UNIVERSITY OF CAPE COAST

HOW VOLATILE IS THE STOCK EXCHANGE? A LOOK AT THE GHANA STOCK EXCHANGE

BY

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DECLARATION

Candidate's Declaration

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

Candidate's Signature: ……. Date: ……

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Supervisor's Declaration

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

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

Name: Mr. Carl Korkpoe

ABSTRACT

The purpose of the study was to analyse how volatile the Ghana Stock Exchange is. The objectives and the research questions of the study were executed by employing GARCH model to generate volatility of returns of Ghana Stock Exchange Composite Index (GSE-CI). The study employed explanatory research design. Secondary monthly data from Ghana Stock Exchange was used in the achievement of the research objective. The quantitative approach was employed. Pertaining the specific objective of the study which sought to examine the nature of the evolution of volatility on GSE, the study shows that the return of GSE showed an upward trend starting from 2011 through to 2017. In analysing the effect of the periods of high or low volatility on Ghana Stock Exchange, the study found that high or low volatility could serve as a guide to investors to make informed decisions regarding investment in the Ghana Stock market. Also, the finding of the study established that the period of low or high volatility of stock returns of Ghana Stock Exchange is significant in influencing investors decisions as to whether or not they should put their money in the stock market. The findings of this study have some implications for both policy makers and investors on the Ghana Stock Exchange as volatility of return of a listed firms arise from the fact that returns on stocks may be captured as the true intrinsic value of a firm and thus the investors might develop interest in investing on the Ghana Stock Exchange.

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DEDICATION

To my family

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CHAPTER ONE

INTRODUCTION

In the literature, the nexus between economic growth and financial markets are demonstrated and established in both theoretical and empirical grounds (Beck & Levine, 2004). Financial markets such as capital markets play a very significant role in the building of the financial systems and development of economies. The 2008 global financial crisis which originated in USA and spread globally is a typical example of the impacts of financial markets on the world at large. As a result, financial markets have become one of the key areas of study by researchers and practitioners with focus on both advanced and emerging markets. It is on this tenet that this study seeks to analyse the volatility of Ghana stock exchange market.

Background to the Study

The stock market refers to the series of organized markets and exchanges in which stocks of publicly traded firms are purchased, sold and released. Such financial operations are carried out through formal exchanges or Over-The-Counter (OTC) markets that operate according to a defined set of regulations. "A stock market is an institution that deals in exchange of securities issued by publicly quoted companies and the government" (Kinder, 2010, pg, 45). "The stock market is part of the broader market referred to as financial market" (Samuelson, 2010, pg. 3). The culture of saving is one of the most significant roles the stock market has played in economies across the world. Investors are motivated to save more and spend less due to the fact that they will be compensated. Individual and institutions that have excess funds

available spend less to save more in order to earn some returns on their invested savings.

There can be several stock trading sites in a country or area that allow stock and other types of securities to be transacted. Although both concepts stock markets and stock exchange are used interchangeably, the latter is typically the first's subset. When it is said that one trades at the stock market, it would mean that he or she owns one or more bursaries that are part of the stock market as a whole. He or she buys and sells shares or equities (Ghana Stock Exchange, 2019).

The Efficient Market Hypothesis (EMH) is one of the fundamental building blocks of standard finance for understanding financial market activities. A capital market is efficient if asset prices observed on the market fully reflect all publicly available information. This implies that in an efficient market, information processing is done rationally in such a way that no systematic errors are done and significant information is not discarded. As a result, financial asset prices are claimed to be equal to the intrinsic value of the asset since all available public information are incorporated into the asset price during the price formation.

Therefore, asset prices are said to be "correct". Jensen (1978) argues further that in financial settings where information accessibility comes with a cost, the market is said to be efficient when prices of securities reflect information to the level where the marginal benefits of employing the information is not greater than the marginal cost of obtaining the information.

It is worth stating that the EMH is built on perfect market assumptions which include no transaction costs, information is costless, homogenous expectations of investors and rationality of market participants.

In 1968, there was the need for a stock exchange market in Ghana. As a result, Finance for Growth in the Commonwealth Co. Ltd had been engaged to investigate and report on how to develop a stock market in the region. It proposed that within two years a bourse be founded in Ghana and suggested ways to achieve get it started with. A selected number of persons convened for the accomplishment of this great initiative. The various governments were exploring ways to establish a stock exchange market in the world. In 1971, a small market was developed but it could not survive to see light. It was then incorporated in July 1989 as a private company limited by guarantee under the 1963 Companies Code.

Given the rapid speed of growth and transition in the different capital markets in Africa, it is not surprising that investors, market practitioners, the business community, the press and academic researchers and other stakeholders in Ghana's capital market are currently interested in understanding the volatility of stock market returns and its dynamics and the extent of stock integration. In the latter half of 2004, African economies strengthened driven by buoyant commodity prices and rapid global trade growth. This led share prices to peak growth in gross domestic product (GDP) and rebound long before economies hit their troughs.

As most African capital markets have witnessed a bullish economy, the economy of Ghana and Nigeria were remarkable because, in the final quarter of 2004, the rate of business growth slowed. Maybe the best proof of Africa 's

desire to be a full participant in the evolving global economy's financial system can be seen in the continent-wide surge of stock markets over the past two decades. Africa today boasts around 20 stock exchanges and some of the fastest-growing economies, which ultimately represents rapid gains in share prices. Interestingly, the majority of research results, for instance, Magnus et al. (2006) and Osei (1998, 2002), concluded that the business in Africa is highly competitive and not usually successful. The capital market in Ghana and Africa as a whole is able to perform better as compared to other Asia, North America and Western Europe stock markets. On the average African financial markets did better than the Standard and Poor's 500 (African Market, August 2008).

The growing popularity of the worldwide stock market has strengthened the assumption that finance is an important ingredient to growth. Long-term capital's role in a nation's economic growth and development cycle cannot be over emphasised around the world. Financial intermediation through the capital markets has the ability to foster greater productivity and economic development, given a sound legal and regulatory institutional structure is in place. Most economists understand the critical position of a well-organized capital market. Mobilization of domestic as well as foreign wealth.

According to Baskin (1989; pg 12), “the stock price volatility is the rate at which the price of a security moves up and down”. In simple terms, price variation in stocks can be termed volatility. Stock price volatility is calculated by finding the annual standard deviation of the price of stocks on a daily basis. It has been observed that if the prices of stocks change slightly, then the stock less volatile but it prices fluctuate more frequently over a very

short time period, then the stock price is said to be very volatile. To measure the potential risk associated with a particular investment, investors use the level of volatility hence it is always good thing to maintain a minimal volatility in the prices of stocks in order to decrease the risk level associated with that stock.

The Efficient Market Hypothesis explains that past information, and public information plays a role in stock market prices. The volatility of a particular stock is also the uncertainty about the returns provided by that stock, and it is usually unnoticed. As the prices of stocks in the past reflect in the future prices of stocks, then that stock market is said to be volatile. Hence, to be able to infuse the estimates of the real volatility of a financial asset, the study can not only take a look at the return series. Standard deviation or variance in the financial market is often used as a measure of volatility.

According to Fama (1970), for an economy to derive optimal benefit from capital market in the form of capital allocation, the capital market must be efficient. A firm performance is measured by its profitability and to a large extent, its efficiency. The society votes in terms of their purchasing power on the markets for a product to some extent determine the profitability of the firm which also directly affects the performance of the firm. The performance of the firm then influences the price of the firm's security. It is worth indicating that a firm's security price would reflect its present and future performance if the market is efficient. This implies that under efficient market, security prices are formed efficiently. Therefore, investors identifying profitable future performance of the firm would invest in such a firm.

The volatility of stock markets influences investor's decision on whether to invest or not. It is on this tenet that the study seeks to analyse how volatile the Ghana Stock Exchange is.

Statement of the Problem

The Ghana Stock Exchange has performed very well in the past few years after its establishment. Though it is a relatively young business, it performed exceptionally well. For example, according to Birinyi Associates, a US-based research firm by Quaidoo (2011), the GSE was ranked the 6th best performing stock market among all emerging markets in 1994, with the index gaining about 124.3 percent. In 1998 in terms of capital appreciation, the GSE was also voted the best performer among all African stock markets and the third best performer among emerging markets. The GSE was once again declared the best-performing company in the world at the end of 2003, with an annual return of approximately 154.7 percent compared to a return of 30 percent on the Morgan Stanley Capital International Global Index (as cited in Yartey & Adjasi, 2007).

In the first half of 2013, Bloomberg (a respected U.S.-based international organization that tracks and reports on business and financial markets around the world again recognized the sector in sub-Saharan Africa as best performing. The questions to ask are, "what are the implications of these sterling performances of the GSE on the economy of Ghana? Have these performances any significance on economic growth or is the stock market just following the activities of the real sector?"

In every economy, the confidence of stakeholders in the capital markets is a critical driver in business cycles, economic affairs and financial

fluctuations. When the confidence increases, investors want to invest at prevailing prices and consumers want to buy durables at best prices. When the level of confidence decreases, risk-taking as well as spending falls (State Street Corporation, 2008). With stock prices dipping to new levels, investors on the Ghana Stock Exchange are become worried as the stock market remains turbulent. This has become even much more alarming with the current situation or dispensation. How the Corona virus has hit a number of businesses and has affected the stock markets as well.

Purpose of the Study

The main objective of the study is to examine the nature of volatility of the Ghana Stock Exchange is.

Research Objectives

Specifically, the study seeks to;

1. Examine the nature of the evolution of volatility on the Ghana Stock Exchange
2. To establish the significance of the period of low or high volatility

Research Questions

1. What is the nature of the evolution of volatility on the Ghana Stock Exchange?
2. How significant are these periods?

Significance of the Study

This study is expected to build up the knowledge of investors on the Ghana stock exchange by investigating the volatile nature of the Ghana Stock Exchange. Also, this research will provide deeper understanding of the nature and relationship between the stock exchange market and its effects on

investors and other stakeholders. An in-depth study of the relationship between volatile nature of the stock market and investors' confidence is critical to understanding how the market is affecting the country's economic development, thereby providing empirical guidance for policy formulation. Where stock market growth in Ghana can be an engine, policy-makers should concentrate on and channel capital for growth to develop and sustain a competitive market in the country with a view to promoting sound and continuous economic development. The study would thus have some breadth of perspective to direct portfolio managers, policymakers and economic analysts.

Delimitation

The study focused primarily on the volatile nature of the Ghana Stock Exchange together with other characteristics for which it is known. An empirical study in this area is highly required especially in Africa stock markets which are characterized with dense, volatility and less liquidity. Due to the difficulty to get data across all African bourses, this focuses on data from the Ghanaian Stock Exchange. The relationship that exists between investors' confidence and the Ghanaian bourse is also looked at in this study.

Limitation of the Study

The study is limited by availability of data sets to extend the time period of the study. The higher the time series data, the more reliable the results become. However, series of studies considered similar time period in order to analyse the volatility of the stock market.

Organization of the Study

The study is organized into five (5) main chapters. Chapter one is made up of background of the study, problem statement, research objectives and questions, significance of the study and the scope of the study as well as chapter disposition. Chapter two covers the relevant literature review on the study mainly from related journal publications in the area. Chapter three looks at the methodology or framework adopted for the study, providing relevant information on data sources, and how the data was analyzed. The Chapter four of this study presents the results and discussion on the findings of the study. The Chapter five of this study presents the summary, conclusions and recommendations grounded on the empirical evidences obtained in the preceding chapter.

