly, investors in Ghana and Kenya should not consider the month in question when making decisions whether to invest in their respective stock markets. But should rather make use of risk and its proxies in estimating monthly returns for stocks in the two markets.

Furthermore, the Security and Exchange Commissions should reduce trade settlement period from T+3 in GSE and NSE to T+1. This would allow investors who sell their shares, to get their money a day after the sale of their shares, hence makes the markets unpredictable and more efficient.

Finally, it is recommended that the Ghana and Kenya Securities and Exchange Commissions in should reinforce the growth of the internet use to reduce information and transaction costs and mitigates the Day of the Week Effect. For instance making market information easily accessible and costless to all market players. Through this, investors can maximise their expected returns by exploiting calendar anomalies hence the stock markets can also adjust and be efficient.

Limitations of the study

1. Stock Indices Used

One weakness of the study is that it does not consider individual share prices rather it considers market indices, which are aggregations of different share prices. So investment strategy on the basis of the finding of this study in case of individual share may not provide expected result.

2. Size of the GSE and NSE

The GSE and NSE are still small sized market having a total of thirty eight (38) and sixty four (64) listed companies respectively. The related researches have been conducted on large stock markets and thus it might be probable that the small size of the markets contributed to the results obtained in this study.

Given the quality of data, rigorous estimation techniques used and the strict adherence to scientific procedures as required by the positivist approach, these limitations do not invalidate the findings of the study. The findings of the study are therefore objective, reliable, replicable and generalizable.

Direction for Future research

1. It is important that a similar study is conducted a few years later taking into account individual share prices.
2. In examining stock returns volatility, the study used GARCH models under the Gaussian Normal distribution assumption. Future studies may consider other distributional assumptions such as the student's t Distribution and Generalised Error Distribution assumption.
3. The study did not consider portfolio and firm size. Since calendar effect anomalies could be mitigated by differences in portfolio or firm size, it is imperative that future researchers take into account portfolio and firm size.

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APPENDICES

APPENDIX A (1)

Plot of Stock Market Returns for GSE-CI (2005-2014)

