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SCHOOL OF BUSINESS

DEPARTMENT OF ACCOUNTING AND FINANCE

**AN INVESTIGATION OF THE RANDOM WALK HYPOTHESIS OF STOCK
PRICES ON THE GHANA STOCK EXCHANGE.**

BY

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ABSTRACT

The aim of this thesis is to investigate whether or not stock prices at the Ghana Stock Exchange follow a random walk model. There have been immersed developments in the Stock market all over the world in the past.

There have also been numerous changes in the stock market in both developed and developing countries. This research aims at investigating whether or not stock prices at the Ghana Stock Market follows a random walk model.

The Ghana Stock exchange financial markets returns series portrays volatility clustering that shows an indication of inefficiency on the Ghana Stock Exchange. The result of both the parametric and the non-parametric test shows that returns from the Ghana Stock Exchange did not follow a normal distribution.

The study uses two test of randomness and independence based on serial correlation test to check for the presence or otherwise of auto correlation in the daily stock prices and returns from the Ghana Stock Market.

The entire test including the Z-score value for both stock prices and their returns show significant indications of dependence in return series hence, non-randomness.

The overall findings suggest that random walk model cannot be a good description of successive price returns at the Ghana stock Exchange and hence results obtained are contrary to the hypothesis that successive stock price are independent random variables and also not consistent with efficient market hypothesis.

CERTIFICATION

The undersigned certify that they have read and recommended to the Department of Accounting and Finance of the School of Business (K.N.U.S.T) for acceptance, a project work entitled ‘An investigation into the Random Walk Hypothesis of Stock Prices at the Ghana Stock Exchange’ presented in partial fulfillment of the requirement for the award of a Master of Business Administration degree.

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GLORY BE TO GOD

LIST OF ABBREVIATIONS

GSE	GHANA STOCK EXCHANGE
SEC	SECURITIES AND EXCHANGE COMMISSION
RWH	RANDOM WALK HYPOTHESIS
EMH	EFFICIENT MARKET HYPOTHESIS
ASI	ALL SHARE INDEX
CAPM	CAPITAL ASSET PRICING MODEL
CRSP	CENTRE for RESEARCH of SECURITY PRICE
CV	COEFFICIENT VARIATION
MSCI	MORGAN STANLEY CAPITAL INTERNATIONAL

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CHAPTER ONE

GENERAL BACKGROUND

1.0 INTRODUCTION

The introduction of this research study considers the general background of this research work, the problem statement of the project work, both the general and specific objectives of the study and justification of the research work. Others include the method adopted for the project work, the scope, factors that contributed to the limitation of the project work as well as how the work is been organized.

1.1 BACKGROUND OF THE STUDY

Over the past years, investors interest have aroused in explaining the theory of random walk hypothesis as used in the capital markets. There are two basic theories that explains how the random walk hypothesis functions in the stock market, the two basic approaches that underpins the excess returns in the stock market are what is known as the theories of the chartist analysis and the theories of fundamental analysis, there are various approaches to the analysis of the stock market thus the theory of random walk in stock market prices but for the purposes of this research work we are going to stick to the aforementioned types. The analysis of the random walk hypothesis (RWH) says that, the returns that accrue on the movement of stock prices cannot be predicted and hence, do not follow any known trend, movement or direction, and per this assertion they can exhibit the quality of either moving up or moving down regardless of its previous direction of movement either it soars up or moves down by the type of security in question. (Kendall, 1953; Fama, 1965; Samuelson, 1973).

According to Bodie (2009) and Olweny (2011) stock prices in the market depends on factors that has an impact on the expected returns and expected risks. Information on

these factors that determines the security prices is released in the market at different time intervals and investors react to the information differently. Stock prices of listed firms therefore follow a random walk path and no one can predict accurately the direction and extent of their movements from historical series of prices.

The random walk hypothesis of stock prices has been an area that has attracted numerous researchers of late. Researchers (Basu,1977;Banz,1981;Foster,1984;and Kein,2008) have uncovered market anomalies and stock market inefficiencies that contradicts the RWH. Proponents of the random walk have always argued that the anomalies are only the tip of the iceberg and contends that, whenever those disorders or anomalies are explicit and known by all, the market participants competing to make excess returns over and above the expected market return by their exploitation should result in its disappearance. The issue of the global financial meltdown in 2007-2010 also led to the aggravation of the RWH models criticisms and the level of scrutiny to another next level, with some investors and market strategist (like Jeremy Grantham a British investor and Martin Wolf, the chief economics commentator of one of the dailies) explaining that financial leaders total confidence in such a model could cause an underestimation of the dangers of asset bubbles breaking up. This then means that it is of no importance to examine how the capital markets function in reality. In addition there are certain major market participants like Warren Buffet that have outperformed the securities market, their investment strategies focus on securities that are underpriced, earned millions of dollars from such strategies and other market participants follow suits.

Bachelor (1990) explains in his early work that the changes in the security prices have independent and identical distributions and again all the earliest effort that studied random walk of stock price were credited to him. Fama (1965) also puts it that the random walk of stock price implies that, neither the chartist analysis nor the fundamental

analysis can study the past trend of the prices history be used to make speculative gains on security prices in any understandable manner. The future direction of the movement of the stock price levels cannot be predicted the more, when trend of series of aggregated random numbers does not exist.

Randomness on the securities at the capital market price returns can be realized when there is an aggregate and total engagement among many market participants seeking excess returns in the market. The various market participants critically leave no information to waste but makes full utilization on the information that drops in the securities market to their merit and by so doing they inculcate all these pieces of information into the determination of the prices of the securities and hence aids in the total elimination of the excess returns chances that gave rise to their aggression (Samuelson, 1965).RWH presumes that all the participants in the market must have equal access to information that is released into the stock market. This presupposes that there is easy availability and accessibility of information by any investor or market player and by that all the participants have equal access to the information with regards to its sufficiency and adequacy and the time it is released into the market with no single individual making excess returns without taking on extra risk from the systematic stock price movements of various individual securities. These participants compete against each other making all non-random fluctuations too small to be exploited profitably. (Seeflenfreund, 1968)

According to Seelenfreund (1968) the underpinning rationale behind a research study on the theory of random walk hypothesis is to find out whether or not the trend in price changes are independently distributed random variables. The empirical testing of random walk hypothesis has been of two sides. The first and predominant method has involved statistical test of the series of prices over time, this includes serial correlation coefficient

and run test. The other equally predominant method involves directly investigating if there is laid down trading rules that can be devised to outperform inexperienced conventional strategy of buying when stock price moves down and holding to sell when stock prices moves up. If indeed stock prices are independent and normally distributed, mechanical trading rules should not show a profit.

The process of random walk is undeniably related to how efficient the market operates. (Sunil, 1996). In an efficient market all latest information that is released into the market about any company's stock is instantly factored into the company's share price trend movement. Company's Stock prices tend to exhibit characteristics that are embedded randomly around their intrinsic values, and fully reflect all new available information released into the market. No player in the market has an added merit in knowing in advance a return that can be earned on a stock price since no one particular investor has access to latest information not already available to everyone else, and thus consistently earning abnormal returns cannot suffice. (Fama, 1976).

Fama (1965) in his research work categorized efficient market hypothesis into levels of efficiency, based on the typical need of information assumed to be used by the market participants in the setting up of security prices of a firm. The weak form of the EM states that the trend in the past prices returns cannot be used as a yardstick to predict future price returns and hence no new information to that effect. The semi strong form of EM also holds that both information from the public and private are incorporated into the determination of the stock prices of firms. There is total aggregation of the efficiencies at all the levels. Strong form EM indicates the semi strong form of efficiency, and semi strong EM in turns incorporates weak form of market efficiency. The practical implication of efficiency with regards to a particular set of information is that the current stock price of a firm takes into account all the information in the set.

1.2 STATEMENT OF THE PROBLEM

The search for appropriate model for explaining and predicting stock prices can accurately be measured and explained by the theory of the random walk process is an area of discipline which is igniting intriguing controversies among all and sundry that matters in the market. This area of discipline has attracted greater attention from both policy makers and researchers.

While some studies indicate that previous trend in price movement on stocks of firms cannot be used as a yardstick to make accurate future predictions of stock prices of a firm and, hence conclusion been drawn that share prices of firms at GSE follow a random walk. Ntim et al (2007) tested random walk for GSE indices. They found that random walk hold on GSE share daily, weekly indices but RWM did not hold on monthly indices.

Many investors who seek to make abnormal or excess returns beyond their expected returns spend ample time and resources seeking to identify securities that are mispriced. They buy these low priced securities hoping to make more than expected profit in the future on selling them at a price higher than the purchase price. It becomes explicit that it is not always the case to achieve the expected profit within the stipulated time. At times the gains are lesser than expected and other the times the gains are greater than expected.

The question which the research attempts to answer is that; is it possible for the stock price returns on the Ghana Stock Exchange to be independent random variables which will make it impossible for investors to make predictions using past data on price returns.

1.3 OBJECTIVES OF THE STUDY

1.3.1 General Objectives

The movement on the stock market provides an insight to investors who buy and sell shares with the aim of making profit. The study explores the weak form of EMH with application of the GSE ASI for the period 1st July, 2012 to 31st June 2015. The general rationale underpinning this work is to find out whether stock price returns of firms on the Ghana Stock market depicts a random trend

1.3.2 Specific Objectives

- To find out whether the GSE ASI follow a weak form efficiency hypothesis?
- To explore whether the random walk hypothesis holds for the GSE ASI.

1.4 RESEARCH HYPOTHESIS

Do successive share price returns of firms on the Ghana Stock Exchange portray a trend of sequence that cannot be predicted?

1.5 JUSTIFICATION OF THE STUDY

The behavior of the stock market returns is at the heart of this research study. It is how the market behaves that determines the pricing of assets, decisions on asset allocation, investment and management of total risk. The proponent of EMH believes the stock indexes of firms are just random. Therefore speculation based on past information on stock prices of firms to predict a trend to make excess returns over and above the expected returns cannot be successful. This research study seeks to investigate the behavior of stock market returns of firms at the GSE. The justification of this study is

expounded based on the statement of the research problem as well as the specific aims of this research work.

This research study seeks to add to the limited body of evidence on the random walk theory of stock market prices in Ghana and Africa at large. I examined the pattern of the movement of share returns of firms on the Ghanaian stock market and to find out whether the market follows a random walk model, meaning no player in the market can earn more than enough returns based on a trend of sequence in the stock price returns movement. This particular research study analyzes a number of alternatives, which are complementary, and finding out practical procedures and finally, this research study uses daily stock data of firms to determine violations of the random walk hypothesis likely to be remote or obscured by using daily stock data of firms at longer sampling frequencies.

The justification of such a contribution cannot be discounted. Results based on such modern econometric techniques will throw more light on the behavior of an emerging stock market in Africa and for that matter serve as a reference material for students, lecturers, researchers, policymakers and practitioners. Precisely, concrete recommendations can be drawn out which can be used for enhancing the efficiency of firms at the GSE at large. For investment analyst, forecasters, and others who deal in stock trading, the efficiency or otherwise of the market holds crucial implications for their day to day activities. Understanding the behavior of the stock market can help them to design appropriate strategies.

1.6 SCOPE OF THE STUDY

The various assumptions that are held on random walk theories indicates that either the stock returns of a firm of a particular stock market follow a random walk system or that the process used to find out the model is unable to discover the true system generating

stock returns. If a practical model will be able to find out a trend, then past stock market data can be used to predict current and future stock market prices and the stock market is considered not to be efficient.

In terms of scope, this study is applied to the Ghana Stock Exchange All Share Index for the period 01/07/2012-31/06/2015. The analysis is purely quantitative and statistical in nature and conclusions would be drawn based on the output of the statistical models for this period.

