

Volatility Clustering, Leverage Effects and Risk-Return Trade-Off in the Nigerian Stock Market

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Abstract The configurations of volatility and leverage effect in financial markets play important roles in portfolio management, especially in asset allocation, asset pricing, portfolio selection, portfolio diversification, and risk management. This paper examines the phenomenon of volatility clustering and leverage effect (asymmetry) in stock returns of the Nigerian stock market, using the daily All Shares Index of the Nigerian Stock Exchange during the 7-year period, covering 4th January 2010 through 2nd August 2016. Descriptive statistics, Generalized Autoregressive Conditional Heteroscedasticity (GARCH (1.1) and GJGARCH (1.1) were employed in the data estimation. The results affirm the presence of volatility clustering, persistent clustering and significant leverage effects of stock returns in the Nigerian stock market. The findings have policy implications for the regulation and policy expediency of measures that progressively checkmate the patterns of volatility in the Nigerian stock market as well as control negative news (such as insecurity, political instability, and macroeconomic policy inconsistency) which largely increase the level of market uncertainty and investors' exposure to risks in the market.

Keywords: asymmetric volatility, GARCH effect, leverage effect, persistent clustering, volatility clustering

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1. Introduction

The relationship between firm-specific variables and volatility behaviour, especially the leverage effect, continues to excite finance academics, investors, investment analysts, regulators and government at large, and yet it is one of the most misunderstood concepts in investing. It is a topic of continuing empirical interest but has not received much systematic investigation in Sub-Saharan African (SSA) countries, like Nigeria. Volatility is a widely discussed measure of risk in finance: it refers to the risk associated with the upward and downward swings in the value of an asset. It is a useful summary measure of the likely effect of a change in returns on an asset's value. Thus, the higher the volatility, the riskier the security. A highly volatile asset or security is one that experiences erratic movements, rapid increases and dramatic falls, and hitting new highs and lows. Investing is inherently about risk-taking and like a sharp knife, it cuts both ways. Investors and the economy are balanced on a knife-edge, implying anxiety about the effect of risk. This explains why many market risk-assessment models use estimate of volatility parameters. Secondly, the concept of volatility has been used in several financial models including the Modigliani &

Miller (MM) model [1]; Capital asset pricing model (CAPM) [2,3,4]¹; pricing of options and corporate liabilities (Black-Scholes model) [5]², and portfolio diversification and hedging [6]. Above all, understanding idiosyncratic volatility is important because of its direct implications on investors' portfolio and hedging strategies [7]. It is equally important because undiversified investors demand a premium for holding a firm's shares that are positively related to its idiosyncratic risk [8].

Stock market returns are a critical sustainability factor for investment decision-making. Investors and stock market participants pay particular attention to the properties of stock market return volatility, such as time-varying volatility, volatility clustering/pooling, long memory or long-term dependence, and leverage effect [9]. Similarly, stock returns volatility is a barometer or useful

¹ Although theoretically, every asset pricing model is a capital asset pricing model, the constant reference in both the finance literature and profession/practice is to the specific model of Sharpe [2], Lintner [3] and Black [4], commonly referred to as the Sharpe-Lintner-Black version of the CAPM [116].

² The Black-Scholes model, also called the Black-Scholes-Merton model, uses volatility estimate as one of the six variables in the option value computation. Volatility is estimated on the basis of the perspectives and expectations of investment analysts and investors. The other variables are the type of option, underlying stock price, time, strike price, and risk-free rate.

measure of uncertainty about not just the stock market but the country's macroeconomic environment. Furthermore, the behaviour of stock returns is very fundamental in sustaining the interests of present as well as prospective investors chiefly for three reasons. First, the behaviour of stock returns is vital for the prediction of an investor's risk-return trade-off in the market. As a measure of risk exposure in investment, investors have more than a passing interest in this metric. Second and related, exploring the behaviour of stock returns is very important in asset allocation, pricing of primary and derivative assets, portfolio selection and diversification, and risk estimation and management [10]. Third and very important, the patterns of volatility in stock returns provide an important investment signalling effect. Investors need to ascertain how the time series respond to different kinds of news: symmetrical or asymmetrical response. In essence, the relationship between economic information events (firm-specific or macroeconomic) and changes in stock return volatility is a search into how corporate and public information induces changes in asset prices and values. Basically, investors study the impact of news on volatility. If the impact is asymmetrical, it is referred to as asymmetric volatility or leverage effect³. Thus, the leverage effect designates the inverse relationship between asset value and volatility.