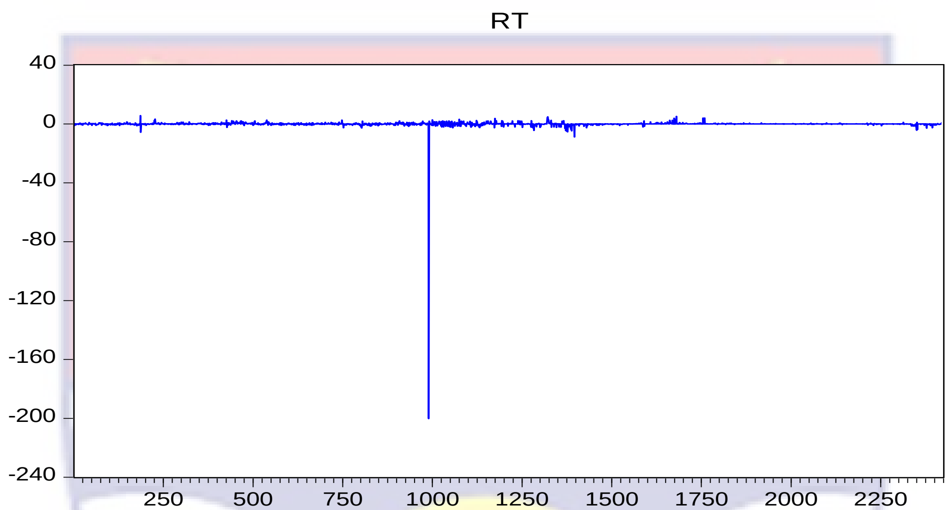

Figure A1: Trend of Daily stock Returns for Ghana

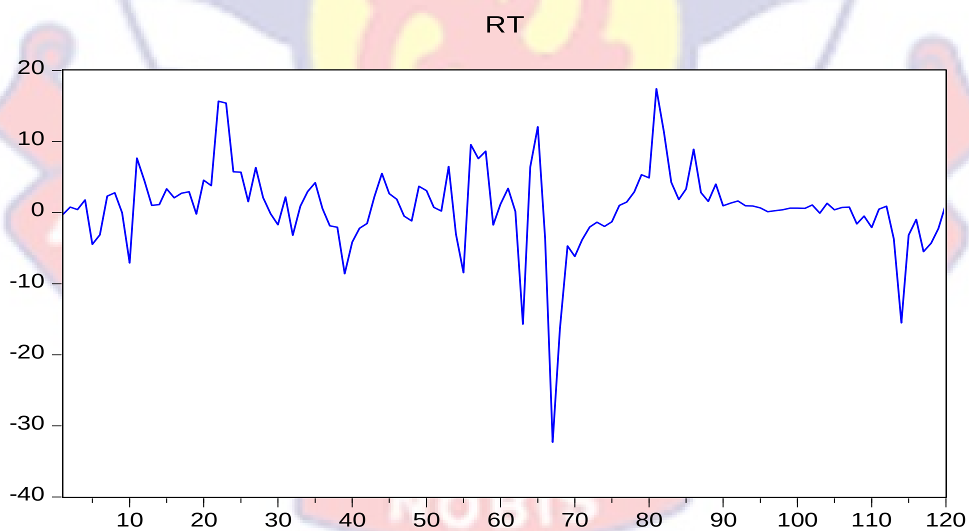

Figure A2: Trends of Monthly Returns for Ghana

APPENDIX A (2)

Plot of Stock Market Returns for NSE-20 (2005-2014)