CHAPTER TWO

LITERATURE REVIEW

Introduction

This chapter of the study is dedicated to the review of both empirical and theoretical literature of the volatile nature of stock exchanges, particularly the Ghana Stock Exchange and focus attention on how these affects the confidence level of investors. The chapter starts by reviewing certain relevant widely accepted theories the researcher saw to be germane to this research. The researcher also reviews certain important concepts about the research topic and makes reference to a number of empirical works that have resorted to some of these theories and concepts in order to help both the researcher and other beneficiaries appreciate the research better.

Theoretical Review

The study is anchored on theories including arbitrage pricing theory, capital market theory, efficient market hypothesis and modern portfolio theory.

Efficient Market Hypothesis (EMH)

The efficient market hypothesis explains that it is highly impossible to beat the stock market because the prices of stocks already incorporate and reflect all relevant information (both private and public). This basic concept is very relevant to any investor who wants to invest in the stock market. “An investor with a diversified portfolio of individual securities with comparable risk achieve greater returns to one who rely only on the spread of information about stock prices without technical and fundamental analysis about the information” (Malkiel, 2003 pg. 65). These information gives a more or less

fair idea of the value of the firm and that it is virtually impossible for any single or group of investors to make excess gains with the available information. The efficient market hypotheses have connections with the questions most people ask as to why prices of securities alternates in the market and as to why these changes come about.

Efficient market hypotheses were mentioned for the first time in a paper written by Fama (1965) who posits that under the conditions of an efficient market, the full information needed to take investment decisions would be reflected in the stock prices on the average as a result of competitions in the market. This is as a result of the fact that when relatively new information arrives on the market, that news spread very fast and it them is factored in the pricing of financial securities immediately. As a result, according to the EMH, no single market player has an advantage in forecasting the prices of stocks since nobody has access to private information that is not readily available to the entire market. Some category of investors still believe that they can select stocks that can outperform the overall market through an analysis of financial information such as dividend payout, company earnings, fundamental analysis, technical analysis; using past stock data to predict future prices of stocks using charts, graphs, etc., asset values and so forth.

In the quest to make excess profits and outperform the markets, many investors and financial analysts look for securities whose price they believe are undervalued and that the value may shoot up in the nearest future to invest in. As the hypothesis claims, no investors or group of investors can outperform the market, the profits that these investors make on their investment is not in

excess of their transaction and research costs incurred. The hypotheses suggest that it is very difficult and highly unlikely for an investor to make gains based on the movements of the predicting prices. Arrival of new information is a crucial factor behind the changes in the prices of securities. Thus, a market is considered to be efficient if prices are able to adjust swiftly and with no bias to any new information. In short, an efficient stock market is that kind of market in which the prices of stocks are but just a reflection of the fundamental information about companies.

Brealey and Myers (2011) gave a definition to efficient markets as that market where it is impossible to earn a return higher than the market return. Thus, in general, efficient market is built on two main ideas; 1) in a market which is efficient, prices of securities already incorporate available information; 2). In efficient markets, it is virtually impossible for investors to earn a risk-weighted excess return. Based on the information that are usually made available in the stock markets, the efficiency of the market is mostly grouped into three main levels; weakly efficient stock markets, semi-strong stock markets and very strong stock markets.

Weak Efficient Stock Markets

Under this hypothesis, the price of stock already reflects all past information and thus technical analysis (this involves using charts, tables, regression analysis and time series analysis (example moving average) of historical data to establish past movements or pattern in security prices to predict future prices) does not lead to abnormal returns (Fama, 1970). This form reflects the situation where the changes or movement in the prices of stocks follows what is called a "random walk". Current stock price changes

are independent of the changes in the prices in the past. This simply means that, all the information contained in the past stock prices, trading volume and the rates of return are already reflected in the current prices of stocks. Thus, the data in the market on the past prices on stocks are of no use in making predictions about the future. As such one cannot gain from using information that everybody else in the market is aware of to make substantial gains on mispriced assets. Analyst and Investors cannot use only technical analysis by plotting charts of past prices of stocks and trading volume in order to make predictions about future price changes since it cannot be used to accurately predict and beat the market.

However, fundamental analysis (focuses on the fundamentals of the company by using the earnings and dividend prospects of the firm, expectations of future interest rate and risk evaluation of the firm to determine proper stock prices. Some of the metrics used are Price Earnings ratios, balance sheet health, growth potentials etc.) may be useful because it does not always use historical information. In essence it is impossible for investors to identify securities that are mispriced and thus they cannot outperform the market based on the past information available to them. This information the investors are given are the most public and easy to chance on information available to the investors. This is because this information is already published in previous periods. And hence an investor should not be able to profit from information that is available to everyone. There are a number of empirical works which validates this hypothesis. It is virtually impossible according to empirical works, after transaction cost of analyzing and trading securities are accounted for to make excess gains.

Semi-strong Efficiency Hypothesis

Fama (1970) under this hypothesis the price of stocks reflects both historical and public available information and this does not lead to abnormal return. Some examples of public information are data reported in a company's financial statements, earnings and dividend announcements, the financial situation of company's competitors, announced merger plans and expectations regarding macroeconomic factors. This information will then be available at random intervals, and are quickly absorbed by the market. Hence, those investors who use fundamental analysis by studying annual reports and company press announcements with the attempt to make above-average returns on a consistent basis would be very much disappointed as the prices of stocks have already reflected such information.

What this implies is that both fundamental and technical analysis cannot aid you to gain unless you possess insider information. The difference between this hypothesis and that of the weak efficiency hypothesis is that, this information are not just old prices of the securities but also data reported in the financial statements of the company, announcements on earnings and dividends, plans of merger, and even the financial situation or position of the company's competition. These may even include expectations on certain macroeconomics indicators such as the rate of inflation, unemployment. Thus, the public information could go beyond the frontiers of just finance. Just like the weak efficient hypothesis, the semi-strong efficient market hypothesis is also underlined with the assumption that no investor should be able to profit using information that is available to everyone.

Strong Efficient Hypothesis

Fama (1970) under this hypothesis, stock price reflects all past information, public traded information and insider information and hence no participant can benefit from these. The current price of the stock is set by considering all information both public and private. Such information may include information about the financial health and major strategies of the company, together with the strategic decisions the company makes that may not be available to shareholders. In the EMH theory, investors play a game of chance and not skill at any time of they are buying or selling financial securities. The difference between this hypothesis and that of the semi-strong efficient hypothesis is that no investors should in any way be able to generate profits even if he has an inside information not available to the entire public.

In essence, the hypothesis is saying that the company's management or even the research department should not be able to make any gain from any inside information on the company by buying stocks in the company some few moments after a decision so to speak of the company pursuing what is considered a very profitable venture. The rationale backing the strong efficiency hypothesis is that the market expects an unbiased manner and consequently the prices of stocks may have included the inside information and processed it than the first-hand informants. Empirical over the period however have been inconsistent with this hypothesis and that there are a number of investors who have gained excessively from the markets with inside information.

Arbitrage Pricing Theory

This theory was propounded by Ross (1976). The theory posits that the return on any stock has a linear relation with a number of systematic factors and risk-free rate. The theory begins by identifying what makes securities risky. The term factor refers to 'any source of uncertainty that creates risk among many securities. The APT aims to clarify the returns in terms of returns from a limited number of structural risk factors. APT acknowledges that, while several different corporate forces will affect the return of each stock in a large and diversified portfolio, these idiosyncratic effects appear to cancel out. The cancelling out is what is termed as the principle of diversification. Since the common economic forces affect all stock sales and are not excluded by diversification, big, diversified portfolios are not risk-free.

In the Appropriate, these collective factors are referred to as systemic or pervasive risk. The assumption that more than one factor determines the returns an asset provides indicates that, the processes by which returns are generated by the market are depicted by a 'multi-factor model'. The return on a financial asset is a linear combination of a risk-free rate and market premium, which is the equilibrium risk return relationship hypothesized by the Arbitrage Pricing Theory.

$$R_i = \alpha_i + \beta_{i1}I_1 + \beta_{i2}I_2 + \cdots + \beta_{ij}I_j + e_i$$

Where;

α_i refers to the expected level of return for the stock i if all factors have value of zero

I_j is the value of the stock factor that impacts the return on stock i

β_{ij} is the sensitivity of the stock i's return to the jth factor

e_i a random error term with mean equal to zero and a constant variance

There is no correlation between the error term and the factors, which implies whatever the outcome of the factor may be, it has no bearing on the outcome of the error term. Also, there is no correlation between the random error terms of two securities. This also implies that the outcomes of the random error term of one security have no effect on the outcome of the random error term of any other security. Two securities may have their returns correlated only through common reactions to factor. If any of these conditions are not met, the model is an approximation and not exact.

Capital Asset Pricing Model (CAPM)

CAPM shows the relationship that exists between the expected returns on investments and market risks. 'The Capital Asset Pricing Model (CAPM) was developed out of the Modern Portfolio Theory (Markowitz, 1952, 1959) and the Capital Market Theory (CMT). In the seminal work of Markowitz (1952) and Tobin (1958). The Capital Asset Pricing Model (CAPM), subsequently refined by Sharpe (1963, 1964), Lintner (1965, 1969), and Mossin (1966) considers that the expected returns from resource suppliers are calculated by a risk-free rate in addition to the expected price for market risk altered by the beta coefficient. The expansion of the Markowitz model allowed us to better understand the issue of a systemic or not systemic or diversifiable risk as regards the total loss of assets. Sharpe (1964) clarified that, with regard to the risk-free interest rate to access capital, there is a point at the competitive boundary, the resulting portfolio of which will be shared with all manner of investors without considering their risk profiles.

The CAPM introduced the beta concept that measures the covariance between a financial asset's return and the market and represents a contribution

to the risk of a well-diversified portfolio by a systematic (non-diversifiable) assets risk. Thus, the CAPM specifically states the principle of systemic (non-diversifiable) risk, as opposed to Markowitz (1952). The CAPM explains explain the return on stocks as a function of the risk-free rate on the asset and the risk premium. The sensitivity of the coefficient of beta is used in measuring risk premium. In making efforts to explain the return on a financial asset in terms of a single market risk factor, these is stated under the CAPM;

It should be noted however that there are more robust theories than the CAPM model, including Arbitrage Pricing Theory (APT), which Ross had introduced in 1977, have been developed and gained importance, offering the CAPM an alternative because, plus beta, a "k" quantity of factors is associated with the return on assets (Copeland, Weston and Shastri 2005). The APT needs more information than what the CAPM does, and is thus subject to greater difficulty in obtaining data. This describes the marginal application of CAPM to professionals who face the challenge of calculating the capital costs, despite criticism of its simplicity.

Conceptual Review

This chapter explains the various concepts underpinning the study. The concepts of stock exchange volatility were explained under this section.