The phenomenon of volatility refers to the tendency of large changes in prices of financial assets to cluster together, resulting in the persistence of the magnitudes of price changes [11]. As first noted formally by Mandelbrot [12], volatility clustering refers to the tendency of large changes in asset returns to be followed by large changes, of either sign, and for small changes to be followed by small changes. This phenomenon is also referred to as heteroscedasticity [13]. Volatility signifies the risk profile (that is, the extent to which daily, weekly or monthly stock prices change from the average) in the stock market. Brooks [14] advances that the shift in volatility over time is caused by the perceived variability (that is, not being constant) of market and firm-specific risks, making some periods riskier than others. Apart from interest in the risk profile of the market, market participants and regulators respectively use the patterns of volatility in financial assets in portfolio management and macroeconomic policy decisions. To be sure, corporate executive and market participants (investors, analysts, brokers, and dealers) as well as regulators (policy makers) are all interested in stock returns and market volatility precisely for the same reason. Excessive volatility gives an unhealthy signal or picture of a firm's security in particular, and the stock market as a whole. Besides, patterns of volatility in financial assets are the critical inputs in asset allocation, asset pricing, portfolio selection, portfolio diversification and risk management [15].

There is a large evidence in the finance literature that stock returns from emerging markets exhibit different characteristics compared to those of the developed markets [16,17,18,19,20]. Also, it is claimed that returns from emerging markets present higher volatility, fatter tails, and greater predictability [16,19]. Moreover, unlike developed markets, volatilities in emerging markets are largely

determined by information variables (local news) [18], or are associated with significant local events or large and sudden shifts [17]. For instance, it has been canvassed that negative shocks/news increase the volatility more than positive shocks/news of equal size [21,22]. The literature also documents the presence of leverage effect in different geographical contexts and markets [21,22,23,24,25]. However, there is no consensus on which factors influence the size of the leverage effect. The thinking behind the leverage effect is that, holding debt constant, as the price of a stock falls so does the firm's equity value decrease, and this makes the firm riskier and more sensitive or vulnerable to negative shocks/news due to a higher debt-to-equity ratio [21,22]. The trade-off theory emphasizes the benefits and costs of debt and holds that high risk is associated with high returns. Thus, as the emerging stock markets are considered highly risky, so are they linked with high potential returns. Although increased risk following a higher debt-to-equity ratio may likely increase the firm's default risk [21,26], increased debt has also been postulated as a solution to the principal-agent problem [27,28].

Ordinarily, stock market volatility evokes both fear and cautious optimism. Naturally, investors prefer a stock market that is marked by record gains. Thus, in trying to keep things in perspective, investors may feel somewhat uneasy about a stock market's historical performance, chiefly its immediate past. Drops in the stock market in the past week tend to make investors rather apprehensive and nervous. Hence, events that provoke more volatility in the stock market give room for cautious optimism. A volatility increase portends a rise in financial risk which can adversely affect investors' asset values and wealth. A number of stylized facts have been presented in the volatility literature [23]. A stock market exhibiting excess volatility not only threatens investors' confidence but also the stability of the market and the economy as a whole. An increase in volatility which is a reactive absorption of new information about fundamentals or some expectations about them, may not necessarily generate doom and gloom in the market. In other words, not all volatility could be deemed harmful. However, if increased volatility cannot be explained by the prevailing levels indicated within the economic context, such volatility will lead to misallocation of resources [29]. Volatility clustering is a prominent stylized fact which suggests that a large (small) market shock tends to be accompanied by a similar large (small) stock.