As such, no attempt is made to present the views of shareholders, analyst or policymakers who have been working with the market for quite some time and probably would have formed some opinions of its behavior over the years.

With respect to the content, the scope of the research is limited to weak form market efficiency hypothesis. The research investigates whether the movement of stock prices on the market follows a random walk process to suggest its unpredictability or otherwise. The empirical techniques used in this study test whether future price movements are directly dependent on past or current price dynamics.

1.7 LIMITATIONS OF THE STUDY

Since problems emerge at every stage of a research project, concrete strategies have to be adopted so as to appropriately tackle them as and when they surface.

This study, ‘An investigation of the random walk hypothesis of stock prices on the Ghana stock exchange’ requires a detailed analysis of the listed companies over a certain range of years. However, lack of secondary data on a long period of years for listed companies was the key limitation to the research study.

The following are some challenges faced in the conduct of the research:

Although, this research study did not involve interviews and questionnaires, some financial constraints were commissioned by the acquisition of data, typesetting, stationary, binding, software, and data analysis.

Also, like any other research, the time allocated for conducting this study was very short to allow for a detailed analysis; again this limited time has to be apportioned between carrying out the other responsibilities as a student and conducting the research.

One major issue with the test for EMH is that it is surprisingly difficult. This calls for due diligence to be practiced in specifying the experimental models. The subject has aroused the interest of certain key players in the stock market that have propelled them to have a certain level of studies in empirical finance, especially when it comes to the determination of the level of efficiency of a particular emerging financial market, albeit the literature is not conclusive on which approach is the best.

Notwithstanding the challenges enumerated above, the necessary steps were taken to ensure the successful completion of the project. The methodological issues were resolved by employing different hypothesis and assumptions.

1.8 ORGANISATION OF THE STUDY

This research work is put into five key classified chapters. The first chapter provides the summarized version of what the research study will be about and hence is made up of the introduction of the project work, background to the study, objectives of the research work. it also includes the research hypothesis, the reasons that justifies the research study and the rest of the chapter is also made up of the scope of the work, what is considered as limitation of this research study and the general organization of this research study.

Chapter two also covers the literature review. The extent theoretical literature on the EMH is reviewed. Also, a review of different methodologies that have been applied in previous studies is presented. Finally, and the findings of studies on stock returns efficiency and random walk hypothesis was reviewed with particular concentration on the GSE and its predictability.

Chapter three is the research methodology. The chapter will throw more light on how the analysis would be conducted. More important is a description of the research designs, data and the various techniques used for the empirical analysis.

Chapter four seeks to cover and presents the empirical outcome of the investigations, analysis and discussions.

The last chapter will cover summary, conclusions and recommendations drawn out from the research study for policy making and investment analysis.

CHAPTER TWO

LITERATURE REVIEW

2.0 INTRODUCTION

This chapter reviews literature on efficient market hypothesis; it looks at other theoretical literatures on random walk hypothesis and Ghana stock exchange.

2.1 THEORETICAL LITERATURE

In principle, the study of stock markets all over the world both in the emerging countries and the well-established economies dealing with the returns of share price and how well to predict the stock price returns of firms from historical data and the efficiency of the stock market has been of considerable interest. The random walk hypothesis and efficient market hypothesis are the two key pivot ideas around which the stock market behavior of firms can be well explained and revolves. The supposition that stock market behaviors represents and reflects vital information's that are rapidly and rationally, has a great effect on the returns of security prices of firms, that any small change in vital information could trigger an immediate stock prices changes.

2.1.1 Efficient Market Hypothesis

Eugene Fama (1970) developed what is considered as the majorly accepted technique underpinning the efficiency of securities market, the efficient market hypothesis (EMH).

The process underpinning the generation of stock returns has sparked a lot of interest in finance. Whether the process is predictable or not has a possible effect for all players especially investors and trading strategist, portfolio and fund managers, and consequently also on economic and financial development as a whole. According to Kendall (1953), as stock movement is not discernable; stock prices of listed firms can

move up and move down as well on any trading day at the stock market, which is wholly, necessarily and exclusively not dependent on their past stock price movements with no recourse to previous stock price movement. This presupposes that future prices of stocks cannot be predicted just on the bases of practically examining the trend in the past prices movement and be making excess returns. The concept is generally described as efficient market hypothesis. Although this concept has been proposed earlier in some studies, it was popularized by a man named Eugene Fama (1970). This concept makes a case that, a market is efficient, when and only when prices of stocks fully takes into account all readily made information that is relevant to their valuation at all times. This implies that to ensure fair pricing of stock, all latest information in the stock market should be taken into account in the determination of the stock price of the listed firms. The key ability of stock markets in including all latest available information into the determination of stock prices measures its level of efficiency.

Fama (1970) made some fundamental assumptions that, all information about stock prices of firms are costless and hence available to all the players in the stock market, and there are no cost associated with transactions in the trading of securities. However, studies have shown that these assumptions cannot be true and hence hold for the concept of efficient market hypothesis since these aforementioned assumptions cannot be out completely from the stock market based on certain abnormalities and anomalies, hence there cannot be an ideal situation in the stock market with regards to the assumptions raised. (Malkiel, 2003, Schwert, 2003, and Shiller, 2003). Since the market cannot have an ideal system there is the evidence of variability and volatility on investment returns (Lo and MacKinlay, 1990), the weekend effect (French, 1980) size effect (Banz, 1981 and Reinganum, 1981), the value effect (Basu, 1977) and the momentum effect (Fama and French, 1996), among others

The concept of efficient market hypothesis (EMH) is the majorly accepted model measuring and explaining the efficiency of capital markets.

Eugene Fama (1970) claims that the stock market is efficient when all readily available information is taken into account when determining the stock prices of the firms, that is the information is automatically adjusted into the stock price determination, such that neither no single market player in the stock market gets in advance certain vital information than other players or others obtains more information about stock prices than information that is already existing and also reflected in the stock market prices of firms. In other words, a stock market is considered and described efficient when prices of stocks are automatically incorporated and taken into account accurately and fully, all the readily available information on stocks of firms. This gives a clue and seek to suggest that, with an equal access to certain range of information on stocks of firms to all players, the system of the market efficiency makes it virtually not possible for the agents in the stock market to make what is general described as abnormal profits by just trading on the basis of this information set and not taking any additional risk to compensate for any excess gains since all the relevant information's are readily and easily accessed by all the agents in the stock market (Ross, 1987). The EMH further goes on to make a case that stock prices of firms cannot just be predicted and hence happens in random fashion, such that no single individual or entity is able to accurately and successfully at all times observe a trend in the stock prices movement and execute a planned investment strategy that is absolutely able to beats the markets at all times. The direct opposite holds that when a stock market is not efficient it greatly aids the agents in the market to make excess returns on their investment due to the huge existence of the momentum in the stock prices especially the seasonal and day of the week effect. (Malkiel, 2007).

The most basic function of the capital markets all over the world is what has been said and described to be how the ownership of an economy's capital stock is allocated. In general a situation the most preferred stock market is where the stock prices of the firms themselves gives a number of accurate signals for resource allocation, hence a stock market where listed firms can make prudent and profitable investment decisions, and other players in the stock market can also in the same line make a choice among the securities of firms which is a body of ownership of firms that the same firms activities under the assumption that security prices of firms at any point in time fully and accurately incorporate all information that is available in the stock market is said to be efficient (Fama, 1970).

Information according to Fama (1970) is hugely considered to play a major function in the stock markets all over the world. It assists in the way stock prices of firms are established, and enables all the interest groups on how to pick what is considered to be an optimal portfolio. According to Caprio and Demirguc-Kunt,(1998) one possible avenue that allows the players in the stock market all over the world to either diversify their investment and not put all their eggs in one basket or spread the risk associated with investment is when the stock market is efficient hence culminating to efficient stock prices. Also, (Green et al, 2005) posits that when the stock prices of firms are efficient meaning it incorporates all the relevant information, it serves as a guiding principle and good benchmark against which the cost of capital and returns on investment of a firms projects can be prudently be judged .(Green et al,2005) again claims that since the stock prices of firms looks into the future , they provide a general and specific unique record of shifts and insights as to how investors and other players in the stock market seek to understand and view the future prospects of firms and the economy as a whole.

Fama (1970) based on his research study grouped market efficiency depending on the assumptions of the information set available and how quickly the information is incorporated into the stock prices: not in any particular form the weak-form market efficiency, the semi-strong market efficiency and the strong market efficiency. In its slightly less detail form, the EMH claims that the stock market is efficient if all the readily and relevantly available information is snappily inculcated in the determination of the market prices of stocks. It continues to say that, practically when the strong form of EM is described as been the most compelling, then the deduction also holds true that the semi strong form of EM can then be described in common terms as the most appealing to most players in the market. It further says that no single individual investor or corporate investor with no additional risk can earn excess returns from trading rules based on information that is already within the reach of all investors in the market. When the stock is considered semi-strong form efficient, then stock price react very quickly to all information that is within the public domain and per that no single market player will be able to beat the stock market to accrue above normal gains than what the market provides. The semi strong hypothesis of the EM incorporates the weak form hypothesis of the EM, in that all the relevant information in the market that describes the weak form EM for example the volume of trading in the stock market, the rates of return in the weak form market, the stock prices is public. This model presupposes that any investor whose main purpose is to fall on new information after it has drop into the public domain should not earn over and above a normal returns from their said transactions taking into account the cost associated with their trading in that, all the new public information is incorporated in the security price already. (Mishkin, 2007). Certain key information's that are in the public domain that are accessible by all the market players' includes but not limited to stock repurchases, increases of dividend and stock splits. For instance, if a set

of investors buy the stock of a firm on the date of dividend announcement and eventually does not earn an above normal gain, that stock market is described as semi-strong efficient. The relationship that exist between the stock prices of firms and the given set of information that is released into the domain to the market to be accessed by all and sundry has been explained by the EMH, which is explained that any new information that is made public is usually and entirely taken into the determination share prices of firms. Any other new information that is lately made readily available to the markets economic value is also quickly impounded in an unbiased manner in the share price of the firms (Fama, 1970).

2.1.2 The Strong form EMH

The EMH claims that the stock market is efficient if all readily available information that is relevant to price information is incorporated in the stock current market price, whether or not such stock price information is either publicly available or privately available. If this assertion holds true for such a stock market. This type of efficient market has been considered to be the most compelling and satisfying form of efficient market hypothesis in a purely theoretical sense, but that notwithstanding, this form slightly suffers from one huge criticism. It therefore becomes difficult to agree scientifically that this research study will not be likely to have received enormous support from the relevant sections of the whole financial community (Fama, 1970).

The strong form of efficient market hypothesis clearly indicates that the stock prices of firms fully takes into account to some extent certain information that are private for instance a private information about an impending change in technology and a possible or even acquisition. Under this form of market efficiency, not even those with deep level of expertise (portfolio and fund managers and financial analyst) would be able to

outperform to earn more on any index traded on the stock market (Malkiel, 2007). This simply means that all the stock markets can be described to be weakly form efficient but hence not all other stock markets can exhibit the other considered stronger forms of market efficiency (Frimpong, 2008).

At one point or the other stock prices is mainly determined based on information from both the private and public sources. This presupposes that no single investor or group of investors even where they have access to certain level of insider information; they (investors) may not be practically capable to devise strategies to trade based on the insider information to continually earn excess returns. All the three levels of market efficiency are together nested. Strong form efficiency takes into account semi strong form efficiency, and semi strong efficiency in turn implies weak form of market efficiency. The scientific outcome of market efficiency with respect to a particular set of information implies that the current stock price of security at the stock market embodies all the sets of information.