Stock Exchange Volatility, Definition and Causes

Statistically, volatility is a measure of the dispersed returns on a particular asset. It also refers to the upwards and downwards swings of prices of financial assets. The more the prices of these financial assets fluctuate you tend to find similar pattern of volatility in the market as well and vice versa (Solnik, Boucrelle & Le Fur, 1996). A high level of stock market volatility

means that prices fluctuate over a very short period of time. For a participant in the market to enjoy all the benefit from a trading environment that is volatile and changing fast, the participant must be willing to navigate all the twists and turns, or step back a bit and play the long game (marketvolume.com). Volatility always indicates day to day market trading; the market tends to move in only one direction in the very long run.

With time, the degree of volatility adjusts but on certain occasions, the stock market is volatile. Stock prices do not climb in nice straight lines in the short term. A graphical plot of the daily prices of stocks looks like a mountain, with daily highs and lows and plenty peaks and valleys. However, "over a period of months and years, the mountain range tends to flattens into more of a gradual slope" (marketvolume.com). For active traders, short term volatility is seen as a good thing in certain cases. Active traders make a lot of money from short term fluctuation in asset prices. The greater the potential for quick gains, the greater the movement in the prices of financial assets. There exists an equal chance for quick loses but active traders are only willing to take on this risk to make substantial returns.

The day-to-day volatility of the stock market is not a worry for long term investors on the other hand. Your good investments will appreciate and there will be nothing to be worried about as long as the stock market continues to climb over time, as it has historically been doing. Because of this long-term appreciation, many people choose to invest in the stock market (wisestockbuyer.com). The market becomes less volatile for investors who are planning to hold a stock for the long term (five years or more) than for traders who engage the stock market on a daily basis. In August 2020, the S&P 500's

five years return was above 50 percent, the Dow Jones Industrial Average's return was around 50 percent, and the Nasdaq Composite was over 110 percent (Fathom KPI Report & Analysis, 2018). Volatility is also calculated as a standard deviation or difference between returns on the same market index or stability. Volatility is also related to significant shifts in both directions in financial markets.

When the stock price rises and falls for a longer time, for example, it's considered a "volatile" price (Rey, 2015). The value of an asset is an important element in contract pricing options. Volatility also refers to the level of uncertainty associated with changing the value of a security. In theory, higher variance will spread the value of a security over a broader spectrum of value. Many investors have been caught off guard by the recent market turmoil triggered by the Covid-19 outbreak. Some had to adjust the distribution of assets in their portfolios to provide much-needed diversification and to reduce risks if not entirely.

Before 1981, the present value of dividends has been the main determinant of stock prices in finance literatures. Nonetheless, Leroy and Porter (1981) and 16 Shiller (1981) discovered that, the prices of stocks were too volatile to be consistent with the movements in the future dividends of stocks under the assumption of a constant discount factor. Excess volatility hypothesis, argues that the prices of stocks show too much volatility to be justified by fundamental variables. While some number of research papers challenged the statistical validity of the variance bounds tests of Leroy and Porter and Shiller, on the basis that stock prices and dividends were non-stationary processes (Flavin, 1983; Kleidon, 1986; Marsh & Merton, 1986;

Mankiw, Romer, & Shapiro, 1991), however dividend variability suggested by the present value model with constant mean have been disproved by most of the subsequent literatures on the movements of stock prices (West, 1988a; Campbell & Shiller, 1987). Inflation rate, trading volume, gross domestic product and dividend policy are some major causes in periods of high volatility on the emerging financial markets.

According to Fama (1990), Liua and Sinclairb (2008), Oskooe (2010), "inter alia, economic growth has the power to affect the profitability of firms by affecting the prices of the stocks, the expected earnings and dividends of shares". In addition, Schwert (1989, 1990) compares through financial leverages the level of economic activity to volatility on stock returns. There is an increase in the volatility of firm's returns on stocks when the financial leverage of the firm increases using debt to buy back stocks or when the prices of stocks fall relative to the prices of bonds.

Schroders (2010) and his Economics teams studies have found that there is a positive relationship between the phases of business cycles and slowdowns, stock returns, GDP growth and economic expansions over the past sixty years. As rising GDP and earning drives returns on equity investments, the stock market tends to perform well in the expansion and recovery phases of business cycles. Monetary policy remains high and the rate of inflation also remains high during the slowdown phase which leads to a difficult environment for organisations. Decreases in the value of firms and earnings one way or the other leads to negative returns for equities. The poor performance of equities is also generally linked declining GDP growth. There also is usually a negative relationship between returns on equities and GDP

growth during periods of recession: returns on equities tend to be negative but GDP growth will still be raising.

The persistent rise in the general price levels of good and services is referred to as inflation. A number of studies have examined how the returns on stocks over the past few years tend to be affected by the rate of inflation available in an economy. When additional factors are taken into account such as time and geography, these came up with conflicting results. Depending on the governments' monetary policy and capacity to hedge, stock prices can either be positively or negatively impacted by the rate of inflation which has been the final conclusion of most studies. Generally, the purchasing power of each unit of goods and services a currency can buy is reduced by the level of inflation. Hence, rising inflation has a treacherous effect: revenues of forms drop, profits decline, the prices of inputs also go up, consumers at this time can only purchase fewer goods and the economy to an extent slows for a time until a steady state is reached.

Unexpected rate of inflation shows a lot of findings, during economic contractions, the timing of an economic cycle is very relevant for investors to gauge the impact of returns on stocks most remarkably being a very strong positive correlation to returns on stocks (Bernanke & Gertler, 2000). It is believed to be a fact that unexpected inflation rates may include new information the future prices of stocks. In that same ability, higher inflation rates is correlated to higher levels of volatility of stock. The level of volatility in developed countries is lower than that of emerging countries using data on the rate of inflation from emerging countries. Research findings from the

1930s suggest that during periods of high inflation rates almost every country one way or the other had significantly poor stock returns.

Dividend policy of a firm according to Pandey (2005) is the guidelines that management of a firm follows in making dividend payout decisions out of a corporation's profits by ascertaining how much dividend should be paid to shareholders of the company and what proportion of that dividend should be reinvested in the company. He believes that there is a balance between current dividends and future growth. He also noted that an outstanding dividend policy is the one that ensures and maximizes the stock price of the company regardless. On the other hands Ross (1977) defined dividend payment as the distribution of part of the profit of a company to its' shareholder. To measure the dividend policy of a corporation, Baskin (1989) took into account dividend yield and the ratio of dividend payout as the two main measures of dividends policy. Brealey et al. (2007) defines the payout of dividend as the percentage of profits paid to shareholders in the form of dividends while dividend yield on the other hand as the return on investments for stocks without considering capital gain.

Nazir, Nawat, Anwar and Ahmed (2010) concluded that there is a negative relationship between dividend policy and the volatility of stock price when they examined the relationship that exists between dividend policy and volatility of share prices. This simply means, the higher the dividend yield, the lower the volatility of the price. In another way, the higher the price volatility of a stock, the lower the yield on dividend. Nonetheless, Allen and Rachim (1996) posits in an earlier study that there is a positive but an insignificant correlation between dividend yield and the volatility of stock prices.

According to Baskim (1989) information effect, arbitrage effect, duration effect and rate of return effect are theoretical mechanisms that makes the dividend yield and ratio of dividend payout to vary inversely with the volatility of stock prices.

Lintner (1956) by conducting interviews of top managements of 28 organisations examined the different determinants of corporate dividend policy and its effect on an organisations market value. The outcome of his research showed that organisations dividend payout ratio determines the market value of the firm. Ross (1977) believes that because of the level of information dividends communicate, dividend decisions are important. As such a decrease in dividend payout may signal poor future earnings and therefore lead to a drop in the price of the firms' stocks but an increase in dividend will signal good future earnings which is eventually factored in the increasing stock prices of a firm.

Allen and Rachim (1996) debate that one of the controversial matters for many years for many years of empirical and theoretical is dividend policy and so is the case with its relation to the volatility of share prices. According to Miller and Modiglian (1961), the policy on dividend does not have any impact on the value of the firm in a perfect world where there are no taxes both personal and corporate, hence all market participants have similar expectations when it comes to the company's future investment and earnings, no floatation cost and no transaction costs as well. Gordon (1963) has a contradictory opinion and discovered that the risk and impacts on prices of stocks is minimized when large dividends are paid.

According to Pandey (2004), mostly research based on practical have been conducted in developed countries and concluded that dividends and the price of a share are marginally associated, thus increasing dividends raises the confidence level of investors' leading to discount firm's cash flows at inferior required rate leading to a rise in the prices of the stocks of the firm. Reducing the dividends on the other hand increases investor's uncertainty which ultimately causes the price of stock to marginally fall flat.

An adage on Wall Street says "It takes volume to make price move" (Karpoff, 1987, Pg. 121). Researchers (such as Osborne) believed long ago and was later supported by many empirical studies that the volume of trade would drive variability. According to studies on price-volume relation by (Ying, 1966; Westerfield, 1977; Rutledge, 1979), there are positive relations between the value of daily price changes and daily volume of trade for both the individual stocks and the market indices. To unearth dependencies that may form the basis of a profitable trading strategies, the volume-return relationship is of common interest and this development has implications for market efficiency (Chen et. al, 2004). Legends of the market claims that whether the market is in a bull or bear, movements of a financial asset is dependent on the relationship between volume and price of the stock. A higher level of volume in a bull market is relatively associated with a given price change in a bear market.

Karpoff (1987) recommended these four reasons to the level of volatility considering the trading volume. The volume of trade gives an intuition into financial markets and its structure. "The relationships which are found can provide information on the speed at which information flows within

the market, the magnitude to which prices of stocks reflect public information, the size of the market, and the existence of short sales and some other constraints on the market". The usefulness of technical analysis can best be explained by the relationship that exist between the volume trades of a stock and the relative price of that stock. For instance, Murphy (1985) and DeMark (1994) made a pubic call by stressing that there is valuable information in the relationship between the price of a stock and the volume of that stock. With low trading volume technical analyst usually give less value to a price with a very significant volume increase than to a similar price increase

In the futures and other speculative markets understanding the relationship between price and volume is important for one to examine why the distributions of return appear kurtotic. The stable Paretian hypothesis says that returns are characterized by a class of distribution with infinite variance. The mixture matrix model is also a different theory which blends data that comes from conditional variance. With changing variance which can be predicted by the volume data, other researches have shown that the data on the price of a stock can be generated by a stochastic process. The volume of trades in futures contracts is affected by the variability of the prices data. Whether speculation is stabilizing or not, the futures contracts determine the prices on stocks.

The volatility of the stocks market can also be influenced by these factors. Aside the other factors considered, these factors to be considered are collective; this means they put the other factors and make them as a holistic point. Some of these holistic factors include:

Economic Crisis

The stock market is obviously very vulnerable to major economic situations. In general, they react negatively: 'the worse the crisis, the greater its impact on the overall performance of the market'.

Changes in national economic policy

For instance, in the short run, changes in monetary policy by the central bank nearly always trigger strong market movements. If the Fed encourages monetary policy and when it tightens regulation, the economy continues to increase. So, the stock markets respond to whatever directions the stock exchange may go, be it a positive shock or a negative shock.

Economic Indicators

Economic data is a window that offers traders the ability to get a grip on the economy: when it is doing very well, the market appears to respond positively. Economic reporting therefore acts as a measure of uncertainty and is therefore anticipated by traders with breathlessness. Monthly reports on jobs, inflation and consumption statistics may all influence the output of the economy. Traders typically try to anticipate the reports before selling or buying their products. If the demand will fluctuate rapidly, the forecast varies from the expected amount.