The literature on volatility presents several stylized facts. In the main, market volatility is attributed to the volatility of macroeconomic variables [30]. Our understanding of the volatility of macroeconomic variables has been facilitated by research attention to the dimensionalities necessary to explain market behaviours and their implications for portfolio management. Macroeconomic variables of special empirical mention are financial leverage, changes in expected returns to stock, interest rates, ex post dividends volatility, changes in the volatility of future cash flows and of discount rates. Specifically, volatility is occasioned by financial leverage [21,22]. Changes in stock market volatility is as well ascribed to changes in expected returns to stocks [31-36]. Macroeconomic volatility is associated with interest rates [37,38]. It has also been canvassed that the high volatility the stock market experiences relative to ex post dividends volatility is induced by either a change

³ The terms *leverage effect* and *asymmetric volatility* are both synonymous and used interchangeably.

in the volatility of future cash flows or discount rates [39,40]. The evidence of Schwert [23] reinforces the prognosis of Officer [30] that the level of stock volatility is determined by a number of economic variables, such as real and nominal macroeconomic volatility, economic activity, financial leverage, and stock trading activity.

Two important features of time series of asset returns are: the presence of volatility clustering and the high kurtosis (fat tails and a high peak) [41,42]. Historical observations of asset price movements and returns have shown that volatility is not constant over time [12]. Also, extant empirical studies, as cited above, illustrate two interpretative deductions, to wit, (a) stock market volatility is a function of the overall health of the economy and of real economic variables which tend to display persistence; and (b) stock returns volatility potentially undermines a country's financial stability and the growth of stock markets. As Black [21] postulates, the leverage effect incorporates the impact of losses on future volatility more than of profits. The leverage effect refers to the relationship between stock returns and changes in volatility. Thus, as stock price falls, volatility increases and, as stock price rises it (volatility) decreases. The term 'leverage effect' derives from the assumption that a firm is leveraged; as such, when asset prices decline, the firm becomes more leveraged and its volatility increases as the stock price declines precipitously towards the level of debt. In other words, as the value of the firm's debt rises following the fall in asset prices, it becomes more leveraged, and the firm's stock is said to be volatile or experiences an increase in volatility. Conversely, as its asset prices rise higher and above the level of debt, its volatility decreases. This capital structure perspective of the market valuation effect of a change in a firm's equity is equally shared by Figlewski and Wang [43]. The leverage effect, first enunciated by Black [21], postulates that: *"a drop in the value of the firm will cause a negative return on its stock, and will usually increase the leverage of the stock. [...] That rise in the debt-equity ratio will surely mean a rise in the volatility of the stock"*.

Technically, a leveraged firm is bound to become more highly leveraged when its stock price declines. In other words, a fall in a firm's stock price is tantamount to a fall in the value of the firm. However, Black [21] argued that stock volatility response to the direction of returns is too large to be explained by leverage alone, a position buttressed by Christie [22], Schwert [23], Bollerslev, Engle and Nelson [44]. More pointedly, Figlewski and Wang [43] assert that "the Black's 'leverage effect' is nothing more than a 'down market effect' that may have little direct connection to firm leverage". These interpretations have not been subjected to systematic comparative assessment from a Sub-Saharan African (SSA) context. The empirical literature on the assessment of the simultaneous presence of volatility clustering and leverage effect in SSA countries is just at its embryonic stage. Related SSA studies on the phenomenon of interest and their contextual stock markets include those by: Adjasi [45], Magnus and Oteng-Abayie [46], Adjasi, Harvey and Agyapong [47], Coffie [48] for Ghana; David and Peter [49], Ogum, Beer and Nouyrigat [50], Wagala, Nassiuma, Islam and Mwangi [51], Maqsood, Safdar, Shafi and Lelit [52], Moyo, Waititu, and Ngunyi [53] for Kenya; Ayele, Gabreyhannes and Tesfay [54]

for Ethiopia; Thorlie, Song, Wang, and Amin [55] for Sierra Leone; Ahmed and Suliman [56] for Sudan; Eskandar [57] for Egypt; and Okpara and Nwezeaku [58], Emenike [59], Onwukwe, Bassey and Isaac [60], Adesina [61], Atoi [62], Osazevaru [63], and Auwal [64] for Nigeria. However, SSA studies in this genre pale in comparison with those from Asia and developed countries. It also opens a wide window of empirical opportunity to contextualise the excess volatility claims which Batra [65] believes may explain why African countries (Nigeria in particular) have not attracted much portfolio or equity investment like the emerging capital markets of Asia and Latin America. From this perspective, an important empirical question is: What drives the stock market volatility in Nigeria? An empirical examination of this kind elucidates the nature of volatility in the Nigerian stock market. Nigeria's quest to be among the World's top 20 economies by the year 2020 requires an active and efficient capital market to harvest huge foreign and domestic investments necessary for a sustained economic transformation.