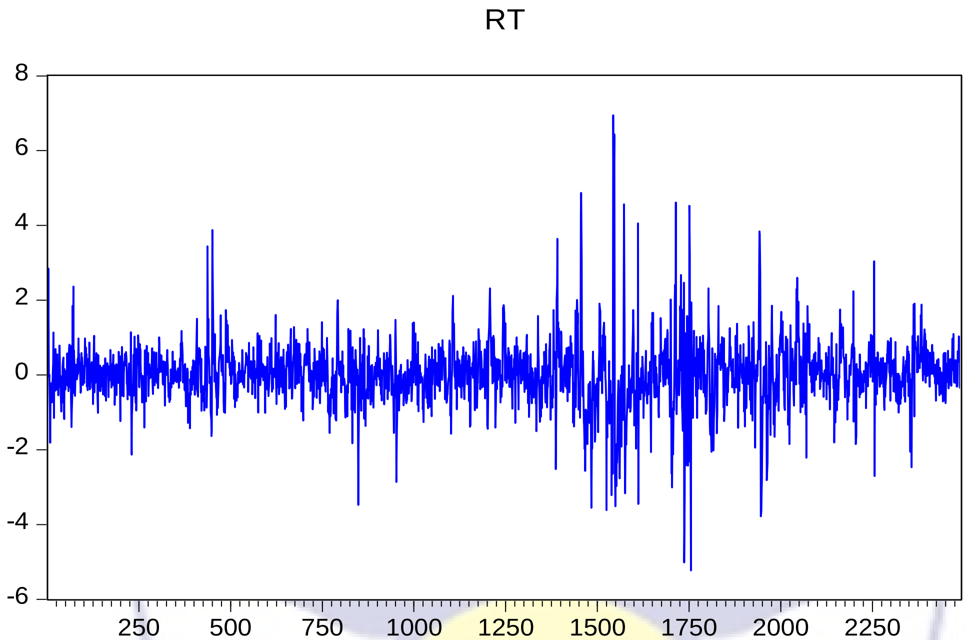

Figure A3: Trends of Daily Returns for Kenya

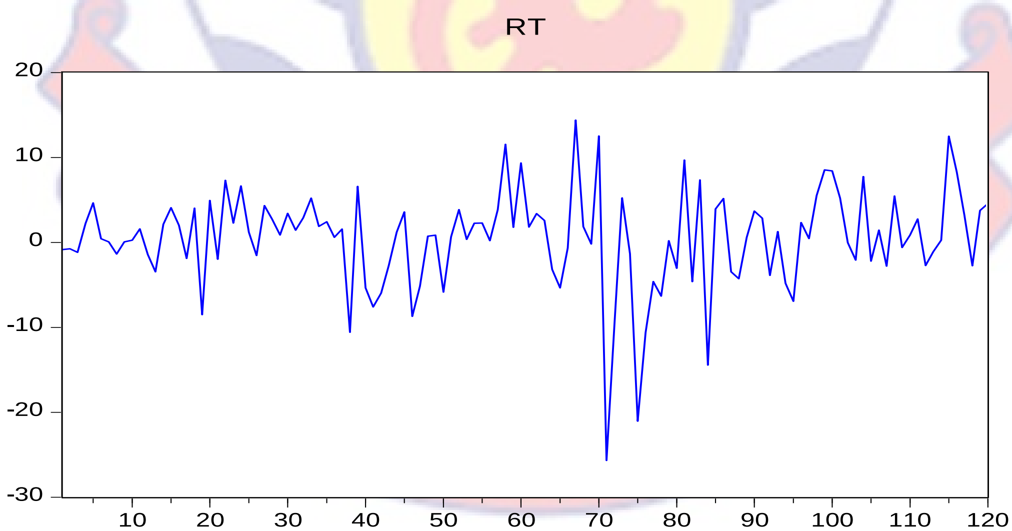

Figure A4: Trends of Monthly Returns for Kenya

APPENDIX B

Residuals of OLS Model Estimation (Day of the Week and Month of the Year Effect) in GSE-CI