Political Developments

Policy is a central influence on the success of the sector. Governments take decisions on trade arrangements, taxation, tariffs and federal budgets – both play a key role in business control and influence the economy as a whole. There may also be market uncertainty in financial discourses. As part of the worsening trade war in 2018, President Trump's announcement of import tariff

rates from China is an outstanding example, causing more than 2% to fall on the Dow, S&P 500, and NASDAQ-100 indices. The US President has since repeatedly changed his tone, but the announcement itself contributed to the instability of the financial markets in this era. Together with these conditions are others not mentioned here that affects the volatile or stable nature of the stock exchange. Noisy traders need some level of volatility, but they must also pay attention its magnitude.

The level of volatility of a stock plays a major role in the selection tradable stocks, and will impact on the costs of brokerage services and eventually the profits from trading. Careful considerations must be given to stop loss strategies in order to protect traders from the downside risk of stocks that appear to be volatile and at the same time avoid unacceptable losses. In markets that are trading downward it has been observed that the level of volatility increases from trading history. The downside may be even greater while the potential upside of buying volatile stocks is apparent, because the stock is trading in a downtrend. This had been one main reason that the prices of stocks with higher volatility tend to have a relatively lower stock prices. It is very important for an investor to have knowledge of stock exchange volatility because it helps the investor to make the best decision. By considering the risk capacity, investors who are risk averse will not invest in a period where there is high volatility but investors who are risk lovers will invest in higher volatile period. October has been spotted as the most volatile month for stocks on average over the years.

The legal framework governing the Ghana Stock Exchange

Regulations affecting Foreign and Non-Resident Investors

Such restrictions have been removed under the new Foreign Exchange Act 2006 (Section 723). There are therefore free and full foreign exchange remittance for initial capital plus all capital profits as well as associated profits. There is an eight percent withholding tax, which is also the final dividend income tax, for all investors; resident and non-resident. This means that non-resident investors are now able to invest on our market with no limit or prior exchange control authorization. Capital gains on the shares listed are tax-free.

Investor Protection Provisions

The Ghana Stock Exchange has made various provisions in its rules which have been designed as a protection for investors in addition to what the Securities and Exchange Commission (SEC) provides. Under the SECURITIES INDUSTRY LAW, PNDCL 333 (1993), as amended, the highest regulatory body in the capital market is the Securities and Exchange Commission and some of its roles include:

i. Maintaining surveillance over the securities business to ensure orderly, fair and equitable dealing in securities.
ii. Registering, licensing, authorizing a stock exchange, investment advisors, securities dealers etc.
iii. Protecting the integrity of the securities market against any abuse arising from the practice of insider trading.

Empirical Review

Choudhry (2003) analyzes the influence of stock market volatility on GDP and the components of GDP using an error-correction framework. Under the assumption that volatility follows a non -stationary stochastic process, he estimates the short-run and long-run dynamics of GDP components using an error-correction framework. His results confirm that stock market volatility has adverse effects on consumption and investment. It was examined that the dynamic effects of monetary policy shocks, identified from Federal funds futures data, by employing a vector autoregressive (VAR) model.

The use of market-based measures of monetary policy shocks allows us to avoid the need to resort to identifying assumptions and circumvents dimensionality (degrees of freedom) problems in the estimated VAR. Our goal from this analysis is threefold. First, they assess the dynamic response of stock market volatility and the variance risk premium to monetary policy shocks. Second, their analysis allows us to characterize asymmetries in the return-volatility relationship. Third, they study the channels through which monetary policy shocks affect stock market volatility by analyzing the joint response of several financial variables to market-based measures of monetary policy shocks. By inspecting the channels of monetary policy transmission to volatility, the importance of changes in the risk premium or leverage on stock market volatility has been identified. This therefore investigates in further details the importance of the volatility feedback and leverage effect hypotheses.

Using 50 Indian stocks, Kumar and Sing (2011) analyze the returns and volume relationship, focusing on the contemporaneous relation between

absolute returns and trading volume, the asymmetric behavior of trading volume in response to price changes and dynamic (lead-lag) relationship between returns and trading volume. They model the dynamic relationship using VAR model. This study also investigates the contemporaneous relationship between volatility and trading volume.

Lamoureax and Lastrapes (1990) supported the influence of trading volume on the persistence of GARCH effects on the returns of the financial assets. Their findings indicate evidence of positive contemporaneous correlation between absolute price changes and trading volume in Indian stock markets. However, they get mixed result on asymmetric relationship between trading volume and returns. Most of the stocks show asymmetric behavior which is in line with the findings of Assogbavi et al. (1995) and Brailsford (1996).

Some of the stocks have asymmetric behavior. This is consistent with the findings of Assogbavi (2007) that clearly indicated the absence of asymmetric relationship in emerging markets. The results of dynamic relationship between returns and trading volume show very interesting results. They find strong evidence that in Indian market, past returns Granger cause trading volume, which can easily conceive in an emerging market (Assogbavi, 2007) where the state of development of the market possibly does not allow instantaneous information dissemination. Their results are further supported by the variance decomposition. However, in most of the cases the relationship lacks economic significance even when statistically significant. The results of impulse response analysis indicate that both returns and volume are mostly affected by their own lag and the volume is more autoregressive than returns

i.e. any shock in either returns or volume does not affect the return series beyond one lag.

Brailsford (1994) paper presents an empirical analysis of the relationship between trading volume and stock return volatility in the Australian market. The initial analysis centres upon Karpoff's (1987) model of the volume-price change relationship. Evidence is found which supports the model. The relationship between price change and trading volume, irrespective of the direction of the price change, is significant across three alternative measures of daily trading volume for the aggregate market and individual stocks. Furthermore, evidence is found supporting the hypothesis that the volume-price change slope for negative returns is smaller than the slope for positive returns, thereby supporting an asymmetric relationship. Trading volume is then examined in the context of conditional volatility using a GARCH framework.

Similar to the results of Lamoureux and Lastrapes (1990), the findings show a reduction in the significance and magnitude of the conditional variance equation coefficients, and a reduction in the persistence of variance when trading volume is added as an exogenous variable. Hence, there is prima facie evidence that if trading volume proxies for the rate of information arrival, then ARCH effects and much of the persistence in variance can be explained.

Karanasos and Kyrtson (2011) investigate the Korean stock volatility-volume relation for the period 1995-2005 and hence contribute to the study of emerging markets' liberalization after the financial crisis in 1997.In this work they have studied the volume-volatility relationship and they have taken into account the highly complex endogenous structures of the Korean stock market

by employing the MG-GARCH model of Kyrtsou and Terraza (2003). Therefore, heteroscedasticity is interpreted endogenously while heterogeneity of expectations about future prices and dividends is the main source of fluctuations in returns. Its performance over traditional stochastic alternatives such as the simple GARCH model sheds ore light on the link between the two variables. They have also provided strong empirical support for the argument made among others by Karanasos and Kartsaklas (2004) that instead of focusing only on the univariate dynamics of stock volatility one should study the joint dynamics of stock volatility and trading volume.

Moreover, as Kim, Kartsaklas and Karanasos (2005) have pointed out, they have shown that in investigating the interdependence of the two variables it is important to distinguish between domestic and foreign investors' trading volume. Finally, by conducting sub-sample analyses it was found that there are structural shifts in causal relations. Specifically, before the financial crisis in 1997 there was no causal relation between domestic volume and stock volatility whereas during and after the crisis a positive relation began to exist. Additionally, the effect of either foreign or total volume on volatility was negative in the pre-crisis period but turned to positive during and after the crisis. For the foreign volume the effects become weaker when they include the Mackey-Glass term. Such findings confirm the high interest in using the MG-GARCH approach, since improper filtering of the stock returns by simple GARCH models can lead to erroneous conclusions about the volume-volatility link.

Asai and Unite (2007) reconsider the relationship between stock return volatility and trading volume. Based on the multi-factor stochastic volatility

model for stock return, they suggest several specifications for the trading volume. This approach enables the unobservable information arrival to follow the ARMA process. They apply the model to the data of Philippine Stock Exchange Composite Index and find that two factors are adequate to describe the movements of stock return volatility and variance of trading volume. They also find that the weights for the factors of the return and volume models are different from each other. The empirical results show (i) a negative correlation between stock return volatility and variance of trading volume, and (ii) a lack of effect of information arrivals on the level of trading volume. These findings are contrary to the results for the equity markets of advanced countries.

Studies since 1970‘s have indicated a strong positive contemporal correlation between volume and volatility. However, two very recent papers challenged this stylized fact using the volatility decomposition technique. Giot et al. (2010) finds that only the continuous component shows a positive contemporal volume-volatility relation, while the jump component shows negatively correlation. Amatyakul (2010) also presents the evidence showing similar negative correlation. Campbell et al. (1993) showed, a positive correlation between current volatility and lagged trading volume is likely to be observed in liquidity trading. When informed traders trade their stocks due to private information, that information will spread over the market through price signal.

Chapter Summary

This Chapter analysed the theoretical framework, underpinning this research. The concept within the study was explained from other researchers’

perspective. The empirical review of other researchers was also analysed in order to identify the results from other research on the subject matter.

CHAPTER THREE

RESEARCH METHODS

Introduction

This chapter explains the methods used in collecting, analysing and reporting the data. The research design, approach and the data analysis were explained under this chapter.

Research Paradigm

Research paradigm refers to the philosophy underpinning scientific research and the scientific approach that is regarded appropriate to the reason, context and focus of the research work (Hallebone & Priest, 2008). This is in accordance with the positivism research paradigm. According to Saunders and Lewis (2012), the propounders of the positivism research paradigm are of the view that the positivist approach to scientific research involves researching into an observable social reality and making law-like generalizations as done by physical and natural scientists.

The fact that such social reality is obvious means that it can be measured and quantified into variables. Thus, the use of the positivism paradigm involves collecting data on variables, analyzing data by using statistical test of significance and affirming or rejecting hypotheses to make generalizations. Positivism paradigm of research produces generalizable findings which are normally reported quantitatively, and also allows for the possibility of making predictions about general phenomena (Hallebone & Priest, 2008). The study adopts the positivism research paradigm because it involves collection of data on stock price

Research Design

According to Saunders and Lewis (2012), research design can be exploratory, descriptive or explanatory. The study employed the explanatory research design. The empirical studies that seeks to establish cause and effect relationships between variables may be termed as explanatory (Saunders & Lewis, 2012). Explanatory research design is employed in the study to explain the impact or effect of stock market volatility on investor's decisions.

Research Approach

There are three main approaches to research, namely, the quantitative approach, the qualitative approach and the mixed approach (Creswell, 2014). According to Saunders and Lewis (2012), positivism research paradigm makes use of the quantitative research approach and therefore the quantitative research method is adopted for this study. Creswell (2014) explained that the quantitative research approach involves seeking for causal explanations so that it could be used for predictions.

The study employs the quantitative approach because hypotheses will be deduced from theories and models will be constructed base on these hypotheses. Since quantitative approach to research makes use of statistical analysis, the study employs inferential statistics (particularly regression) to analyze the data.