Owing to their critical role in economic development, financial markets have long been of interest to men of affairs (governments, business leaders, investors, researchers, investment analysts) and the society at large. The various interest groups evaluate financial markets from different perspectives. An important component of the financial market is the capital or stock market, the other being the money market. One characteristic of the stock market that has generated a lot of interest both in the financial literature and among market participants and policy makers is the relationship between the stock returns and volatility. The latter is related to, but not the same as, risk. Volatility refers to the quantum of uncertainty or risk about the size of changes in the value of a security or firm. Because risk is associated with undesirable outcome, it (risk) is inherent in every investment. This implies that there is always a chance that the investment market will decline and diminish the value of the investment or holdings. Volatility is a technical euphemism for 'swings', fluctuations or ups and downs in share prices. It represents the frequency and severity of the fluctuation in the market price of an investment (security or asset) or the degree of change in the stock market value. The more the market swings, the more volatile it is characterized. Such fluctuations in stock prices are natural in stock market as share prices respond to the forces of supply and demand. Thus, stock prices are subject to constant market change. Volatility is symptomatic of a highly liquid stock market [25], which is a measure of uncertainty possibly from a positive outcome [66,67].

The extent to which volatility manifests in a country's stock market encourages or discourages investment (local & foreign). The prognosis that the volatility of financial assets' prices potentially undermines the stock market growth reinforces the presumption that financial stability is endangered more or less by sudden shifts in volatility than by sustained increase in the level of volatility [68]. That the NSE powers the economic development and growth of Africa's largest economy is indisputable. Since the NSE began operations officially on August 25, 1961, even though informal operations commenced earlier in June, 1961, empirical exploration of the volatility of the market has been few and far between. Therefore, the crucial question is this: To what extent does the phenomenon of

volatility clustering and leverage effect manifest in the Nigerian stock market? The paucity of research in this important praxis is not analytically conducive to the growth of the economy and the country's vision of joining the league of the World's top 20 economy by the year 2020. To be sure, econometric investigations of the impact of stock market returns volatility are affirmative grounds for policy options for promoting the development and growth of a national stock market.

This study examines the presence of volatility clustering and leverage effect in stock returns in the Nigerian stock market. The hypothesized relationships are that: (1) there is no volatility clustering in the stock returns volatility of the NSE; and (2) leverage effect does not exist in the stock returns volatility of the NSE. Studies of this kind enrich the literature and are potentially beneficial to extant and potential investors, analysts, policy makers and regulators, and researchers. The rest of the paper is organized as follows. Section 2 presents the relevant theoretical and empirical literature. Section 3 describes the data and econometric methodology, including a specification of the mixed GARCH-Jump model. The results are discussed in Section 4, while Section 5 concludes the paper.

2. Literature Review

Capital markets play a very significant role in economic growth and development of a country. A functional stock exchange provides liquidity, contributes to capital formation, and reduces investment risk by offering opportunities for portfolio diversification [69]. Large equity markets offer additional advantages of lowering costs of savings mobilization and facilitating investments in most productive technologies [70] and productive sectors of the economy. However, the stock market remains a volatile investment window. Stock return volatility represents the irregularity of stock price changes over a period of time. Market participants (investors, analysts, brokers and dealers) and regulators have more than a passing interest in idiosyncratic volatility of stock returns. Because volatility redounds to risk, 'excessive' volatility with its impact generates interest, especially if this is not triggered by any significant news about the firm, market or the economy. Above all, excessive volatility or noise undermines the signalling effect of stock prices, that is, the usefulness of stock prices as a signal about the intrinsic value of a firm, which is a central concept of the efficient market hypothesis (EMH) or of the informational efficiency of markets paradigm.