2.1.3. The Semi-Strong form EMH

Another form of efficient market hypothesis is the semi-strong form of efficiency, it claims that stock prices at the stock market takes into account in its determination since it makes a full utilization of readily available public information which includes but not limited to the reports published by companies, company's annual earnings, stock splits and the profits declared by public company. The form of efficiency that is considered a stronger form of market efficiency, however, exist when the stock prices of firms incorporates both private and public information about company's annual earnings, book values and investment opportunities, inter alia (Malkiel, 2007)

Another assumption underpinning the semi-strong EMH is that, share prices of firms immediately reflects in a rational fashion and also in manner that is not biased to readily available new information that is released into the public domain. That will lead to certain investors earning excess returns on such new publicly made information. The Semi-strong form efficiency indicates clearly that the analysis of the fundamentalists will not be capable to beat the market and hence produce abnormal gains. Testing this form of market efficiency will mean that all past news about stock prices of firms must be adjusted to take account of the current news which must be of reasonable size and also immediate. If there are any consistent movement up or movement down, it would then mean that all the players in the market had clearly unambiguously explained both the new and old information in a biased fashion and hence in an inefficient way.

The semi-strong form of EMH posits that security prices of firms fully takes into account all readily available public information in the determination of its stock prices. It therefore asserts that security prices of firms quickly admits the release of all public information in its stock price determination; that presupposes that the current stock prices of firms fully incorporates all readily available public information in the determination of the stock prices. This form of market efficiency encompasses the weak form hypothesis, in that all the information released onto the stock market such as trading volume, the rates of return and prices of stock are made public market. This form of efficient market hypothesis means that investors who make investment decisions solely on relevant new information after it is released into the public domain and accessible by all should not expect to earn above average risk adjusted profits from such dealings, taking into consideration the associated cost of trading, in that all new public information is already factored in the determination of the stock prices of the firms. (Mishkin, 2007).

2.1.4 Weak form EMH

The weak form of market efficiency exists when a stock price only takes into account information relating to the trend in past information and hence this past price movement is fully imbedded in the current stock price automatically. This means that there cannot be an avenue to earn excess returns by simply studying the trend in past price changes (Malkiel, 2007).

When the changes in future stock prices happens in random fashion and independent of the changes in price. Then then this form of efficient market is purely based on the random walk hypothesis (Malkiel, 2007), meaning that changes in the stock price do not follow any laid down trend over a period of time.

This form of stock market efficiency in its less detailed form, the EMH sums itself to incorporate a major of public information, which includes past information about the share price of firms. Both the new information must be parallel to past information; otherwise it cannot be described to be information that is new. It then seeks to provide a trend in the share price of firms which is in direct response to new information released into the market which cannot also be predicted from previous trend in the stock price sequence. The future stock price of firms cannot be projected just on the basis in studying from past prices. (Fama, 1970).

Therefore, neither a single individual nor group of individuals can simply gain excess returns by using investment strategies based on past stock prices of firms and other past financial data of firms. It also makes a case that not even the technical analyst will be capable with all their expertise to earn abnormal gains. Testing for this form of market efficiency, it is therefore adequate to make full use of statistical tools that seeks to find out whether there is a link between the past stock prices and current stock prices making

it easy to predict the future stock prices of firms. The current stock prices of firms in a weak form market is considered the best, not biased, estimate value of a firms share. Information is fundamentally considered to occur randomly, so that share price movements of firms must also thread on that random sequence. (Fama, 1970).

If that holds true then the weak form of EMH can be interpreted to mean that the sequence of past stock price returns virtually does not contains information on future price returns. It again assumes that the current market prices of firms already includes all the past returns in the determination of its stock price and any other market information on the security of firms, this means that the past rates shares that determines the return to be earned and other past market information should have nothing to do with future rates of return. Hence, this hypothesis holds that one should at least gain little from the use any trading rule that is able to well predict whether to buy or sell a security just on the past rate of return or any other historical stock market data (Reilly, 2006)

Research study by Frimpong (2008), Osei (1998, 2002) Ntim et al (2007), are very popular in this field. But Frimpong and Osei (1998,2002) continued to research on how efficient the GSE is using a composite market index.However,Ntim et al.(2007) also went on to complement the literature with a practical analysis of the microstructure, by researching on the efficiency of the various individual stocks of firms that listed on the Ghana stock exchange. All their research unequivocally concluded with one outcome that GSE is weakly inefficient.

Nonetheless, all market players would practically be in the wait in that research studies on emerging stock markets and Ghana for instance where most companies are listed manually onto the exchange.

2.1.5 Empirical Evidence from Ghana Stock Exchange

Adam and Tweneboah (2009) used quarterly data from 1991q1 to 2006q4 to find out the effect of foreign direct investments on the gradual development of the stock market. A co-integration examination discloses the persistence of the long period of term relationship that exists amongst foreign direct investments, development of stock market in Ghana and nominal exchange rate. Though, the research work of previous researchers on foreign direct investment seeks to negatively affect growth of stock market in Ghana, but the most interesting aspect of this is that other authors report significant positive impact of the foreign direct investment on the development of the stock market in Ghana.

Adam and Tweneboah (2008) again tested the role of macroeconomics variables inclusive in the share price of firms movement in Ghana by means numerous models such as the innovation accounting model and the notable johansens multivariate integration technique. Such technique's and models provide long term evidence of a relationship that exist amongst exchange rate, treasury bill, stock price, consumer price index .

Frimpong (2008) evaluates how efficient the Ghana stock market operates for the period spanning from 1999 to 2004 and came out with a statement that the Ghana stock market cannot be described to be consistent with the weak form of the efficient market hypothesis. Numerous rationales have been cited to be the causal factor for the inefficiencies of the Ghana stock market; the most cited reasons for such inefficiencies in the stock mark includes but not limited to the usual manual listing and paper certification on the Ghana stock exchange which usually deters the flow of information in the stock market. During the period from 1999 to 2004 the information that needs to be incorporated into the determination of the stock prices were delayed which could result in either under valuation of stock prices or over valuation of stock prices. This then

provides enough evidence to presume that the introduction of automation of trading is likely to soar up due to how efficient information is released into the stock market.

Ntim et al (2007) went on to re-assess the efficient market hypothesis (weak form) of the Ghana stock market using both the parametric and non-parametric test. Ntim et al (2007) made a report that the stock returns of firms are conclusively inefficient in the weak form, whether using the strict random walk perspective or using the relaxed martingale difference sequence form. Unlike previous evidence, the author's findings were robust to thin-trading as a result of using daily stock prices of the listed firms.

These researchers Magnusson and Wydick (2002), Appiah Kusi and Menya (2003), and Simons and Laryea (2004) have all assessed the level of weak form efficiency of the stock prices on the Ghana Stock Exchange and reports that on the basis of all their aggregated outcome they hold the view that the stock price behavior on the GSE is weak form inefficient.

Analyzing the data, it portrayed that more than 70% of the shares and other macroeconomic variables are rationally distributed. This has been acclaimed to be an imperative result, indicating that the returns at the Ghana stock exchange as a whole is rationally and normally distributed, Mandelbrot (1963) and Fama; (1965) also gave very contrasting results which are widely accepted in the contemporary financial theory.

Other studies have rejected the stock market efficiency of Ghana. Alagidede (2004) in his recent work reports on one of the key qualities of the stock market called the day of the weak effect in the Ghana stock market which rejects market efficiency. Osei (2002) examined the features of pricing asset and its impact on the eventual announcement of annual earnings of the Ghana stock Exchange and discovered that the stock market in

Ghana is highly inefficient in relation to the information released by listed companies on their annual earnings.

2.1.6 Test for Market Efficiency

Since time immemorial researchers have measured the efficiency of a stock market based on the movements of the aggregate return earned from the market and then endeavors them to discover the process generating those returns in the stock market. When the stock market is considered efficient for the share prices, then there cannot be any practical model to discover any trend and hence it can be deduced that the returns on the market do not follow any pattern but a random walk process. If that is true then, the assumption of random walk means that return generating process cannot be predicted. If there can be an identified pattern, then past data on stocks can be used to predict both current and future market prices. A number of techniques have been applied to capture the data generating patterns in times series data.

2.1.7 Auto/Serial Correlation Test

Studying the weak form of market efficiency, it claims that there should be no correlation in the movement of stock price. Another way to measure the extent of relationship in the sequence of stock prices is to adopt serial correlation technique. This statistical method (serial correlation) outlines the movement of stock prices of firm from one period to another period at one particular time can be said to have relation to past period stock price movements. This statistical method (serial correlation) is used to discover the relation that exists in the series of periods and time of its own figures at different lags. When the serial correlation value is negative it suggests that we cannot

reject the null hypothesis but when the outcome of the analysis has a positive coefficients then it rejects the null hypothesis.

The serial correlation of the random walk process gives a clear meaning to the relationship between values of the process at different points in time, hence functioning at the time differences. Auto-correlation is usually referred to as correlation co-efficient, but if there is a relationship existing in two different variables, then the relationship between those two variables of the same variables at times, T_i and T_{i+k} . then the relationship coefficient for values of the series periods apart.

A number of experts and researchers have discovered that usually there is a significant level of autocorrelation found in the case of some portfolios of small shares. Even this sometimes comes with some kind of problems when measuring especially in the process of collating information on stock price. It is therefore difficult for investors to hope on prices for small stocks in that they are not traded frequently hence non-synchronous trading problems arising.

2.1.8 The Run Test

This particular model is concerned about changes in the stock prices over a period of time. It is then followed by the comparison of the actual changes recorded with the expected changes for random series. Fama (1965) describes the run test as the unpredictability trend in a set of data. To affirm as to whether there is a relationship between lagged values, the run test of unpredictability is used. (Run test). To find out whether in an observed data there exist a correlation the run test is used. Since the random walk model tends to ignore the properties of normal distribution it is preferable than any of the non-parametric test models and hence capable of proving the random walk model. This non-parametric model functions on the premise that once a series of

data is considered to be in a random fashion the observed number of runs in that same series must be close to the expected number of runs. But when there are too many runs, it implies that the residuals signs change frequently, which simply means there exist negative serial correlation, in the same way, when there are only few runs, it implies that the residual signs do not change frequently and hence there exist positive autocorrelation. According to Fama (1988) when there is a positive autocorrelation we can infer that there is predictability. Either many runs or few runs imply enough evidence against the hypothesis of random walk process.

2.2: REVIEW OF EMPIRICAL LITERATURE

2.2.1: International Evidence of EMH

Clearly there is no doubt numerous literatures on the stock market efficiency are all over the world. That notwithstanding major of the research work on how efficient the stock market functions have been consistently been directed towards how the stock market behaves with particular attention in the well developed countries where we seldom rejects the weak form market efficiency.(Kendall,1953 and Fama,1970).Borges (2008) also went on to say this in his research study that due to the efficiency of the indexes of the stock market of well developed countries like Germany, UK, Portugal, Greece, France and discovered that there exist a random walk behavior in countries like UK, Spain, Germany, France but the stock market of Portugal and Greece also showed signs of inefficiencies as a result of positive serial correlation.Eventhough some research studies have evidenced some level of stock price predictability of future stock price changes in the stock market there has not been clear evidence of trading strategies that is most profitable due to the predictability that has been shown. This presupposes that majority of the economies that have a stratified financial market there is enough grounds to say that financial market is considered weak form efficient markets.