Data Collection Procedures

The study estimates and explains the volatility of Ghana Stock Market. Base on this purpose, secondary monthly data for the period of 2001 to 2017 on stock prices from GSE Website. One of the challenges was using quarterly data. As stock returns is very volatile, using monthly analysis became difficult.

Model Specification

Volatility has come to be accepted as synonymous with risk in the financial markets. Indeed, Engle and Patton (2007) highlighted this point in assessing what constitute a good volatility model. Investors generally see the fluctuations of returns around the mean return as risk with the downside being value destroying. They treat volatility asymmetrically, liking the upside when volatility exceeds the mean as good and downside when returns are less than the mean as bad and must be avoided.

As a mathematical artefact, volatility is not directly observed in trading sessions in the markets. It is calculated from historical asset prices. It is generally taken to be the average of the mean squared standard deviation of assets returns from their mean. This value is actually the variance which is standardised by taking the square root to get the standard deviation which is taken as the volatility of the returns. It is a constant value over time and did not communicate the real market variations around it as actually obtained in the market.

J. P. Morgan (1996) came up with an improved volatility metrics, the exponentially weighted moving average (EWMA) which was capable of capturing the heteroscedastic nature of the volatility found in time series data that is financial. It is still in use in the finance industry. The problem with EWMA is the determination of the constant known as lambda. This lambda varies from time to time and from market to market. Again, it has to be determined using a long series of data which obviously is not available in much of the emerging and frontier markets (Alexander, 1998).

Engle (1982) came up with an iterative method of determining the volatility of assets returns which truly shows the time variations and captures some of the known stylized facts in the data. This method known as autoregressive conditional heteroscedasticity or ARCH was later expanded into the 'generalized autoregressive conditional heteroscedasticity' (GARCH) by Bollerslev (1986). It is a method that is based on the current variance being a regression on the lags of the errors and the variance, the length of the lag essentially a matter of expertise or determined by the Akaike Information Criteria (AIC) or Bayesian Information Criteria (BIC). (G)ARCH originally was mean to capture the clustering in the financial time series. It has been expanded to other characteristics of time series including asymmetry in response to volatility (Glosten, Jagannathan & Runkle, 1993), long-memory processes (Baillie, Chung & Tieslau, 1996), asymmetric power ARCH model (Ding, Granger & Engle, 1993) among others. Mention must also be made of the stochastic volatility model (Kim, Shephard & Chib. 1998), realized volatility (Barndorff-Nielsen & Shephard, 2004) and the forward-looking volatility backed out of option prices called VIX (Whaley, 1993). Of all these, however, Hansen and Lunde (2005) put the GARCH (1,1) at the top of their class. The study therefore adopted the GARCH (1,1) in our work.

The GARCH

The ARCH models of Engle (1982) generalised in GARCH by Bollerslev (1986) sought to capture the clustering of volatility, a key stylised fact of financial returns series. This is the situation where there is clustering in high and low volatility respectively in the data.

Assuming the study has a series of $\{r_t\}_1^T$ being returns from equity markets where t is the time in this case daily. Then the variance at any particular time, σ_t^2 is given by the GARCH equation as

$$\boldsymbol{r_t = \mu + \varepsilon_t} \quad (1)$$

$$\boldsymbol{\varepsilon_t = \sigma_t z_t} \quad (2)$$

$$\boldsymbol{\sigma_t^2 = \omega + \sum_{i=1}^{p} \alpha_i \varepsilon_{t-i}^2 + \sum_{i=1}^{q} \beta_i \sigma_{t-1}^2} \quad (3)$$

In equation (3), restrictions are placed on the GARCH coefficients ω, α and β to ensure the 'positivity of the variance'. These are $\omega > 0$, $\alpha \geq 0$, $\beta \geq 0$. It is also a requisite that $\alpha_i + \beta_i < 1$. This would ensure that the series is stationary. The z_t in the equation (2) is an independent and identically distributed process which captures the tail behaviour of the process. Typically, processes include normal, student-t or generalised error distributions and their skewed versions.

The GJR GARCH

Other equally important characteristics which exposed investors to risk exist in financial returns. Glosten, Jagannathan and Runkle (1993) identified leverage in financial returns arising out of the fall in equity returns thereby increasing the debt value sponsoring the assets of the firm. That is, for any given assets of the firm sponsored by a merger of equity and debt, the level of debt tends to be constant but that of equity grows or shrinks depending on how volatile market conditions are. This was first observed by Black (1976). Rising volatility points to a fall in asset prices which results in a diminished value of

the equity relative to the debt. This gave rise to the GJR-GARCH leverage dynamics which is stated as:

$$\sigma_t^2 = \omega + \alpha\varepsilon_{t-1}^2 + \gamma\varepsilon_{t-1}^2 I_{[\varepsilon_{t-1}<0]} + \beta\sigma_{t-1}^2$$

where

$$I_{[\varepsilon_{t-1}<0]} = \begin{cases} 0 \; if \; r_{t-1} \geq \mu \\ 1 \; if \; r_{t-1} < \mu \end{cases}$$

is an indicating function. The leverage in the data is given by γ. To ensure positivity of the variance, the condition $\omega, \alpha, \gamma, \beta > 0$ is therefore imposed on the GJR-GARCH equation.

The TARCH

The restrictions of the GARCH values have been controversial in financial econometrics literature. Alexander (2008) is of the view that if restrictions are needed in the GARCH equation, it means that models is just not good. This led to Zakoian (1994) coming up with the threshold ARCH which assumes the form:

$$\sigma_t = \omega + \alpha|\varepsilon_{t-1}| + \gamma|\varepsilon_{t-1}|I_{[\varepsilon_{t-1}<0]} + \beta\sigma_{t-1}.$$

A more general form of the TARCH is written as

$$\sigma_t^k = \omega + \alpha|\varepsilon_{t-1}|^k + \gamma|\varepsilon_{t-1}|^k I_{[\epsilon_{t-1}<0]} + \beta\sigma_{t-1}^k$$

where k defines other powers of the volatility dynamics that improves the fit of the data.

Conditional Tails

The distribution in the tails is very vital to risk management. For a normal distribution, the tails are mesokurtic and this gives an assurance that the characterisation of the distribution is just the first two moments – mean and variance. However, there is ample evidence that the distribution of

financial return data deviates from normal (Peiro, 1999; Lux, 1998; Mandelbrot & Hudson, 2010). Often than not, financial market returns tend to be characterised by student-t distributions with heavy or leptokurtic tails. Analysis of GARCH models therefore will be done with both mesokurtic and leptokurtic tails in order to properly capture the characteristics contained in the data.

Sampling Monthly Data

The data for the analysis as to the months of extreme volatility is a daily dataset. The study looked at the average monthly volatility rankings (AMVR) and characterise the months of extreme volatility in our sample. Thus, the data is going to be resampled from daily to monthly by changing the frequency of the data.

Chapter Summary

This chapter reviewed volatility processes from finding the standard deviation through GARCH processes to the modern VIX approach. The GARCH process is the industry's workhorse; hence it was settled and expatiated on it. The GARCH has been extended to capture various stylised facts seen in financial return series beyond the volatility clustering which originally was the work of the (G)ARCH of Engle (1986) and Bollerslev (1986). In the next chapter, the study modeled the heteroscedastic functions of the data and look at how volatility varies month-on-month over time.

CHAPTER FOUR

RESULTS AND DISCUSSIONS

Introduction

Frontier markets tend to be volatile but the volatility is more pronounced during some months of the year. This chapter analysed the daily data from the GSE composite index for the appropriate function that describes that heteroscedasticity of the data and also establish the month (s) which is/are very volatile.

Data Description

The data is a time series from January 04, 2011 to December 31 2017 being the closing daily index level of the GSE composite index levels. The study considers this data as a mirroring the long-term dynamics that tell us about the volatility seasonality across the various month of the years from 2011 to 2017. The raw data is being plotted to see its behaviour. A plot of the data is shown Figure 1 below.

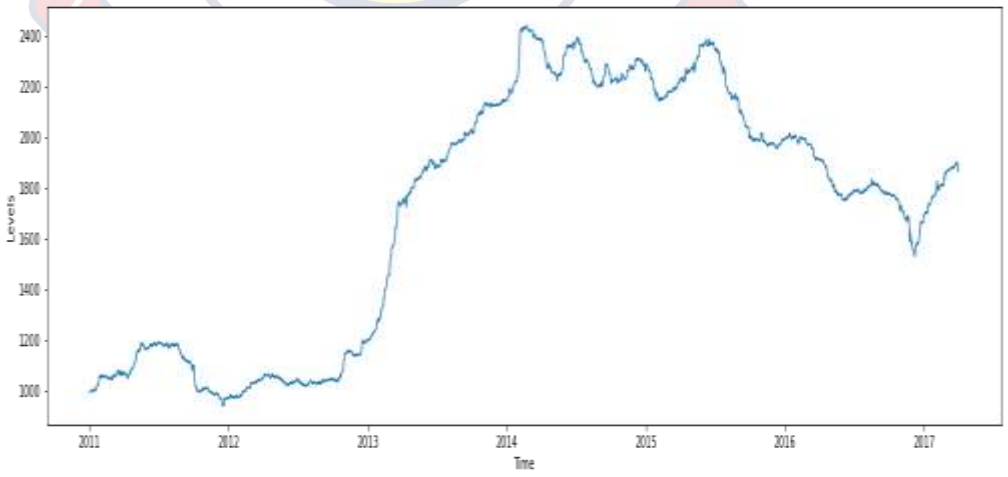

Figure 1: Index Level of the Ghana Stock Exchange (GSE)

Source: Ghana Stock Exchange (2020)

As shown in Figure 1, there is an upward trend in the index level of the GSE from 2011 to the middle of 2011 and falls from the middle of 2011 to 2012. An upward trend is observed from 2012 till 2014 where the index level of the GSE reaches maximum. The index fluctuated between 2014 and end of 2016. A downward trend is until 2017. The return rises after 2017.

The return is the index was found as log return from the relation $r_t = \ln\frac{P_t}{P_{t-1}}$ where r_t is the return on day t and P_t is the level log return on a particular day. The returns are plotted as shown in Figure 2. This plot shows that daily returns of the GSE is mean reverting and on the face of it, the returns appear stationary. The spikes represent the volatilities. The horizontal line through the mean shows the breadth of the changes in returns from time to time. Persistence in changes over time could also be observed in the graph of volatility of returns. This is to mean that relative short amplitudes last over time coupled with relative long ones between early and mid-2012, from mid-2013 through to the later years. Thus, these volatilities are autocorrelated.