Since the 1980s, the imperatives of globalization occasioned the integration of national economies and financial markets into a global market and boosted the growth of cross-border international portfolio investments. The momentum of increased economic and financial liberalization and integration of markets forced many countries to open their capital markets to foreign investors, resulting in the growth of foreign investments in these markets. Increased foreign participation brought in its wake the influx of foreign capital in these markets. The injection of liquidity is salutary to not just for the financing of national economic development but for the efficiency and reduction of cost of capital associated therewith in the markets [18,71]. In addition, foreign investors play a potential monitoring role

and assist emerging market firms with the tools and incentives to improve corporate governance [72,73]. Specifically, the stabilizing effect of foreign investors in relation to firm-level stock return volatility, is to be traced in no small part to their foreign corporate ownership and increased involvement relations in risk-sharing, corporate governance, disclosure and operations. The reading of the literature is that good corporate governance, of which disclosure quality is an ingredient, plays a significant role in improving corporate performance which potentially leads to greater risk sharing [8] and leads to lower or reduces volatility [74]. Notwithstanding the benefits of internationalisation of capital markets through economic and market liberalisation and regional integration of many developing countries, research evidence coheres with anecdotal evidence that the speculative short-termist behaviour of foreign portfolio investors have a destabilizing effect on the local stock market and increase its risk [75,76].

Generally, the volatility of stock returns, instead of being a destructive tendency, signifies a positive implication. In the main, it denotes market efficiency in stock markets. Where, however, price fluctuations become excessive, they assume a destructive effect on the financial market efficiency. As the saying goes, excess of anything is bad: thus, excessive volatility can be destructive and lead to a catastrophic crash or crisis in financial markets. In finance, stock return volatility is underlain by a dichotomy of endogenous and exogenous influences. The endogenous influences or factors refer to domestic or country-specific physical, political and socioeconomic characteristics of the country. These incorporate trade/market, economic and political conditions or relationships with trading/international partners that are somewhat within the sphere of influence or control of the national government. Specifically, these encompass macroeconomic variables such as monetary and fiscal policies and implementation, various policy mechanisms of government at all levels that define the operating terrain for businesses, including market and trade liberalisation, rapid integration into the global environment, attraction of significant levels of foreign investment into the economy, availability of critical mass of human resources (capital and skills capacity) in various sectors of the economy, the quality of civic and private sector relationships with government agencies, and other endogenous strengths in terms of policy mechanisms for education, healthcare, security of lives and property, strong judicial system, tourism, etc. In effect, arising from the working of a system, micro-and macro-economic, political, legal, sociocultural conditions, market structure and efficiency properties, the level of physical and social infrastructure, and competition and demand are endogenous influences expected to impact investment strategies and stock returns volatility.

Exogenous influences, defined as factors which influence the endogenous variables, are often imposed on a system from outside. In other words, the endogenous factors are considered to be outside the economy or outside the circle of influence and control of the country. For example, the dominant firm condition (structural monopoly or oligopoly) in an industry can be endogenous where the economies of scale allow large firms to crowd out smaller ones (as in the petroleum and telecommunications industries), or it could

be exogenous, where it is imposed by the state giving one firm a legal monopoly. The extent to which exogenous forces influence endogenous factors depends to a considerable degree on the strength of the economy, government and resilience. Exogenous factors that circumscribe stock return volatility are the relationships of the economy and markets with regional and global economies/markets and the external factors that affect them. These include trade links/partnerships, global market conditions, and strategic alliances. Technology is another exogenous factor to most SSA countries. As modern economies are increasingly technology-driven, new technologies can put a country's business landscape at a disadvantage. For instance, Nigeria's refineries have become obsolete and unproductive because their technologies have been overtaken by new refining technologies. Endogenous and exogenous factors are mutually complementary to one another.