However, that of emerging countries is quite controversial. Most of the research study undertaken on emerging markets of various economies stock markets produced mixed outcomes. Barua (1987); Chan et al (1996) observed that the many developing stock markets were weak form inefficient. Sharma and Kennedy (1977) also did a research study on the Bombay stock market (BSE) and came out that the market is also weak form efficient. Poshakwale (1996) tested the Indian stock market and showed that it is also weak form inefficient, using a collated daily BSE index data for the period spanning from 1987 to 1994. other researcher like Gupta and Basu (2005), Mishra et al (2009) disclosed a pattern in the outcome of the Indian stock market and said it showed a random walk behavior and hence inefficient. Barnes (1986) also did a research work on the o Kuala Lumpur stock exchange and produced similar outcome like the Indian stock market. Ryoo and Smith (2002) conducted a research study in the Korean stock market using a variance ratio model and discovered that the Korean stock market indeed follow a random walk process when the price limits for stocks were relaxed during the certain period especially from March, 1988 to December, 1988.

Econometrics advances and recent empirical evidences suggest that random walk is rejected by robust test and specifications (Lo and MacKinlay, 1988). Again, to some extent prices returns can be predicted with some precision. Fama (1991) acknowledges that the initial empirical evidence lacked statistical power. They were also limited to testing returns based on past information.

Among the seminal contributions in the area of stock return predictability are Fama (1965), French (1988), MacKinlay (1988) and Poterba (1988). Fama (1988) has examined a one month data returns for all stocks at new York exchanges (NYSE) from 1926-85, they tested autocorrelation of stocks for increasing holdings period. In their results, stocks that produced autocorrelation they have for a return horizon that extents

more than one year are that are large negative should be in consonance with the hypothesis which means that the revert price components are relevant in the estimations of the variations of return. Returns of stocks can be predicted for stocks with small capitalization. When stocks can be Predicted then variations in the results is estimated to be in the range of 40% of 3-5 years variation in return for small capitalization stocks while that for large capitalization stocks tends to fall by 3.5%.

Researchers like Lo and MacKinlay (1988), in their most influential research study, outline clear cut evidence that sought to say that the random walk is strongly rejected when we adopt variance ratio (VR) statistical technique for the sample period 1962-1985 and also on other sub periods for a number of combined U.S indices.

Lo and MacKinlay (1988) reject the random walk model, their results did not imply that the stock market is inefficient, or that price are not rational assessments of fundamental values.

In Latin America. Urrutia (1995) tests the random walk for countries like Chile, México and Chile that has the homoscedastic technique of the Variance ration technique. But the variance ratio provides a robust a heteroscedasticity which fails to reject the random walk hypothesis for Argentina. Kararera et al (1999) in his recent research study discovered that the random walk model cannot be consistent with the series on stock returns in the Latin America.

In Africa, smith and Jefferis (2003) test the random walk process for several indices in the Johannesburg stock Exchange using statistical models. Four of these stock indices exhibited a random walk process.

Some other indices of stocks were rejected due to their small capitalization and medium capitalization because of the autocorrelation that exist among their returns. Their results are generally consistent with weak form efficiency for large capitalization and liquid stocks, and inefficiency for low capitalization stocks.

The unanimity of results across markets supports the finding of substantial transitory price components. Generally, factors like the level of autocorrelation coefficient give a certain degree of confidence in the returns of the individual securities. But when the aggregate difference in the stock returns is very minimal it is described as a value that is not statistically and economically insignificant and hence unpredictable. Lo and MacKinlay (1988) claims that, when a firm contains a specific noise that is makes it very difficult to discover the predictable trend component then then individual stock returns is expected. However; the evidence so far concentrates on the first moments of stock returns.

Also the variance ratio, serial correlation and unit root tests all assume linearity in the return generation process. The assumption of linearity takes as given that the means and standard deviations of stock are constant through time. In the light of structural changes, technological innovation and complex dynamics of the environments in which economies separate, this assumption is not likely to be tenable (Alagidede, 2008).

2.3: RANDOM WALK HYPOTHESIS

Random walk hypothesis postulates that changes in the stock prices of firms for successive period are actually independent variables. According to Kendall (1953) in random walk market, stock prices tends to move up or move down independently around the securities intrinsic values; returns on stocks tends to move very fast towards the equilibrium and fully accommodate the new information readily in the market. Even

though the changes in the stock price may not be perfect, it cannot be biased; meaning that securities of firms can either under adjusted or over adjusted by the latest information in the market and hence predictability of the sequence in the stock prices becomes impossible at any given time.

Some experts hold the view that random walk hypothesis presumes that information about traded securities are available always and there are large numbers of competing rational profit maximization market players with adequate capabilities to tap into any profit opportunity arising from the systematic stock price changes of an individual stock. Competition will cause firms to have a full impact of new information on stocks intrinsic values to be adjusted instantaneously into the actual stock prices determination and make all non-random fluctuations so small that they cannot be exploited profitably; when this hold true neither those that study critically the trend in past stock price movement will be able to make future predictions based on a certain trend analysis nor fundamental analysis which analyze publically available information to determine misprices securities would be able to earn abnormal returns over and above that could be earned on buy and hold strategy (Seelenfreud,1968;Robert,1959;Fama,1970).

Fama (1970) again posits that there exist random walk processes in the stock price when future stock price changes are independent and identically distributed. When future residual increments are said to be independent and rational then the sequence in the stock price movement is also said to follow a random walk, implying that adjustments in the future stock prices cannot be determined by the trend in past price changes. The underlying principle underpinning the theory random walk can be explained from the standpoint that changes in stock prices from one period is different from changes in stock prices during previous period. Fama (1970) went on to assert that random walk theory is only as an extended version of the fair game model. The fair game model only implies

that the factors of market equilibrium can be stated in terms of expected returns on securities while the theory of random walk also indicate the details of the process generating returns on the securities. Fama therefore went on to conclude that the empirical tests of random walk hypothesis can be said to be more powerful to support of efficient market hypothesis than that of the fair game model test.

According to Bodie (2009), since any latest information is reflected in the determination of the stock prices, the stock prices should not be biased to the current information available in the market, which includes the risk of owning the security. The aggregate impact therefore is the new information that is randomly dropping into the stock market. This will make the players in the market to quickly adjust their securities to take into account of the latest information which implies that stock prices changes are independent and happens in a random fashion.

For several years great economist and other finance experts have had great interest in the development of stock price behavior models. Though many models have been developed but the most imperative model that has erupted from this research study is the random walk theory. The random walk hypothesis really down plays other techniques for measuring and able to predict the behavior of stock price movement. It goes on to assert that if the theory of random walk process is an exact description of what is happening in the stock market then the either technical or fundamental procedures for making prediction stock prices of firms are completely without value.

In general terms the theory of random walk points out key but challenging queries for the market players who has in depth interest comprehending the stock price behavior.

2.3.1 Common Predictive Techniques

Generally, there are numerous techniques that can enable players in the market to predict stock prices behavior in the markets. For the purpose of this research study I will only dwell on the two main common predictive techniques. They include the fundamental analysis (intrinsic value) and the technical analysis (chartist).

The technical analysts are those that study the trend in the past pattern in the stock behavior and believe that that trend will continue in the future. These types of analyst hold the view that the only to make accurate future predictions of stock prices to develop a familiarity with the trend in the past stock prices behavior so you will be able to discover situations capable of reoccurring. These groups of analyst tend to use their past knowledge of the series of past stock behavior to make predictions of what future stock behavior in the market. There is always some degree of doubt about their predictions but most experts have found them to suspicious. These types of analyst are rare in the stock market.

The fundamental analyses (intrinsic value) are those that hold the view that at any point in time the stock price is dependent on the stock earning potential. This is also dependent on factors like the economy, outlook of the stock market and management quality.

The random walk theory presents an imperative drawback for both the technical analysis and the fundamental analysis. When it comes to the technical analysis the drawback is quite clear. it implies that when the model of random walk theory is a valid description of what happens with the work of the technical analysis then their work that's not have any value at the stock market. But the only avenue for the technical analyst to proves his position to determine stock prices than to make chance predictions of stock prices.

The other challenge that confronts the fundamental analysis in terms of the random walk process is that it evolves over the time. The fundamental analysis holds true when the stock market is efficient and says that the stock prices in the market at any point in time represents a real intrinsic value.

2.4: EMPIRICAL LITERATURES

2.4.1: Market Anomalies in Stock Exchanges

There are several easy accessible statistics which seems to make abnormal predictions on stock returns. These outcomes are hard to reconcile with the efficient market hypothesis, hence referred to as market anomalies.

Most market experts and researchers have adopted these anomalies in the market and exploited on them to beat the market. Among the market anomalies are the market size effect, stock price returns ratio prediction, the January effect, the momentum effect, the holiday effect, the seasonal effect, the calendar anomalies and weather.

Usually aggregate stocks with low price earnings ratio often performs better than aggregate securities of high price earnings ratio. Usually some experts and researchers make hypothesis, based on the capital asset pricing model which compares risk and return, and this happens because securities that have increased risk is associated with low price earnings ratio stocks. Other researchers like Basu (1977) disclosed that firms with large portfolios have greater returns than firms with fewer portfolios at the Ghana Stock exchange. This presupposes that these outcomes are interpreted to mean that stocks with returns are not usually adjusted for the prevailing risk in the market. When two companies are considered to produce the same returns the stock with the high risk will be sold at a lesser price and hence produce lesser stock price earnings ratio. Due to the degree of risk the lesser stock price earning securities also comes with higher return

hence unless the capital asset pricing model betas adjust for the risk price, earnings ratio will be used as an accurate description of risk. The level of the risk determines the degree of the returns that will be associated with stock and what is considered the benchmark of the market.

When the relationship that exist between the firm's equity and the stock price returns is negative then it is called the size effect. In the United States, Banz (1981) is recognized to be the first to pen down an anomaly. He discovered that most returns were produced by large firm's portfolio. The correlation coefficient on the market size provides enough explanation power than the correlation coefficient on the capital asset pricing model to describe the returns to be earned on stocks. Most stock markets around the world have been using the size effect factor for most samples. An investor can measure the size of a firm with small cost and accrue excess gains by simply adopting a rule of investing in low cap securities. Usually market players expect low effort to produce low returns.

When announcement is made on earning it can have impact on the stock prices of firms. Most often when announcement is made stock prices of firms soars up, usually when firms expect negative information they decline on the information before its announcement. Investors future earnings are based on experts reports. The fundamental principle underpinning the EMH implies that latest information must be reflected into the stock price determination. If all latest information are released into the public domain and provides returns surprise, the security price should soar up to accommodate that as soon as possible. A very confusing disorder in the stock market is the slow response of stock prices to firms earning announcement (Ball and Brown, 1968).

Researchers like Foster (1984) outlined in their research study that if a security has an earnings surprise, the more the impact is felt on the stock prices of the firms, when the

securities has a positive earnings surprise it causes a rise in the stock prices for a period not more than two months after its announcement. But when the securities have a negative earnings surprise it causes a decline in the stock price within first several days of its announcement, but this tells us that the changes in the stock prices are not quickly reflected in the stock prices determination as the efficient market hypothesis would indicate.

Rozeff (1976) says that the January effect refers to the way for stock prices returns are in most times high in January than any of the other months. Firms with small size stock usually have strong January effect. (Kiem, 1983), and can also be seen in large cap firms. Some researchers sought to establish if there was turn of the month and January effects on stock prices at the Ghana Stock Exchange using GSE daily closing prices. They found that it did not suffice. Keim (2000) and Reinganum (1983) discovered that the small firm effect occur virtually in the month of January.

According to Amihud and Mendelson (1989) small firms stocks show an increased high risk of adjusted returns in that these firms are not much analyzed and their stock are not liquid. The impact of how liquid the stock is explained partially.