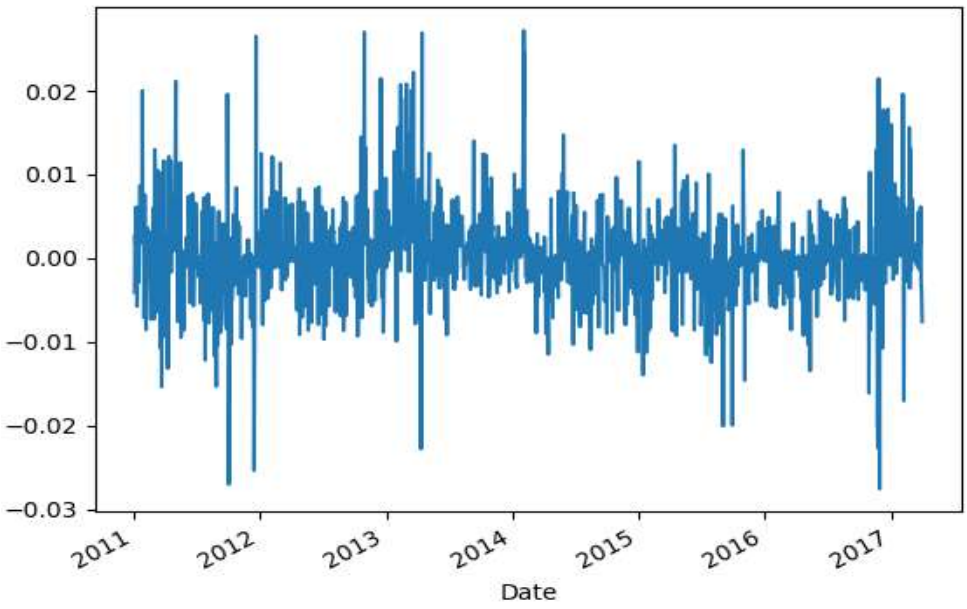

Figure 2: Returns volatility of Ghana Stock Exchange
Source: Ghana Stock Exchange (2020)

The clustering of the volatility does not show clear patterns across the years. It seems elevated sometimes mid-year and other times towards the end of the year.

Table 1 presents the descriptive statistics of the return series of the GSE. Across the years, the standard deviation, a proxy for the volatility of the index is 0.000406. The table also shows that mean of return which is almost zero and far less than the standard deviation of the returns. The returns are slightly skewed to the right, much against the findings of Cont (2001). These statistics show that the distribution of the returns deviate from the gaussian distribution.

Table 1: Summary Statistics of the Returns of GSE for 2000 to 2019

Count	1548.000000
Mean	0.000406
Std	0.005367
Min	-0.027582
25%	-0.001780
50%	0.000151
75%	0.002341
Max	0.027212

Source: Ghana Stock Exchange (2020)

Figure 3 shows the monthly volatility of GSE. Starting from 2011, returns of GSE shows stationarity in the level of monthly volatility of GSE. The series reverts around the mean signifying that the returns of GSE is staionary.

A histogram of the plot of the returns with the probability density function overlay is shown in Figure 3. The histogram shows that the plot of

returns of GSE deviates from the Gaussian distribution especially with extreme outcomes in the tails.

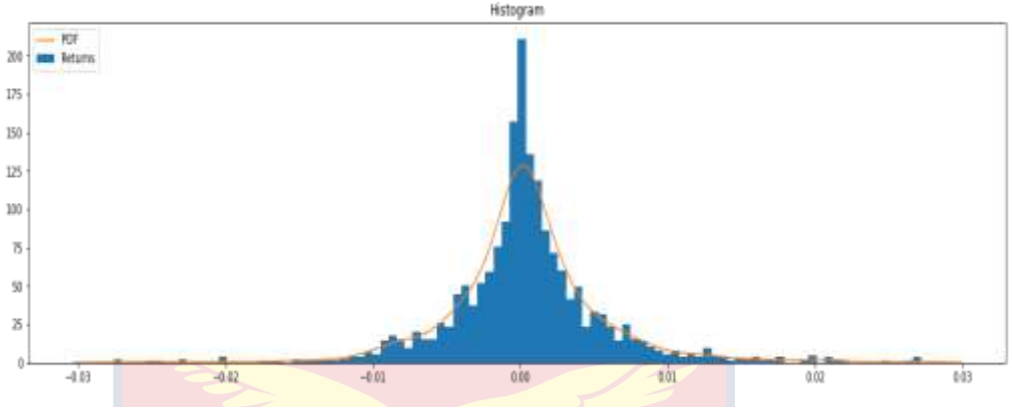

Figure 3: Histogram of return of Ghana Stock Exchange

Source: Ghana Stock Exchange (2020)

To test for the presence of GARCH effects in the data, the researcher conducted the Engle's test and had a Lagrange multiplier test statistic of 199.4513 with a p-value of nearly zero ie. $1.3353 * 10^{-29}$. This confirms the existence of GARCH effects in the data.

The GARCH(1, 1) models with normal errors

The GARCH(1, 1) models was run with normal errors in the tails. The results are shown in Table 2.

Table 2: The GARCH(1, 1) Models with Normal Errors

	Estimate	Std. Error	T-statistic	p-value	95.0% Confidence Interval
μ	0.0177	1.194e-02	1.480	0.139	[-5.734e-03,4.107e-02]
ω	0.0350	1.215e-02	2.882	3.948e-03	[1.121e-02,5.884e-02]
α	0.1720	4.100e-02	4.196	2.714e-05	[9.168e-02, 0.252]
β	0.7086	6.915e-02	10.248	1.213e-24	[0.573, 0.844]

Source: Field Data (2020)

The GARCH(1, 1) models with student-t errors

In Table 3, the GARCH(1, 1) models with student-t conditional errors was run.

Table 3: The GARCH(1, 1) models with student-t errors

	Estimate	Std. Error	T-statistic	p-value	95.0% Confidence Interval
μ	0.0181	8.204e-03	2.210	2.709e-02	[2.053e-03,3.421e-02]
ω	0.0593	1.958e-02	3.028	2.462e-03	[2.092e-02,9.768e-02]
α	0.3350	8.162e-02	4.105	4.042e-05	[0.175, 0.495]
β	0.6650	7.357e-02	9.039	1.587e-19	[0.521, 0.809]
ν	2.5773	0.155	16.597	7.306e-62	[2.273, 2.882]

Source: Field Data (2020)

The GJR-GARCH (1, 1) models

The study incorporated leverage and run the GJR-GARCH (1, 1) on the index. The results are shown in Table 4.

Table 4: GJR-GARCH Model Results

	Estimate	Std. Error	T-statistic	p-value	95.0% Confidence Interval
mu	0.0199	1.136e-02	1.750	8.019e-02	[-2.391e-03,4.215e-02]
omega	0.0391	1.407e-02	2.779	5.445e-03	[1.153e-02,6.668e-02]
alpha[1]	0.2110	7.248e-02	2.911	3.600e-03	[6.895e-02, 0.353]
gamma[1]	-0.0651	7.452e-02	-0.874	0.382	[-0.211,8.092e-02]
beta[1]	0.6854	7.831e-02	8.752	2.099e-18	[0.532, 0.839]

Source: Field Data (2020)

The GJR-GARCH (1, 1) with Student-t errors

The results of running the GJR-GARCH (1, 1) with Student-t conditional tails are summarized in Table 5.

Table 5: GJR-GARCH Model with student-t errors

	Estimate	Std. Error	T-statistic	p-value	95.0% Confidence Intrerval
Mu	0.0179	8.243e-03	2.170	2.998e-02	[1.734e-03,3.404e-02]
Omega	0.0621	2.100e-02	2.956	3.113e-03	[2.092e-02, 0.103]
alpha[1]	0.3756	0.110	3.420	6.266e-04	[0.160, 0.591]
gamma[1]	-0.0652	0.104	-0.628	0.530	[-0.269, 0.138]
beta[1]	0.6570	7.571e-02	8.677	4.057e-18	[0.509, 0.805]
nu	2.5675	0.157	16.333	5.783e-60	[2.259, 2.876]

Source: Field Data (2020)

The TARCH(1, 1) models

A TARCH model with normal errors was run on the model. The results are exhibited in Table 6.

Table 6: TARCH Model Results

	Estimate	Std. Error	T-statistic	p-value
mu	0.0297	1.282e-02	2.320	2.034e-02
omega	0.0546	2.417e-02	2.260	2.380e-02
alpha[1]	0.1676	4.894e-02	3.425	6.158e-04
gamma[1]	-0.0223	4.153e-02	-0.538	0.591
beta[1]	0.7862	6.607e-02	11.901	1.174e-32

Source: Field Data (2020)

The TARCH(1, 1) models with Student-t tails

Finally, the Student-t conditional tails version of the TARCH(1, 1) was run on the data. The results are shown in Table 7.

Table 7: TARCH Model with Student-t tails

	Estimate	Std. Error	T-statistic	p-value
mu	0.0168	8.032e-03	2.092	3.645e-02
omega	0.0874	3.384e-02	2.583	9.793e-03
alpha[1]	0.3003	7.339e-02	4.091	4.287e-05
gamma[1]	-0.0482	5.148e-02	-0.936	0.349
beta[1]	0.7238	7.425e-02	9.748	1.876e-22
nu	2.5100	0.161	15.594	7.943e-55

Source: Field Data (2020)

From the analysis on Table 7, omega had a positive significant impact on mu. With the exception of gamma [1], the other variables were positively significant.

The graphs of the various GARCH models are shown in Figures 4-9:

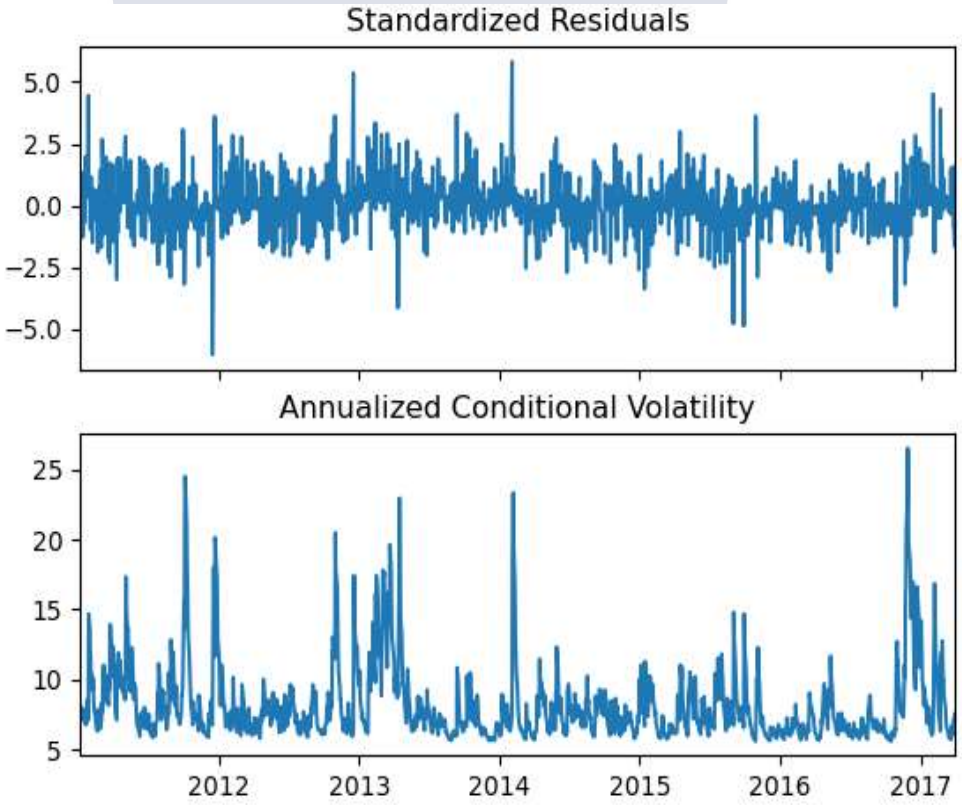

Figure 4: Evolution of volatility for GARCH(1, 1) with normal errors

Source: Field Data (2020)