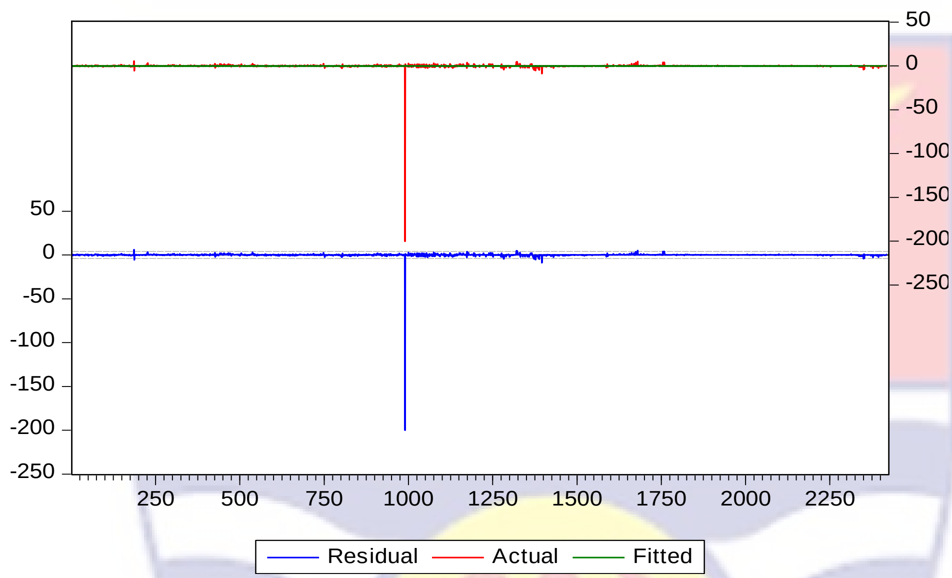

Figure B1: Plot of residuals for Day of the week effect in GSE

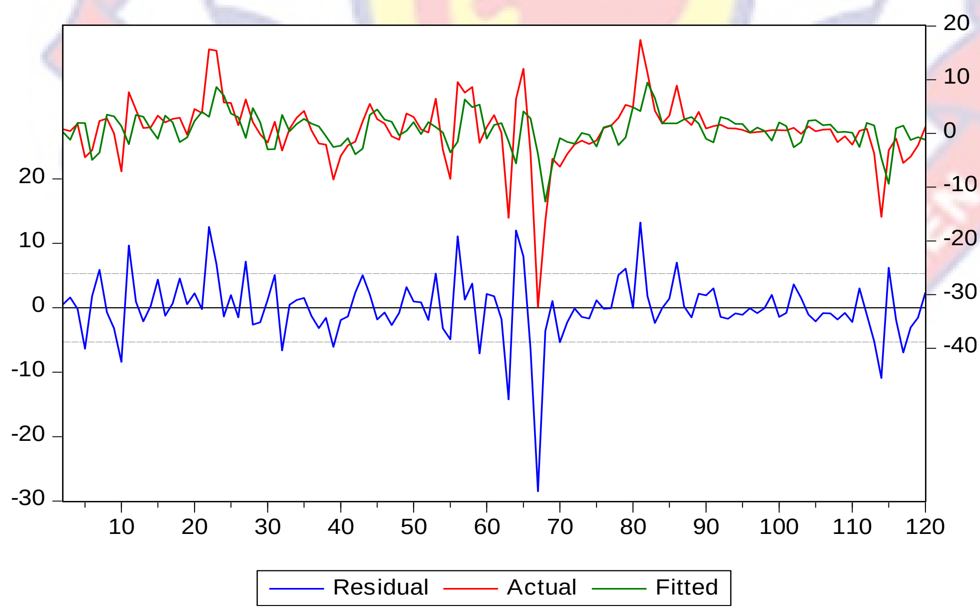

Figure B2: Plot of residuals for Month of the Year effect in GSE

APPENDIX C

Residuals of OLS Model Estimation (Day of the Week and Month of the Year Effect) in NSE-20