2.5: PREDICTABILITY OF STOCK RETURNS

Recent research studies have proved beyond reasonable doubt that the movement in the stock price can be predicted during short windows. The research study goes on to say that the movements in stock price returns can be determined with above average level of accuracy for any security for up to time limit of sixty seconds leaves the bid and ask spread confines. Where the window to predict the degree of accuracy has closed.

Many renowned researchers have question the notion held by people that the movement in the stock price cannot be predicted. Other researchers have also held to the proposition that stock price cannot be predicted so long as information on financial statements can move stock prices, the belief stands, nothing inherent in a stock price trend line can be used to make projections of where the price goes next.

They go on to say that stock prices can be predicted and immediately the stock price leaves the bid and asks spread it portrays a trend. That there is predictability and that once price escapes the confines of bid-ask spread its shows a trend.

An investigation of this nature seeks to investigate the movement in stock price of one stock called the S&P 500 exchange traded stock. The stock makes the assumption that all 500 S&P stock is a true reflection of the overall stocks in the U.S market. It's considered as the majorly traded securities on the U.S.market, during the study period it was discovered that nearly 90,000 transactions is recorded a day, hence proving the authenticity of the date used for the research.

Their earlier research study analysis discovered that stock prices cannot be predicted within the bid- and ask spread meaning that it is the period in between the stock price that buyers are willing and able to pay for a stock (the bid) and the stock price sellers are willing to sell it for (the ask) as the stock market endeavors to determines the asset value. The major issue arising from their research study is what becomes the outcome once market players does the setting of the assets value and the stock price leaves the spread, immediately the price leaves, the research study tracks the security price at 1,2,3,5,10 and 20 seconds, and 1,5,and 30 minutes.

They say that the sequence in the stock price movement is only determined by earlier traded stock prices. Their assumption is fundamentally based on the fact that since a

financial report which drives stock prices cannot be incorporated into the determination of stock in a short period.

Anyone who is able to accurately predict successfully the future stock price will be able to accrue much return. Investors have the believe that the trend in the stock price movement are guided by the theory of random walk .This clearly indicates that the stock prices of firms cannot be predicted. But others strongly disagree with this assertion, but goes on to say that there are myriad of methodological and technological techniques which aid them to have a clue of information that is possible to drop into the market. Largely it is the belief behind the market efficiency that will help predictors to predict the future changes in the stock prices relying solely on a given set of information. An intriguing scenario of market efficiency is that when the efficiency of the market is slow, there is a high movement of stock price movement. (Mubarak and keasey, 2000).

Fama (1965) carried out a study on the behavior of stock market prices. He computed serial correlation coefficient and carried out run test in daily price changes of 30 stocks that comprised the Dow Jones industrial average index. He found that the serial correlation coefficient for successive price change were extremely close to zero; the average for absolute coefficient was 0.026.He also found that the number of actual runs of successive price changes was not significantly different from the expected number of runs. He concluded that daily stock price changes were independent from previous stock price changes.

Kendall (1964) explored stock prices of the U.K to be short period dependence. His research study adopted eighteen industries data. He could not identify share price trends with data for the eighteen industries for the period of the research study. There was

neither significant correlation between one periods price changes and the previous price change, nor between earlier periods.

Roberts (1959) provided evidence of random walk on Dow Jones industrial average. He argued that security price changes fully reflect the available information set which include all public information, and that implied that no individual stock price be separately distinguish from a series of successive random numbers.

Dickson and Muragu (1994) examined the informational efficiency and the theory of random walk process on the Ghana stock exchange using the run test and serial correlation. The first created a database of the stock prices on weekly basis for a period spanning from January 1980 to December 1989 and selected the most actively firms that had the highest transactions recorded for the period under study to be the most traded firm. Using the weekly data, he computed serial correlation coefficient for the individual stocks of the thirty firms for lags of 1 to 30 weeks. The outcome from each serial correlation coefficient proved that the correlation coefficient of many of the selected firms were not statistically different from zero at 5% level of significance. This outcome implied a robust for both weekly and monthly returns. The results for the other few firms showed a few significant correlations in small in absolute values with few power of explain the results.

The run test model indicated that the expected number of runs was more than the actual number of runs for the 14 firms; it was only 1 firm that the expected number of run was less than the actual number of runs. The expected number of run was equal to the actual number of runs in 2 companies. The researcher went on to conclude that with adequate and accurate measure over the data and the use of large number of data observations the

random walk model can be a good description of the trend in price returns in the Ghana stock exchange

Osei (1998) tested the independence of successive weekly average price returns of 14 stocks trading at the Ghana stock exchange over the period 1992 to 1998. He examined the serial correlation between an observation and the lagged observations. He found that autocorrelation coefficient was less than 0.5 but greater than -0.5 throughout the period; no significant correlation between one observation and the lagged. They concluded that price returns at the Ghana stock exchange are independent and one cannot predict future prices based on the past price trends

Tweneboah (2010) tested whether GSE indices follows random walk. He assessed variance ratio of GSE all share index and GSE composite index for the period march 2004 to April 2009. He found that GSE share daily and weekly indices were unpredictable but monthly was predictable in some cases.

The Random walk theory has received a lot of criticism by a number of research work that seek to say that the stock price returns cannot be fully explained by simple measures of risk, and other studies that have documented returns predictability across a variety of time horizons. Grossman (1976).

If stock market is perfectly informational efficient, then there is no need to gather information to generate stock price return. In Other words, how the stock market is able to respond to latest information to a larger extent determines how all the market players and the key investors will be able to invest in gathering information and to trade on such information gathered. This will usually lead to stock market equilibrium when market players are able identify an opportunity to earn excess returns from the stock market this

is because the excess returns will be an amount that is used to make good for the cost associated in gathering information in the stock market.

Leroy (1973) and Lucas (1978) argued that the random walk hypothesis is neither a necessary nor sufficient conditions for rationally determined security prices; unforecastable prices need not to imply a well-functioning financial market with rational investors and forecastable prices need not imply the opposite. Various anomalies have been identified relating to calendar periods such as those across weekends and turn of the year. Variable such as markets to book ratio and size have been shown to explain expected return.

Lo and Mackinlay (1988) also investigated how predictable of stock market return for U.S. market using single variance ratio test methodology. They used 1216 transactions from September 6, 1962 to December 26, 1985. The stock price returns on weekly basis were derived from the center for research security price return index (CRSP) table and performed an examination on equal and value weighted CRSP indexes. They were able to discover for the first time an order autocorrelation for weekly holding period returns.

They also discovered that the securities on the stock market had only an average variance ratio where were not more than a unity indicating a negative serial correlation for average securities but statistically insignificant. They went on to prove that the random walk process does not hold true for stock market returns on a weekly basis. For individual securities they argued that returns contained certain firms which make it impossible to identify the presence of predictable component in the stock market movement. They resulted finally that the result did not necessarily, exclusively and wholly imply that information on the stock price movement is not efficient.

Ayentimi (2012) explored the weak form market efficiency on the Ghana Stock Exchange over the period of time spanning from 2007 to 2012 using autocorrelation test

and run test. They used weekly price data (volume weighted) for fourteen stocks that were listed on the GSE over the five years period of the study. He found that majority of the stocks had negative autocorrelation coefficient. Out of the fifteen stocks eleven has first lag serial correlation greater than 0.3. On the run test the actual runs were less than expected in thirteen out of the fourteen stocks. They concluded that there were clear noticeable patterns of share price and thus the theory of the random walk process cannot be an accurate description of the changes in the stock prices at the Ghana Stock exchange.

Osei (2002) also explored the Ghana stock exchange efficiency at the semi strong level in relation to how adjusted stock prices are quickly incorporated on firms' cash dividends announcement over the research period from 1998 to 2002. He used daily data for the stocks that constituted the GSE All share index. The event of his study was cash dividend announcement. The event window was 21 days; the date and positive returns after the announcement date. Cumulative adjusted excess return was significant for 10 days before and after the announcement of cash dividend has an impact on share prices at the GSE, another outcome of their research work was that the stock market inefficiently react to cash dividend announcement in the adjustment of the stock price.

Tei Mensah et al (2002) explored the relationship that exist between the earnings in terms of accounting and stock prices using weekly data 30 publically listed firms at the Ghana stock exchange over the period of time 1997 to 2002. He examined the relationship between percentage changes in price and concurrent percentage change in earnings. He used cross tab to determine if an earlier positive change was followed by an increase in earning. He found that 60.38% of the companies had their share prices moving in the same direction with earning.

Apiah-Kusi & Menyah (2003) argued that when information disclosure is minimal, say at the firm level, investors then make the assumptions for lower price. Firms are therefore driven to disclose information since the news cannot be bad than the market would assume. As a result, prices will be less noisy and therefore more accurate, increasing the trading activities with enhanced ability to transact at current prices.

Market analyst are practically not in support of the theory of efficient market process which contend that past stock price movement cannot be benchmark in determining future stock performances. The chartist analysts also hold to the notion that stock prices slowly incorporate latest information and believe that prudent investors can develop strategies to identify the beginning of a movement to new equilibrium. Hence, they hope to rely on the strategies identified to take advantage of the subsequent adjust in the stock price.

According to Jensen and Bennington (1978), technical analyst is based on three assumptions. The first assumption is that market prices discount all the latest information released into the stock market; this imply implies that all readily and relevant information is incorporated in the determination of the stock price. Hence all latest information is already discounted since it's earlier captured in the stock price. This presupposes that all readily latest information that is released into the stock market will instantly be factored in the pricing of stocks and then after, such information will not be of any use again.

The second assumption says the stock prices in the market thread along a path which continues over a period of time; this means that after a sequence has been identified, then the possibility of future stock prices to thread along that direction as a trend. The stock prices at the market prices react gradually, over a long period to latest information, the incorporation of the latest information is so gradual and slow that investors should not be

much interested in the information itself and should be interested in the direction through which the stock prices trending since the direction of stock price movement usually continues for a longer period of time.

A third assumption is that past stock prices trend usually repeats itself; this means that the extent of how past stock prices is repeated is as a result of the market psychology. In other words investors in the market consistently and persistently react to the stimuli in the market over a period of time. In a market increasingly driven by market psychology, fundamentals take a back seat to technical analysis as a reliable approach in predicting where the market will go next.

According to Jansen et al (2006) the technical analysis is criticized for its much academic theories, especially EMH but does not recognize how the stock market works; this is so because investors track the trend in the stock price movement to make future expectation. Usually stock prices in the future can be highly affected by investors' expectation; it can therefore be deduced that stock prices in the future are influenced by past movement of stock prices.

Fundamental analysts hold the view that by using publicly available information, it is possible to determine the real intrinsic value of a security. To forecast future security prices, fundamental analysts combine economic, industry, and company analysis to derive a stock's current fair value and forecast future value. If fair value is not equal to the current stock price, fundamental analysts believe that the stock is either over or under valued and the market price will ultimately gravitate towards fair value and as a consequence they change their portfolio position. Fundamentalists neither heed the advice of the random walkers nor believe that markets are efficient. But believe that prices do not accurately reflect all available information and seek out perceived price discrepancies to exploit.

Fundamental analyst uses the firms dividends prospects, expectation of interest rates in the future and security prices to calculate the current discounted value of all cash flows a security holder earns from each unit of security Reilly and Brown (2000). Only those analyst who can discover more better estimates of firms or firms that are managed badly but as bad as the firm's stock price returns will be able to accrue. The insider dealers believe that they can hedge on price sensitive information which is not in the public domain for companies issuing securities to increase expected gains.