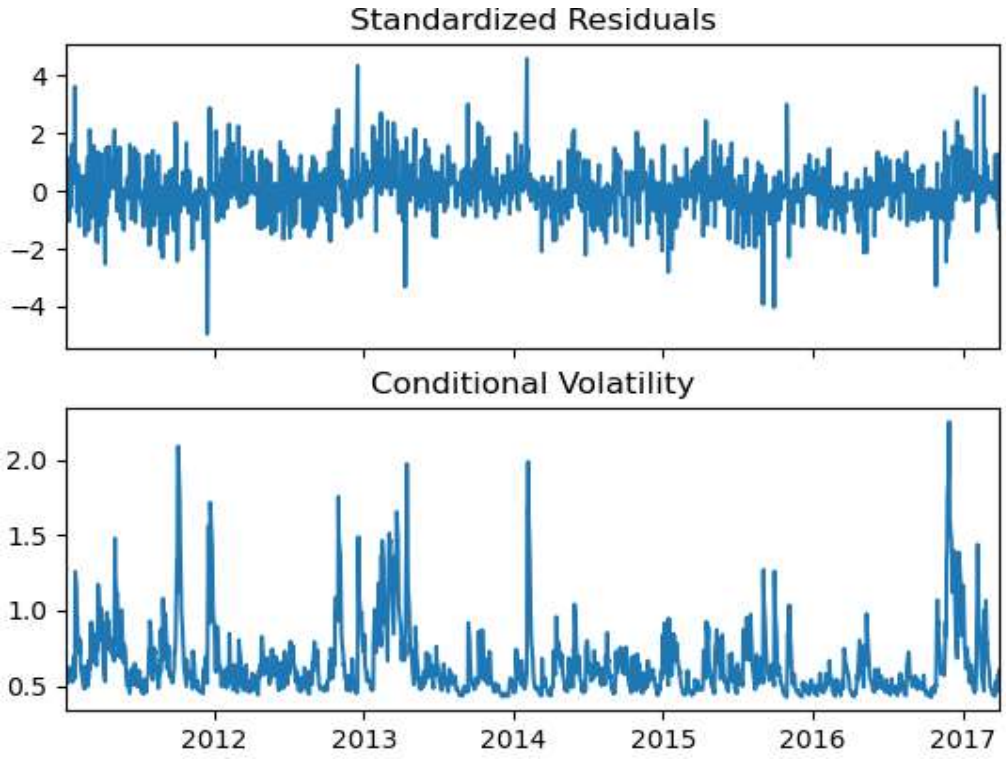

Figure 5: Evolution of volatility for GARCH(1, 1) with Student-t errors

Source: Field Data (2020)

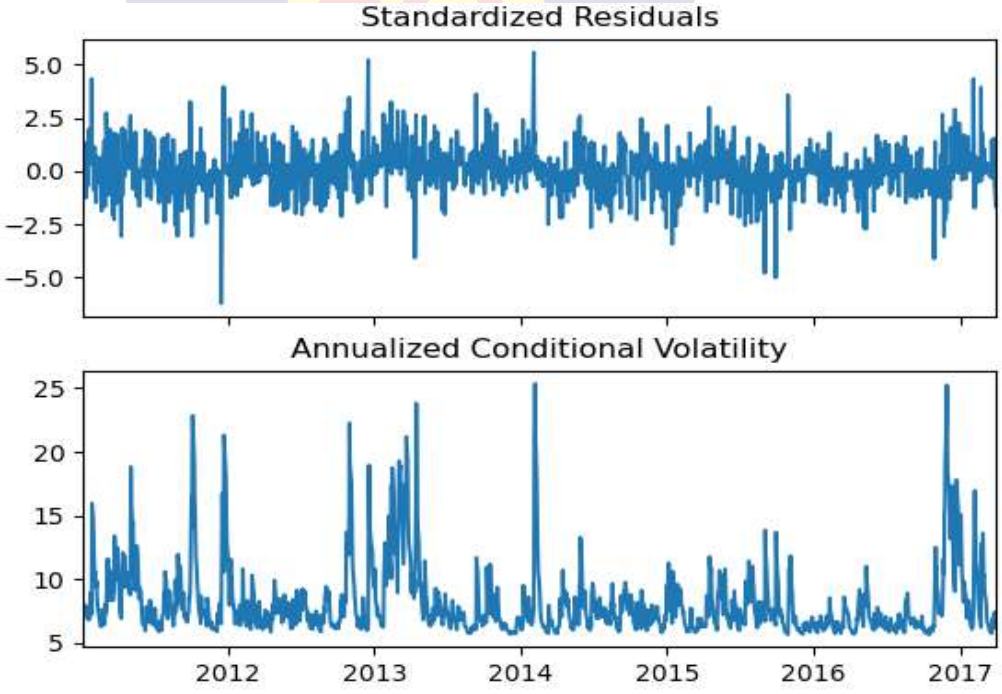

Figure 6: Evolution of volatility for GJR-GARCH(1, 1) with normal errors

Source: Field Data (2020)

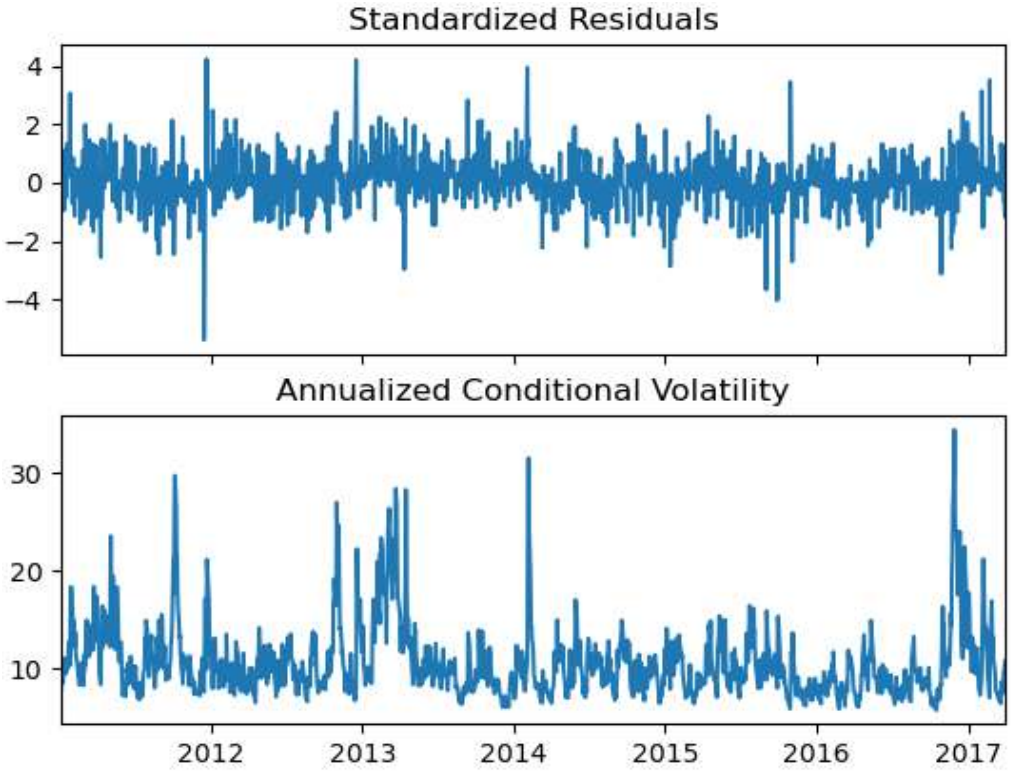

Figure 7: Evolution of volatility for GJR-GARCH(1, 1) with Student-t errors.

Source: Field Data (2020)

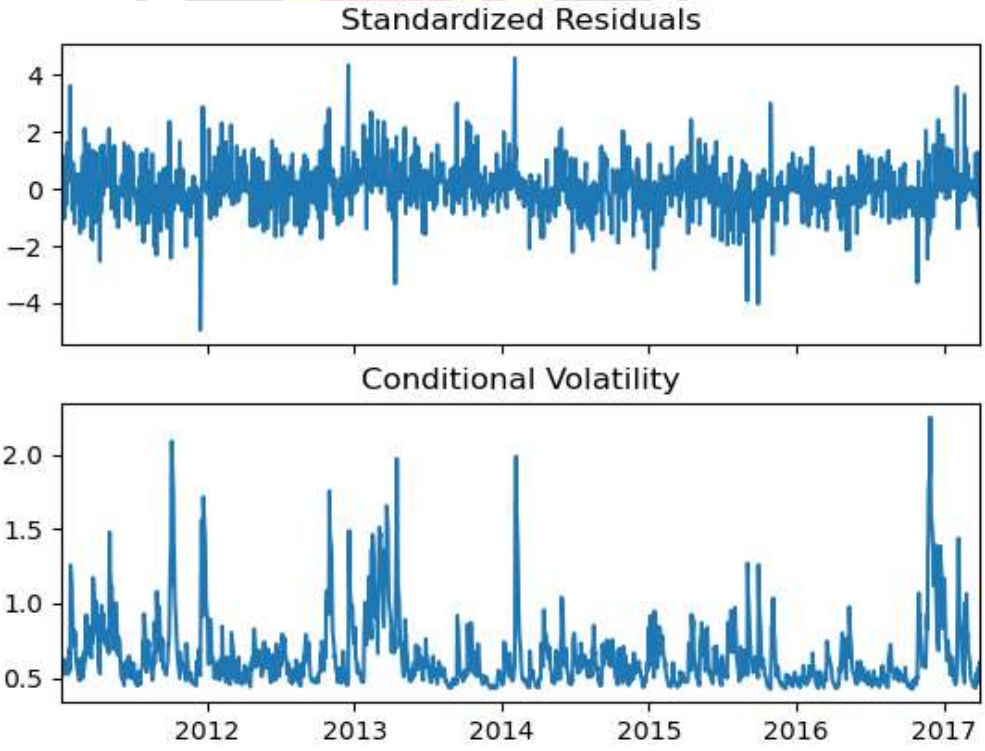

Figure 8: Evolution of volatility for TARCH(1, 1) with normal errors.