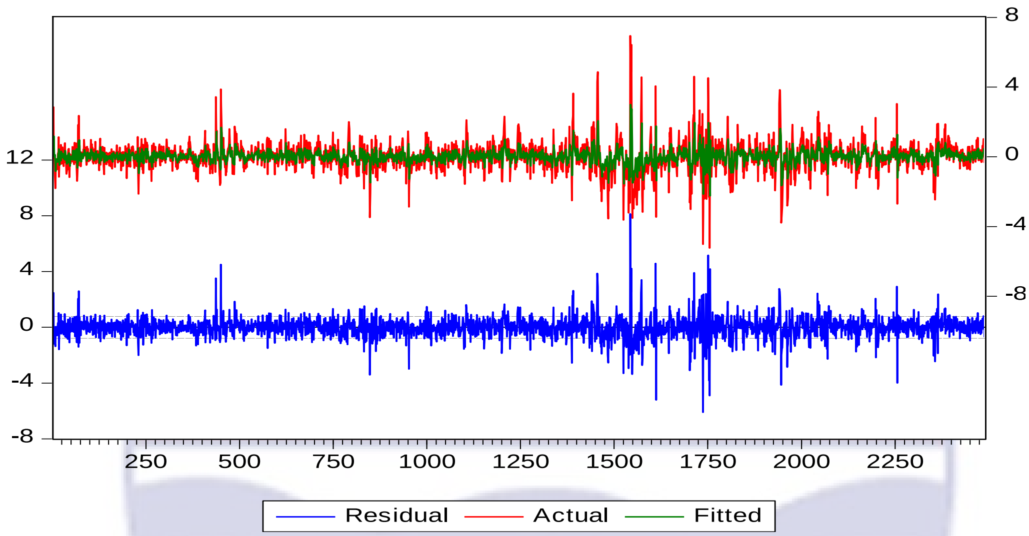

Figure C1: Plot of residuals for Day of the Week Effect in NSE

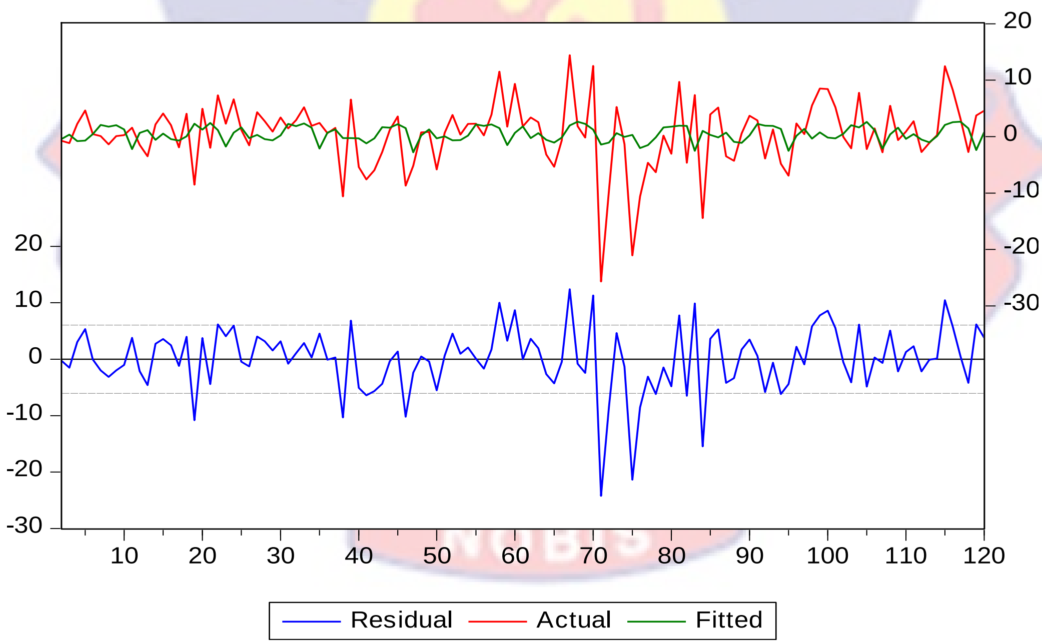

Figure C2: Plot of residuals for Month of the year Effect in NSE

APPENDIX D (1)

Post Estimation Tests For GARCH Models (Day of The Week Effect)

GARCH (1, 1)

Heteroskedasticity Test: ARCH

F-statistic	0.869360	Prob. F(1,2488)	0.3512
Obs*R-squared	0.869755	Prob. Chi-Square(1)	0.3510

TGARCH (1, 1)

Heteroskedasticity Test: ARCH

F-statistic	0.881335	Prob. F(1,2488)	0.3479
Obs*R-squared	0.881731	Prob. Chi-Square(1)	0.3477

EGARCH (1, 1)

Heteroskedasticity Test: ARCH

F-statistic	5.715736	Prob. F(1,2488)	0.0169
Obs*R-squared	5.707219	Prob. Chi-Square(1)	0.0169

APPENDIX D (2)

Post Estimation Tests For GARCH Models (Month of The Year Effect)

GARCH (1, 1)

Heteroskedasticity Test: ARCH

F-statistic	0.738502	Prob. F(1,117)	0.3919
Obs*R-squared	0.746415	Prob. Chi-Square(1)	0.3876

TGARCH

Heteroskedasticity Test: ARCH

F-statistic	0.444674	Prob. F(1,117)	0.5062
Obs*R-squared	0.450563	Prob. Chi-Square(1)	0.5021

EGARCH

Heteroskedasticity Test: ARCH

F-statistic	0.908137	Prob. F(1,117)	0.3426
Obs*R-squared	0.916546	Prob. Chi-Square(1)	0.3384