Follower of efficient market hypothesis however disagrees on the fundamental and technical analyst notion of stock price determination; EMH claims largely no individual market player can practically outperform the stock market in the long run that is produce returns that outperforms the market through either technical analysis or fundamental analysis. Fama (1976). The reason underpinning this notion is that all latest information is incorporated into the stock prices efficiently on an ongoing process hence any chance to gain abnormal returns , based strategies designed by the technical analysis and the fundamental analysis could be almost instantly be washed away by the stock markets. This therefore make it not possible beat the stock market over a long period of time.

2.5.1 Predictability of Stock Prices at the Ghana Stock Exchange

According to pesaran (2003) factors that enables market players to be able predict the stock price changes in macroeconomics variables includes; price earnings ratio, exchange rate, interest rates changes, movement in inflation rate, dividend yield,, output growth , term premium. Efforts to develop models that could be used to predict share price at the GSE have produced varying and sometimes conflicting findings.

The relationship between stock return for companies listed at GSE and some selected market and industrial variables using arbitrage pricing model. A regression analysis

conducted on security monthly returns and economic indicators on 30 companies trading at the GSE over the period 1996 to 2003. The results suggested that the macroeconomic variables gave an explanatory power on the variability and volatility on the securities at the GSE the research went on to say that the addition of the macroeconomic variables highly improved the explanatory power of a sampled expected returns.

Frimpong (2008) conducted a study to discover how reliable the dividends discount model on valuation on common stock at the GSE. He studied 18 companies trading only on ordinary share over the period 2000 to 2004. He compared predicted share prices with the actual prices. Using t-test he tested for significance in the price difference. He found that only 3 companies showed differences that were significant. He concluded that dividend discount model was not a reliable in the valuation of stock at the GSE.

A similar study was done on 13 companies listed at the GSE over the period 1999 to 2003 by Osei (2009). He aimed at determining predictive ability of the dividend valuation model on ordinary share prices. The model postulated by William (1938) and Gordon (1962) was found not to be a good predictor of the stock prices at GSE. The model could only predict 54% of the ordinary share prices for companies listed at the GSE. He used the box jacking model, time series analysis and the ARIMA model and found that all did not qualified to be good predictor of the share price.

Ntim et al (2007) studied the extent to which P/E ratio and price to book value ratio in the GSE can predict share price returns. He used daily prices for companies that traded continuously over the period 1998 to 2007. P/E ratio and price to book for the firms were computed for the period 1998 to 2002 for testing their predictive ability in the subsequent years 2003 to 2007. He formed two portfolios; one for those firm with high valuation multiple and the other for those firms with low valuation multiple ratio. Two sample paired t-test were used to test if indeed significant difference between the

averages returns for the two portfolios. He found that the portfolios for the firms with low P/E ratio and P/B ratio. He further used coefficient of variation (CV) to measure performance. He found that portfolio firms with low P/E ratio had lowest CV followed by portfolio for firms with low P/B ratio. Worst performance was for portfolio for firms with high P/E and P/B .He concluded that those valuation multiples can be used to measure or predict stock returns.

Ayentimi et al (2012) studied the companies constituting the GSE share index for three years from 1999 to 2002 to determine the profitability of filter rule test in the GSE .Using the filter rule developed by Fama and Blue (1996) They found that the filter rule exist in GSE and with a filter of between 4.3% and 4.9% investors can profit in the market. The filter rule trading strategies attempts to make returns from the stock price return and states that market players usually purchase securities when the price of securities soars up by a given margin above its price and sell when it falls by a particular margin below its past high price.

Frimpong (2008) had performed a similar research work and found that with proper control random walks holds for GSE.

2.5.2 Summary

Much of the studies on EMH and RWH have been carried out in the developed markets and there is consensus among researchers that these markets are efficient and security price returns follow random walk. On the other hand not much is documented and the consensus was reach to break down when the research study is explored in emerging market in general and the GSE in particular where some studies suggest that stock price returns are predictable, others give a contrary suggestion that the returns on security

prices cannot be predicted and hence such a process follows the theory of the random walk process. Numerous research studies that were recorded the past disorders in the security market which oppose the efficient market hypothesis and random walk process. Since the disorder in the stock market is accepted by all, the most difficult scenario is how market players can use the strategies developed to earn excess returns. The fact that there exists a trend in the stock price movement does not mean that such a trend will continue in the future. In addition transaction cost and tax may prevent outperformance in future.

Many of previous studies conducted their analysis based on traditional methods which includes auto correlation and variance ratio test which is considered the most reliable method. The key challenge associated with this model indicates that the return on the stock price shows a line and normal distribution. They used indexes, weekly or monthly observations may give an untrue outcome to the extent of the stock price variability and volatility especially in highly volatile stock market. All the reviews on the literature says that all the evidences are not so clear to support for the theory of the random walk hypothesis at GSE empirical studies have resulted to mixed and conflicting findings.

Frimpong, (2008) says that for the Ghana stock exchange to continue to be the major place to acquire capital for economic development.it is targeting how to reform its development to be able to serve its primary purpose.

The Ghana Stock Exchange is made up major segments making up the economy. They include sectors like manufacturing, banking, and oil.

The governing Body of the Ghana Stock exchange is made up of appointees from the licensed Dealing Members, the listed firms, the Banks, the Insurance firms, the Money

Market players and the general public at large. The Ghana stock exchange is managed on a day by day basis by well versed team of management.

For all the years the exchange has been in actual operation it has significantly made huge impact towards the total enhancement of the of the capital market, which has resulted in the total and significant overhauling of the capital market and financial market as a whole.

2.6 INEFFICIENCY OF AFRICA STOCK MARKET RETURNS

Although most of the results that are in favor of the proposition under this research study, but others makes the stock market in Africa in General practically difficult to make future predictions of stock prices and its accompanying returns thereof to be explicitly say that the theory of the random walk process is sufficient for the market players. Particularly in the contest of Ghana stock market and Africa stock market at large .The correlation test ignore the possibility of trading rules (Alexander, 1961, 1964). This simply means that are no clear cut link that exist between the stocks magnitude of the correlation coefficient and expected returns of a laid down strategy. Thus mere linear relationships underlying serial correlations coefficient not difficult in identifying the trend in the stock price movement that most chartist usually discovers in the stock prices. Also, thin trading can impact on the validity and interpretation on the serial correlation tests. To be able to accurately test for market efficiency therefore, these issues have to be accounted for.

Studies in some part of the world's stock market holds that if indeed the stock prices of firms listed on their various market takes into account all readily information within the public domain and expects stock prices to reflect same then the stock price will be accommodate instantly all latest information on stocks leaving all earlier information on

stock. If this notion for the market efficiency is accurate then the semi strong form of efficient market hypothesis abrogates the analysis of the fundamentalist. In addition, there have been an increasing number of studies into a firm's reaction to specific economic and company variables and public information events such as dividends announcements, stock splits and analyst recommendations.

Studies that rely on event methodology analyze the adjustment in the market so as to give latest information. Given that these are direct tests of market efficiency; they are joint hypothesis problems and hence establish efficiency without making preference to an asset pricing model.

Many experts have delved into how to provide a clear front for measuring and comprehending how efficient and effective the stock market of Africa. Among all the three levels of market efficiency it is only the weak form that is not been extensively examined in that there is no adequate data to do so. Generally the stock market in Africa is more inefficient.

Jefferis and Okeahalam (1999) investigated the South African stock market to assess how efficient the stock market is using the unit root statistical techniques. Their research study discovered that they found that the South African stock markets are efficient under the period of their research but the only criticism with their research study was that the statistical model used was not powerful to make deductions and inferences on the efficiency of the market.

Researchers like Jefferis and Okeahalam explored thoroughly the semi-strong form of market efficiency of the stock market in Nigeria, Zimbabwe and Botswana. Their research focused on how the information announcement was incorporated into the determination of the single stock firms and how these stock price information is reflected

into the stock's prices. They discovered that the Nigerian stock markets to a larger extent semi-strong but Botswana, Zimbabwe are not.

Other researchers like Magnusson and Wydick (2002) performed an auto-correlation test to find out how stocks behave in eighth African stock markets. Utilize a partial autocorrelation test to they discovered that with the exception of Zimbabwe Ghana all the other countries exhibited a weak form market efficient characteristics.

Simons and Laryea (2004) investigated four different stocks from four different countries for the period spanning from 1990 to 2003. Using parametric test and non-parametric test. They discovered that with the exception of South Africa, the stock market for others (Ghana, Egypt, Mauritius) were described as stock markets that are weak efficient.

Jefferis and Smith (2005) examined the serial-dependence in daily stock indices of four countries (Ghana, Mauritius, Egypt) for the periods spanning from 1990 to 2001. They also discovered that their obtained results did not give enough grounds in support of the weak form of stock market excluding their South Africa.

Eight African stock market have reported by Ntim et al (2012) to be inefficient. This stock market belongs to these countries; Ghana, Nigeria, Egypt, Kenya, Mauritius, Morocco, Botswana and Zimbabwe. This are so clear when a robust test is implemented.

Just recently, Mckerrow (2013) investigated the stock market efficiency of another five stock markets in Africa. These countries are Namibia, Ghana, Botswana, Cote d'Ivoire, Mauritius. The outcome of the research study rejected totally that random walk hypothesis does not exist in the stock market of countries like Mauritius, Botswana and Ghana. But the stock markets of countries like Namibia and Cote d'Ivoire did not reject

the random walk hypothesis. These result indicate clearly that the research were straightforward and cannot be relied on in challenging markets been tested for efficiency.

2.7 LESSONS DERIVED FROM MARKET EFFICIENCY

When stock prices are automatically adjusted to take into account all available latest information to show the stocks true intrinsic value, then stock market is said to be efficient. it is therefore imperative worth noting that the more efficient the stock is, the less the opportunity for investors to make speculative returns. The Ghana stock market and other African countries seeks to provide certain lessons which includes the following:

- ***The stock market has no memory:*** the weak form indicates that the trend in the past price movement contains no information about future adjustments. This means that past price history does not matter.
- ***The market prices must be trusted:*** in an efficient market you can trust prices because all available information is incorporated in the securities value.
- ***There are no financial illusions:*** In an efficient market, there is no need for creative accounting and you cannot deceive the market.
- ***Investors are not married to one firm.*** They will jump in as soon as there is opportunity.

CHAPTER THREE

RESEARCH METHOD

3.0: INTRODUCTION

The research methodology presents the methods followed to answer the hypothesis. This chapter is made of the description of the research design used, followed by the presentation of the population of the study. The next section explains the study sample and how it was arrived at. This section further outlines the procedure used in collecting data and finally the methods used to analyze the data.

3.1: RESEARCH DESIGN

Research strategy simply refers to the method of addressing the research hypothesis. The design of the research, however, mainly focuses on the structure of the research. This research is classified more as quantitative research. The rationale underlying the choosing of quantitative research over qualitative research is mainly due to the nature of the research topic as well as how it will be effective and address the research hypothesis.

This is purely an empirical study seeking to test whether or not successive daily prices changes of stocks trading at the GSE are genuinely independent and hence produce a random walk sequence. The design was adopted as it allows collecting of large amount of data from the target population. This design is useful in studying the randomness of stock price returns to test whether they portray random walk behaviour. The data is mainly made up of past stock prices for companies whose shares formed the GSE all-share index over the period July 2012 to June 2015. Serial correlation test and run test were used to analyze the data to test for independence of successive price series.

3.2 POPULATION

The population of the study comprises all thirty seven listed the companies quoted at the Ghana Stock Exchange.

3.3: SAMPLE

The sample is made up of 14 companies that continuously constituted the GSE All share index and traded for a period under the term of the research study. In arriving at the sample fourteen companies that are making up the GSE All share index were selected and any company that did not constitute the GSE All share index at any time over the study period was not selected.