Source: Field Data (2020)

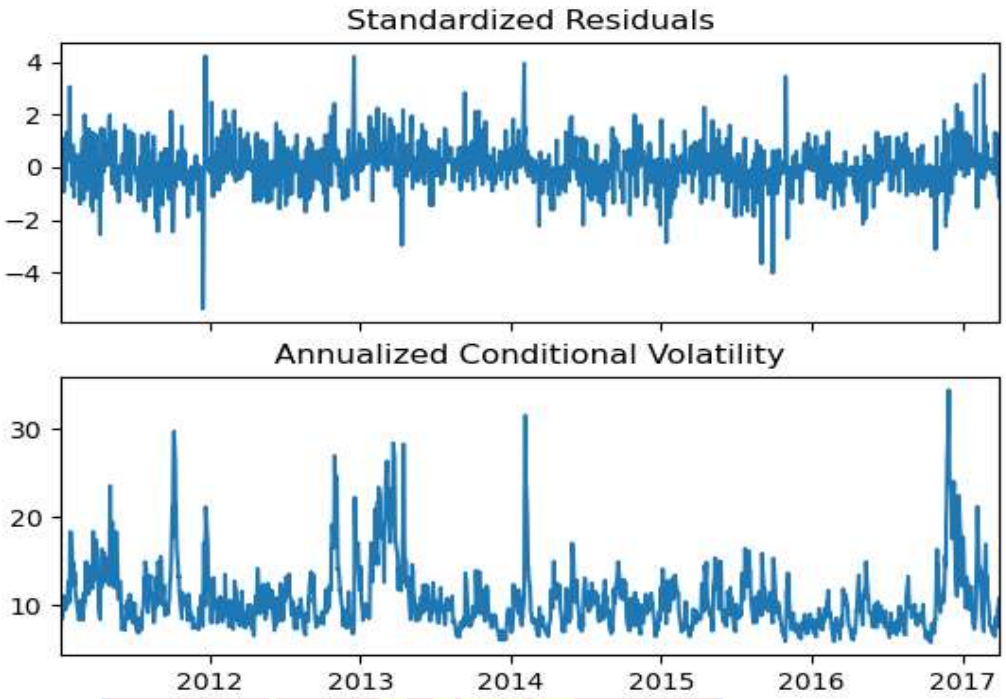

Figure 9: Evolution of volatility for TARCH(1, 1) with Student-t errors

Source: Field Data (2020)

The Akaike Information Criteria (AIC) was run as our model selection criteria. The AIC values are exhibited in Table 8.

Table 8: AIC values of various models

Model	Tail	AIC
GARCH(1, 1)	Normal	2195.08
GARCH(1, 1)	Student-t	1887.47
GJR-GARCH(1, 1)	Normal	2193.83
GJR-GARCH(1, 1)	Student-t	1888.99
TARCH(1, 1)	Normal	2200.78
TARCH(1, 1)	Student-t	1880.58

Source: Field Data (2020)

From Table 8, it is seen that the model with the least AIC value of 1880.58 is the TARCH (1, 1) with the Student-t conditional tails. Thus, the

evolution of volatility of the index is best described by the threshold GARCH (1, 1) with Student-t tails.

Resampling was done to convert the frequency of the data from daily to monthly. The monthly data is plotted in Figure 10.

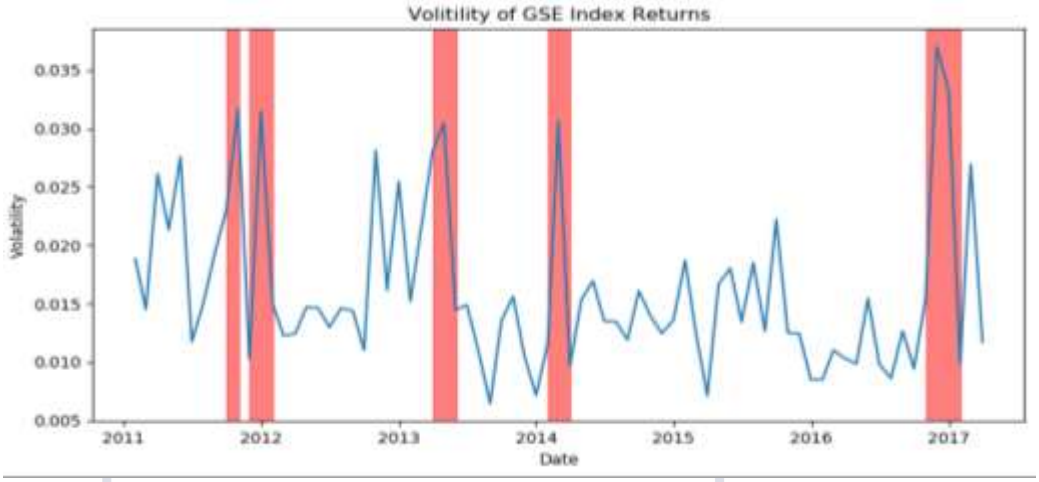

Figure 10: 12-month resampled volatility of Ghana Stock Exchange with patched regions showing high volatility.
Source: Field Data (2020)

The patches show periods of spikes in volatility around 31%-35% occurring at the beginning or the end of the year. The month were aggregated for the sample data from 2011 to 2017 and the results plotted for the AMVR as shown in Figure 11.

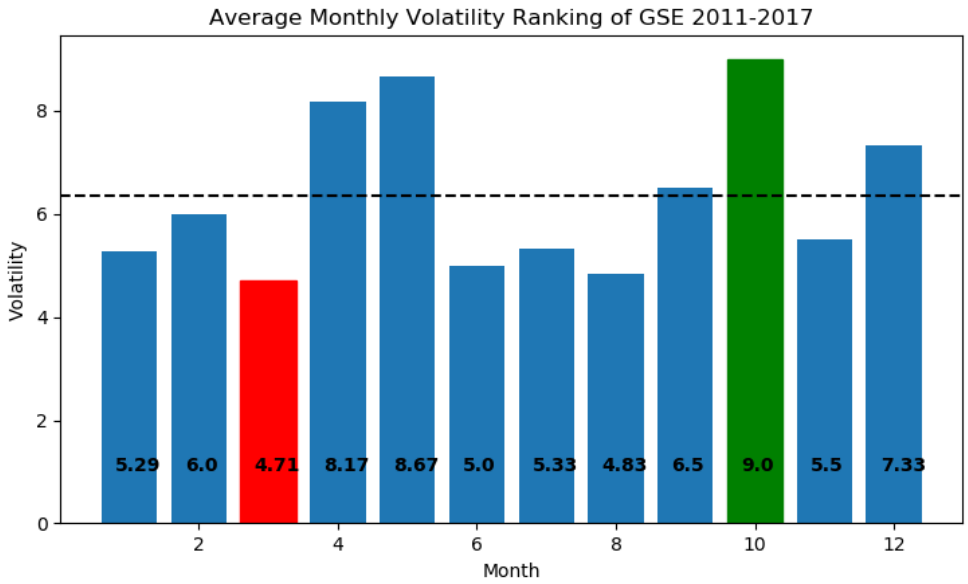

Figure 11: AMVR for Ghana Stock Exchange Composite Index returns

Source: Field Data (2020)

Figure 11 shown the month of April, May, October and December as being particularly volatile with the average volatility above the overall AMVR of about 6.2%. The month of October has been particularly volatile over the years and that of March as the least volatile. The month of December is also volatile and this confirms the time series plots.

Discussion

From the Figure 8 above, the Student t-GARCH(1,1) tracks the variance of the original returns series closely than the Normal-GARCH(1,1). Filtering out the noise that is invariably present in market data, it was concluded that the Student t-GARCH(1,1) describes better the volatility dynamics of the market for the period 2011 to 2017.

Trading on the Ghana Stock Exchange occur in spurts led by the financial and energy stocks. This is characterised by the value of 0.1974 which confirms that the market is not very sensitive to market events. Block trading

from institutional investors is the main source of liquidity in the financial and energy stocks in the market.

Alexander (2008) asserts that the GARCH error parameter above 0.1 indicates volatility is very sensitive to market events, something that has been empirically observed. Market activity can be quiet for so long on the GSE. This thin trading clearly shows in seemingly low volatility in the asset returns.

The GARCH lag parameter of 0.8014 points to mild volatility which dies out quickly in the market. Overall, the sum of volatility parameters above 0.9, according to Alexander (2008), points to a market with a relatively flat volatility. This confirms the peculiarities observed in frontier and emerging markets with thin trading.

Raunig and Scharler (2010) evaluate the uncertainty hypothesis by estimating the influence of stock market volatility on durable consumption growth, nondurable consumption growth and investment growth. Their analysis is based on quarterly time series data for the U.S.A. Based on a number of different estimates of time-varying stock market volatility, they find that stock market volatility exerts an economically and statistically significant effect on aggregate demand. Moreover, they find that the adverse effect of stock market volatility on aggregate demand depends on the extent to which decisions are reversible. Based on their richest specification (Table 3), they find that an increase in volatility by one standard deviation reduces the quarterly growth of durable consumption by around –0.70 percentage points, whereas the effect on the growth of nondurable consumption is only –0.14 percentage points. Investment growth responds with a lag of one quarter and declines by 1.12 percentage points.

This chapter has established the TARCH (1, 1) with student-t conditional tails as the model describing the evolution of volatility for our sampled returns. The study has also been able to establish, after resampling the daily to monthly data, October as the most volatile and March as the least volatile across the years. This information is of use to investors regulators and policy makers. Investors, depending on their risk appetite, know when to enter and when to exit this market. Policy makers will know when to calibrate fiscal and monetary tools to dampen the devastating effects of the markets during these months.

This confirms the study by Akiwori (2019) who also recorded similar result in their study on the volatility of Nigeria Exchange Market.

Chapter Summary

This chapter explains discuss the results from the objective of the study. GARCH model was used to test the volatility of the share price of Ghana Stock Exchange market. The chapter started with the descriptive statistics of the data from the Ghana Stock Exchange. This was then followed by the analysis of the objective of the study.

CHAPTER FIVE

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

Introduction

This Chapter of the study presents the summary of the findings, conclusions and the recommendations on the key findings of the study. The summary presents significant findings of the study with conclusions tackling the overall result of the study in light of a brief overview of the problem statement, objectives, methodology and research question tested. Furthermore, recommendations were made for the connected institutions and suggestions were made for future researches.

Summary of Findings

The study sought to examine the effects of the performance of the Ghana Stock Exchange on Investor as its main objective. In realizing the specific objectives of the study, the study first explained conceptual issues and reviewed literature relevant to the study. The objectives and the research questions of the study were executed by employing GARCH model to generate volatility of returns of Ghana Stock Exchange All Share Index (GSE-ASI).

Pertaining the specific objective of the study which sought to examine the nature of the evolution of volatility on GSE, the study shows that the return of GSE showed an upward trend starting from 2011 through to 2017.

In analysing the effect of the periods of high or low volatility on Ghana Stock Exchange, the study found that high or low volatility could serve as a guide to investors to make informed decisions regarding investment in the Ghana Stock market. Also, the finding of the study established that the period

of low or high volatility of stock returns of Ghana Stock Exchange is significant in influencing investors decisions as to whether or not they should put their money in the stock market.

Conclusions

The study concludes that a comprehension of the nature of the evolution of volatility on GSE is very crucial in determining the cost of capital of financial security and in evaluating investment decisions in case of growing economies particularly where the market comprises investors who are risk–averse. Also, it is concluded with the upward trends of returns of GSE, investors can predict the pattern of their investment with some level of certainty and this has the potential of guiding their investment decisions.

Recommendations and Policy Implications

The findings of this study have some implications for both policy makers and investors on the Ghana Stock Exchange as volatility of return of a listed firm arise from the fact that returns on stocks may be captured as the true intrinsic value of a firm and thus the investors might develop interest in investing on the Ghana Stock Exchange.

Suggestions for Future Research

While it is important to know the nature of the evolution of volatility on Ghana Stock Exchange and the significance of low or high volatility on Ghana Stock market, there is the need for a more detailed empirical studies on the factors that determine the volatility of returns of the Ghana stock market so as to shed light on the specific cause of the wild volatility of stock returns to inform a particular policy in the area.

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