3.4: DATA SOURCES

This study makes use of daily stock price and returns of the GSE All share Index obtained from Morgan Stanley Capital International (MSCI). This research Study made use of daily stock returns since it gives representation of the stock price.

3.5: DATA COLLECTION

Research study in the securities market depends largely on past quantitative data. It consists of daily stock prices for companies that constituted the GSE All share index over the period July 2012 and June 2015. The share price are the daily stock price of each equity in all the days that the stock market traded. Information from GSE services historical database is a reliable source of data for shares price trading at GSE .The research study was undertaken for the purpose of availability of data from July 2012 through to June 2015 with the exception of public holidays not traded.

3.6: DATA ANALYSIS

There has been some controversy in the literature as to what is the underlying probability distribution of price changes. The most popular view is that it is a lognormal. This view is based on the observation that prices are bound from below but unbound from above. In this view it would be necessary to study logarithm of price changes and parametric test used since population is assumed to be normally distributed. To stand aside from the controversy one would use non parametric tests. However non parametric test tend to be less efficient than parametric tests. Serial correlation test model and the run test model were used to test the share price. Data processing was done using statistical package for social science (SPSS) and Microsoft excel.

3.6.1: Serial Correlation Test

This is a statistical technique that shows the extent of similarity between a given series of time and a lag version of itself over successive interval of time. If there exist a random walk process in the stock market the auto correlation value should approach zero for the time lag separation. If there exist a non-random walk process at least one auto correlation value will be significantly be non-zero.

First: *compute the natural logarithm returns difference* (u_{mt})

$$U_{mt} = P_{mt} - P_{mt-k}$$

Where:

U_{mt} = daily stock market returns for the single stocks for the time k

P_t = daily stock price at time k

P_{k-1} = daily stock price at time k-1

The above formulae estimates the gains in the market from the daily stock prices with no adjustment on right issue, cash bonus and dividend payout. Fama and French (1993) indicate vividly that a stock price remains the same after their inclusion or not.

Second: *compute the auto correlation coefficient*

The serial correlation coefficients are estimated for individual stock over 5 lags as follows

$$Y_{mt} = \frac{\text{COV}(U_{mt}, U_{mt-k})}{\text{VAR}(u_{mt})}$$

Where Y_{mt} is the auto correlation coefficient of security m at lag k ; $k=1, 2 \dots 5$

The statistic is used to test for the presence of both positive and negative correlation in the natural logarithm returns residual

Third: *Testing the hypothesis*

H_0 : $Y_{mt}=0$, the correlation coefficient of successive price returns on the GSE at lag k is zero.

H_1 : $Y_{mt} < > 0$, the correlation coefficient of successive price returns on the GSE at lag k is not zero.

According to Chatfield(2004) when the stock market is random for its time series and there exist large sample size so that its lag serial correlation coefficient is approximately rationally distributed .it has a mean value of zero and variance $1/N$. The critical level of confidence for the serial correlation for 95% significance ($\alpha=0.05$) is $Y_{0.95} = \pm 2/Z^2$

Where N is the sample size

Region of acceptance and rejection of the null hypothesis		
$Y_{jk} < -Y_{0.95}$	$-Y_{0.95} < Y_{JK} < +Y_{0.95}$	$Y_{jk} > Y_{0.95}$
Reject H0: Negative autocorrelation	Accept H0 No autocorrelation	Reject H0 Positive autocorrelation

3.6.2: Run Test

Run test has been defined by various scholars to mean a succession of identical symbols which are either preceded or followed by a different sign or no sign at all. To investigate whether the trend in series of the stock price observed for the stock price returns follows no calculated pattern, the observed runs is used in the analysis.

Step one: *compute the changes in successive stock prices*

Change in price = $P_t - P_{t-1}$

Step two: *determination of runs in the share price*

The series of changes are replaced by series of symbols: a price gain is denoted by a '+', a price drop is denoted by a '-' and '0' shows that return is zero

The total number of runs of the price change will serve as an indicator of degree of randomness of the sample. In a series of security price changes, either very few or very many runs are unlikely if such security price changes are truly random overtime. Clustering of symbol is an indicator of a trend. To test a series of price returns changes for independence, the number of runs in the series is compared to see whether it is statistically different from the number of runs in a purely random series of the same size.

Step three: *compute the test statistic*

Expected total number of runs is given by;

$$Means = \frac{N(N+1) - \sum_{i=1}^3 n_i^2}{N}$$

$$Standard\ deviation = \left[\frac{\sum_{i=1}^3 n_i^2 \left\{ \sum_{i=1}^3 n_i^2 + N(N+1) \right\} - 2N \sum_{i=1}^3 n_i^3 - N^3}{N^2(N-1)} \right]^{\frac{1}{2}}$$

$$Z\text{-score} = \frac{R + 0.5 - M}{\sigma_m}$$

Where

N=Total number of price changes

ni=Number of price changes of each kind (plus, minus, zero)

R=observed number of runs.

σ_m =standard deviation

m=Mean

Hypothesis

H0: The successive price returns of a company's share on the GSE are random

H1: The successive price returns of a company share on the GSE are not random.

STEP FOUR: *compare Z score calculated with the Z tabulated in the table*

The expectation under this test is that the standard Z score obtained fall between the ranges of -1.96 and +1.96. It is when this happens that successive price changes are said to be random.

Region of acceptance and rejection of the null hypothesis		
z-score < -1.96	-1.96 ≤ z-score ≤ +1.96	z-score > +1.96
Reject H0	Accept H0	Reject H0

The run test is a non-parametric test, in which the value is estimated and compared against its sampling distribution under the random walk hypothesis. It has been shown that the distribution of the number of runs converges to a normal distribution asymptotically when properly normalized. The test statistic used is the standardized normal variable $Z(Z \sim N(0,1))$. Positive Z indicates that there are too many runs in the sample, while negative value of Z shows that there are less runs than expected if the changes were random. The imperative advantages of this test are its simplicity and independence of the extreme values in the sample.

3.7: PROFILE OF GHANA STOCK EXCHANGE

3.7.1: Background

The Ghana stock exchange was established in July 1989. Trading did not begin the same time it was established. It began trading on its floor in November, 1990. From that time onwards there has been dramatic improvement in terms of raising long period fund. The investors are also obtaining liquid funds. Funds obtained from the stock exchange are safe source of funds. Since the time the exchange was established. It's a primary source of capital for those that need costless funds. It started business on its floor with only twelve listed firms and bonds of the government. The various securities that are listed on the Ghana Stock Exchange are government bonds, corporate bonds and equities, presently thirty seven firms are listed on the exchange with standard chartered Banks one preferred stock together with two corporate bonds. After the first two years the stock exchange had a cap of 4.2 billion and increased to 47.35 billion by the end of year 2011. The two key indices on the Ghana Stock exchange are the Databank stock index and the Ghana Stock Exchange All share index.

Other indexes in the Ghana Stock Exchange are published SAS index, AS manufacturing index and SAS financial index for the exchange.

Frimpong, (2008) says that for the Ghana stock exchange to continue to be the major place to acquire capital for economic development.it is targeting how to reform its development to be able to serve its primary purpose.

The Ghana Stock Exchange is made up major segments making up the economy. They include sectors like manufacturing, banking, and oil.

The governing Body of the Ghana Stock exchange is made up of appointees from the licensed Dealing Members, the listed firms, the Banks, the Insurance firms, the Money Market players and the general public at large. The Ghana stock exchange is managed on a day by day basis by well versed team of management.

For all the years the exchange has been in actual operation it has significantly made huge impact towards the total enhancement of the of the capital market, which has resulted in the total and significant overhauling of the capital market and financial market as a whole.

CHAPTER FOUR

ANALYSIS AND DISCUSSION FINDINGS

4.0: INTRODUCTION

This chapter outlines the outcome of the research study with particular reference on the objective of the research work. This chapter is organized into segments; 4.1 outlines the introduction of the aggregate statistics of the analysis together with the findings of the work, 4.2 also outlines the general aggregate statistics of the research work, section 4.3 then provides the results of the data analysis and also includes relevant tables that help to explain and understand the analysis of the study.

4.1: AGGREGATE STATISTICS

Using natural logarithm return difference of daily stock prices. To ascertain the values for the statistical test, it was estimated for individual listed companies that continuously traded on the GSE for the period of the study for lags 1 to 5 days. The rationale behind the computation of the serial correlation coefficients are to help in the testing the securities and to find out whether there is factor that helps for independence of future stock price returns at the separate lags, that is from lag 1 to lag 5.

The null hypothesis explains that there is no significant correlation. At 5% level of significance the future stock price returns are not dependent on past stock price returns if the correlation coefficient at all the lags should lie between $+2/N$ and $-2/N$. which N represents the number of return observation

Again run test was conducted on the company's daily stock prices that continually traded on the GSE. The result of the run test were used to find out whether future stock price exhibit the random characteristics.

The null hypothesis explains that there is a randomness in future stock price return of the shares of listed firms. At 5 % level of significance, the test statistic computed (z-score) is not significant if it fall within the critical values of -1.96 and +1.96.

4.2: DATA ANALYSIS, RESULTS AND INTERPRETATION

The results of the data analysis are grouped according to the various models used in presenting the findings of the research work; namely the serial correlation test and the run test.

The findings based on the data accumulated and the interpretations of the findings are discussed below in segments.

4.2.1: Results of the Serial Correlation Test

The summarized results of the model used are presented in tables as appendices. The Table clearly portrays the results of the coefficients of the model at lag 1,2,3,4,5. These values determines the link between the gains on stock prices at given period and stock price returns of its previous periods.

When the model produces a positive coefficient value it suggests the possibility for prices returns rise in one period to have been followed by further rise in the next period.

When the model on the other hand produces a negative coefficient value it suggests the possibility for price returns to fall in one period to have been followed by a further fall in the next period.

At lag 1,8 companies have negative serial correlation and 6 companies also have positive serial correlation.13 out of the 14 companies have absolute serial correlation lying between 0.150 and 0.406,with exception of one company namely CAL Bank. These

companies have statistical values that are significant from zero at 5% level of significance. For the GSE All share index at lag 1 it has a positive serial correlation (0.501) which is significant from zero at 5% level of significance. This implies that at lag 1, we can reject the independence hypothesis for 13 out of 14 companies and again also for the GSE All share index at 5% level of significance at lag 1

At lag 2, 4 companies have negative serial correlation and 10 companies have positive serial correlation. Again only 2 companies out of the 14 (Produce buying company, Benso oil palm plantation) have serial correlation coefficient significant from zero at 5% level of significance. The GSE All share index though has a positive serial correlation (0.001) which is not significant from zero. At lag 2, the results of the data analyzed fails to reject null hypothesis for 12 companies and also fail to reject null hypothesis for the GSE All share index.

At lag 3, 7 companies have positive serial correlation and 7 companies have negative serial companies. Only 1 company's value (Fan Milk Limited) is statistically significant from zero at 5% level of significance. We therefore fail to reject the null hypothesis for 13 companies. The GSE All share index has a negative serial correlation (-0.003) which is not statistically significant from zero and thus we fail to reject the null hypothesis.

At lag 4, the coefficients value is negative for 12 companies and positive for 2 companies. Only 2 company's value is statistically significant from zero and thus we fail to reject the null hypothesis for 12 companies. The value for coefficient for GSE All share index is (-0.004) which is not statistically significant from zero and hence fail to reject the null hypothesis.

At lag 5, 13 companies have positive serial correlation and 1 company has negative serial correlation. Only 3 companies have coefficient values that are significant from zero level

of 5% level of significance and hence we fail to reject the null hypothesis for 11 companies and that of the GSE All share index since its value is also significantly not different from zero.

Generally, based on the data analyzed, we fail to reject the independence hypothesis at lag 2, lag 3 and lag4, lag 5. From the coefficient values it is clear that the majority of the individual values as coefficient are not significant from zero at 5% level of significance. The number of values that significant over the five lags for the listed firm that is presented in the last column of table 4.1. At 5% significance level, CAL Bank has no statistically significant coefficients out of 14 companies at any of the lags. 10 companies have only one significant coefficient. 2 listed firms have two significant serial correlation coefficients value and three listed firms have three significant coefficients.

When the coefficient significant it implies that the dependence of price return series. The results clearly indicate that there can be predictability of share price returns from the immediate previous period information of stock price return which genuinely repudiates the random walk hypothesis assumptions. Following the analysis of the data, future price returns can only be predicted from lag 1 price return values. But from lag 2 to lag 5 cannot used to predict future price returns.

4.2.2: Results of the Run Test

The analyses of the run test model are presented Table 4.2. A positive run indicates an increase in stock price returns. Again, cluster of positive stock price returns or other words long positive runs shows an upward trend. 12 out of the 14 companies have positive runs of average length of 3 positive signs and 2 companies have positive runs of an average length of 1 positive sign.

GSE All share index has an average length of at least 3 positive signs for each positive run. This shows that the upward trend in the stock price was only short term. 11 companies have runs of zero's of average length of 3 and 3 companies have runs of zero's of average length of 1. The GSE All share index has run of zero of average length of 2. The sequence of the stock price movement were going up and down along the zero return line in a not random fashion. Most often the sequence would move several points up or several points down

A negative run on the other hand also indicates a decrease in stock price returns. Cluster of negative stock price returns or long negative runs shows a down ward trend. 11 out of the 14 companies have runs with an average length of 2 minus signs. 3 companies on the other hand also have runs with an average length of 1 negative sign. All share indexes have an average length of two negative signs for negative number of runs. This indicates that there were short terms downward trends in the stock prices return at the GSE.

This research work explains the total number of run to be expected as the number of runs that is generated in the series of random of the same size as the research series of stock price. The number of runs observed serves as a guideline to discover how the sample size exhibits randomness characteristics. Either too few runs, too many runs or a run of too much length shows dependence between observed cases, and which is not likely in a truly random sequence. A much lower actual number of runs than the number of runs expected shows that the stock market is overreacting to the market information, whiles, and a much higher actual number of runs than expected number of runs indicate sluggish response to the market information. Any of the situations discussed above suggest an opportunity or a leeway to make abnormal returns from the market.

To actually test for the bout of trend in the movement of stock price returns for non-dependence, the observed number of runs in the sequence is compared with the total number of runs to be expected. This helps to know if it is practically and significant following the random walk process in using the same sample size. The tests refuse to accept the null hypothesis in that the number of runs expected is practical significant from the actual observed number of runs. This presupposes that the sequence of the daily stock prices returns exhibit the characteristics of randomness.

The run test models changes the total number of runs into a Z statistic. Clearly, with a large sample size, the Z statistics gives a probability of difference between the actual number of runs and the expected number of runs. When the changes in the stock price movement are purely not dependent then the Z-statistic value is also expected to fall between the range of -1.96 and +1.96. In the situation of this caliber we again fail to reject the null hypothesis at 5% significance level. A Z-statistic value lesser then -1.96 or more than +1.96, I fail to accept the null hypothesis at 5% level of significance. When the Z-statistic value is less than -1.96 it means that the number of runs observed is less than the expected, but when the Z-statistic is also greater than +1.96 it means that the observed number of runs is greater than the number of runs to be expected.

Based on the analysis of the data, all the calculated Z-score values are negative. This means that the runs observed fell short of the runs to be expected. The Z-score is less than -1.96 for all the 14 companies. the Z-score value for GSE All share index is also less than -1.96, this presupposes that I fail to accept the randomness hypothesis for all the 14 companies and the GSE All share index at the 5% significance level, only 4 companies have Z statistic value

4.3: SUMMARY OF FINDINGS

The main reason underpinning this research work was to probe into how a price of securities on the Ghana Stock Exchange portrays no trend of stock price movement. Hence no individual can beat the market. The analysis sort to use daily stock price gains from July 2012 to June 2015 have provided the following results. 12 companies with significant serial correlation coefficients at lag 1 also have statistically significant z-score value. Again, 3 companies out the that number also have a z-score value that are not statistically different from zero. It is only 1 company at lag 1 with a correlation coefficient that is not statistically different from zero and also have a z-score value that is significantly different from zero. All the companies at lag 1 have a correlation coefficient and z-score value that are statistically significant at 5% level. The most intriguing is that the correlation coefficient and z-score value for the GSE index are both statistically significant.

Therefore, both the results for set of statistical models used in the analysis both clearly indicate rejection of the null hypothesis. Meaning that the sequence of the gains of stock price exhibited no randomness.

CHAPTER FIVE

SUMMARY, CONCLUSION AND RECOMMENDATION

5.0: INTRODUCTION

The concluding part of this project work brings the study to an end. It contains the findings, from which logical conclusions are drawn and recommendations made to help improve the GSE. We begin by summarizing the key findings of this work, what guided me in this direction and what can be learned from our estimations and findings. We then present the conclusion based on the findings and make final recommendations for investment and policy making.

5.1: SUMMARY OF THE STUDY.

The EMH stipulates that, under conditions of perfectly competitive markets, an informationally efficient financial market should price stocks to be the best possible estimate of their economic value under that condition; the stock prices take into account all latest information so that any adjustments in the stock prices come as a result of events and news not planned.

The singular rationale behind this research attempted to answer the research hypothesis; do future stock price returns on the Ghana Stock Exchange happen in a random fashion and not dependent on any variable for its determination. The test models used in the analysis were adopted to test for the independence of the succession in the stock price sequence. Historical price series for 14 companies, whose shares continually constituted the GSE All share index over the period July 2012 to June 2015, was used.

The research provided answers to the hypothesis by analyzing the null hypothesis: $H_0: Y_{mt}=0$, the value of future stock price returns on the GSE at lag k is zero. The hypothesis

was examined with serial correlation coefficient. The result of this research study showed that during the period July 2012 to June 2015, there were significant correlations between stock prices and their lag 1 observations, the average serial correlation coefficients of the companies for all 5 lags were significantly little in magnitude. The result indicate explicitly that majority of the correlation coefficient at lag 1 were significant from zero at 5% significance level. This indicates that for the other lags other than lag 1 majority of the coefficients are not significantly from zero and only a portion of the significant coefficients are small in magnitude. Based on the serial correlation coefficient at lag 1, it clearly posits that they were inconsistent with the independent hypothesis.

The other null hypothesis tested answers the question: H_0 : The successive price returns of a company's shares on the GSE are random. The hypothesis was tested using run test. The results of the run test indicate that the prices series of majority of the companies were non random. Considerable numbers of runs observed were fewer as compared to the expected. All Z- scores figures were negative and significant for 14 out of 14 companies. The computed Z-score values were also less than -1.96 for 14 companies.

5.2: CONCLUSIONS

The results of the study indicates clearly that stock prices were not fluctuating randomly during the study period from July 2012 to June 2015. The significant correlation coefficients between stock price series and their first lag version indicated that stock prices could be predicted from previous days prices due to the high inefficiencies in the market. The results for both correlation coefficient and run tests were not consistent with random walk and thus the two null hypothesis; the correlation coefficient of successive

price returns on the GSE at lag k is zero and the successive price returns of a company share on the GSE are random were rejected.

The conclusion made from the study points to the fact that experts in the stock market are able to beat the stock market when an individual makes full utilization of the information inherent the past stock trend. Again, when it comes to determining stock prices the market cannot be relied on. The bout of sequence of proof provided here to back the assertions held by the stock market administrators and regulators that the market is not reliable price setter and that it is easy to manipulate the market unless strong and stringent controls are put in place and strictly monitored.

5.3: RECOMMENDATIONS

Generally, what will be the acceptable and most appropriate investment strategy for all the players in the Ghana stock Exchange, and how this appropriate strategy determines the extent they invest are explicit phenomena that needs to be researched, this research work appears to portray that the Ghana Stock Exchange is inefficient, suggesting an opportunity to make speculative gains to exist, which all investors, other players and markets analyst can exploit.

Rejecting the random walk hypothesis simply implies that investors cannot adopt what is predominantly referred to as 'adequate returns to compensate for moderate risk taking' by not putting all your eggs in one basket to avoid total loss in times of great difficulties at the Ghana stock exchange.

Policy makers need to have a critical look at the pricing mechanisms of the stocks at the exchange since it may be unreliable as a determining factor of stock prices using historical data on securities hence the need in making necessary and massive structural

reviews geared towards achieving fair value pricing securities in the exchange. There is the need to establish sufficient prudential policy measures, supervision and regulatory framework for the activities of the exchange and listed companies.

Table 4.1: Serial Correlation

	lag1	lag2	lag3	lag4	lag5	Average	Number of
						correlation coefficient	significant cc
GCB	-0.336	0.052	0.011	-0.01	0.001	-0.2828	1
SCB	-0.23	0.012	-0.014	-0.013	0.006	-0.2438	1
SIC	0.336	0.032	0.004	-0.011	-0.061	0.3488	1
UTB	0.0407	-0.016	0.099	0.11	0.021	0.2379	0
EBG	-0.006	0.301	0.016	0.015	0.007	0.3274	1
EGL	0.309	0.02	0.013	0.018	0.007	0.3614	1
ETI	0.922	0.016	-0.012	-0.01	0.005	0.9169	1
HFC	-0.111	0.04	-0.005	-0.003	-0.099	-0.0988	1
SG-SSB	-0.11	0.006	-0.001	-0.01	-0.088	-0.1326	1
TBL	-0.191	-0.011	-0.006	0.0525	0.109	-0.1337	3
CAL	0.001	0.033	0.03	-0.022	0.002	0.0424	0
FML	0.211	0.005	-0.408	-0.012	0.002	-0.2036	2
PBC	-0.15	-0.367	0.051	-0.007	0.003	-0.4724	2
BOPP	-0.273	-0.097	-0.002	-0.016	0.021	-0.3838	2
GSE INDEX	0.029	0.002	-0.016	0.006	-0.005	0.02	1

Table 4.2: Run Test

	TOTAL CASES	POSITIVE		NEGATIVE		ZERO		EXPECTED	ACTUAL	Z-SCORE
	OBSERVED	NUMBER of RUNS	NUMBER of RUN	NUMBER of RUN	NUMBER of RUN	NUMBER of RUN	NUMBER of RUN	NO: OF RUNS	NO: OF RUNS	VALUE
GCB	924	416	333	436	346	408	312	672	655	-4.77
SCB	924	474	338	478	336	308	274	648	612	-3.07
SIC	924	460	343	473	341	327	289	655	637	-5.41
UTB	924	386	304	474	324	358	300	663	592	-6.01
EBG	924	365	331	421	333	449	284	672	614	-7.81
EGL	924	366	313	425	319	396	322	670	614	-1.99
ETI	924	408	329	437	313	326	316	671	602	-4.79
HFC	924	440	308	456	306	393	322	673	562	-4.10
SG-SSB	924	404	311	424	316	351	318	673	611	-2.20
TBL	924	405	335	356	336	480	336	672	657	-3.77
CAL	924	428	321	455	329	418	322	644	628	-4.99
FML	924	445	315	402	313	401	297	654	635	-5.07
PBC	924	452	343	482	392	492	288	676	653	-1.98
BOPP	924	430	338	489	399	336	325	661	611	-5.11
GSE INDEX	924	503	303	565	236	192	191	567	472	-4.36

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