Research by Douma, George and Kabir [77] and Wang and Shailer [78] suggests that the positive effect of foreign ownership on firm performance is substantially attributable to the significant equity holdings of foreign corporations which translate into higher commitment and longer-term involvement. The suggestion adumbrates the significant impact of foreign institutional and corporate shareholders on the performance of emerging market firms with respect to corporate governance, corporate performance and low volatility. Foreign ownership interest can be decomposed into foreign institutional and foreign corporate shareholdings. Thus, in examining the role of foreign ownership in emerging markets, it is instructive to clarify and incorporate this distinction. This is because, in many jurisdictions, the dynamics governing institutional investments and corporate shareholdings are vastly different. Also, research has shown that the impact of foreign institutional investors on firm performance is not clear-cut [77,78]. The distinction between foreign portfolio/institutional ownership and foreign direct/corporate ownership is particularly relevant to SSA emerging economies, whose gullibility is colossal in respect of external capital inflows, whether Chinese loans or portfolio investment. The International Business literature is also replete with evidence of the benefits of foreign corporate ownership to host countries through the accruing advantages of their ownership and internalisation advantages (resource endowments and capability) - managerial and financial, superior corporate governance disposition, including financial disclosure and monitoring abilities. However, foreign portfolio/institutional ownership uses their superior resource advantages to egregious exploitation of their host countries' markets, thus making the economy vulnerable or hostage to their shenanigans, including affecting the market volatility.

The daily, quarterly and monthly movements of stock prices can be histrionic, and it is this instability which also generates the high market returns that attract further investments. However, these benefits are unrealizable if the equity market is inefficient and/or the financial system is inchoate. Inefficient financial system castrates the equity market which, in turn, blights accurate representation of information about the true fundamentals of the economy which may mislead investors. In such circumstances, the stock market's capacity to influence significant developments in the economy may be attenuated. In developing countries, the high level of price volatility on stock market returns

reduces the efficacy of price signals in allocating investment resources [79]. To be sure, investors are averse to risky markets/economies. African economies are plagued by economic and socio-political upheavals, a development that is not only risky for investment but dents investors' confidence, and also antithetical to economic development [63]. In their study of volatility in 20 emerging markets, Bekaert and Harvey [18] found that it differs across emerging markets and that the more liberalized the local capital market the greater the correlation of its returns with world market returns. In effect, the correlation between the local market returns and world market returns increases through and with market liberalization. Also, while examining changes in the level and volatility of stock returns, inflation and exchange rate in stock market openings of 20 emerging markets, Kim and Singal [80] show that stock returns increase immediately after market opening without a concomitant increase in volatility. Xuan [81] finds that foreign ownership decreases a firm's stock price volatility, while Li, Nguyen, Pham and Wei [82] suggest that exposing domestic stock markets to foreign investors reduces stock price volatility and injects a stabilizing effect in emerging markets.

2.1. Stylized Facts of Financial Returns

In ordinary parlance, a stylized fact is a generalizable assumption about the real world, constructed to be factual. Such summarized presentation stems from systematic empirical investigations. Technically, as an economic term, a *stylized fact* refers to "empirical findings that are so consistent (for example, across a wide range of instruments, markets and time periods) that they are accepted as truth, and due to their generality, they are often qualitative" [83]. Simply put, the term 'stylized facts' refers to all nontrivial statistical properties which are observed throughout financial markets. Cont [84] identifies eleven such stylized statistical facts which are common to a wide set of financial assets, namely: (1) Absence of autocorrelations, (2) Heavy tails, (3) Gain/loss asymmetry, (4) Aggregational Gaussianity, (5) Intermittency, (6) Volatile clustering, (7) Conditional heavy tails, (8) Slow decay of autocorrelation in absolute terms, (9) Leverage effect, (10) Volume/volatility correlation, and (11) Asymmetry in time scales. Also, Chen [85] associates financial returns with the following stylized facts: First, the distribution of returns is not normal, but exhibits the following empirical properties. The time series returns are (a) stationary, implying that parameters such as mean and variance do not change over time; and (b) the distribution of the returns is approximately symmetric, with fat tails and a high peak. Second, there is almost no correlation between returns for different days. Third, the correlation between magnitudes of returns on nearby days are positive and statistically significant, and fourth, the daily stock returns are generated by a nonlinear process [86]. Against this backdrop, asset returns, rather than asset prices, have been the object of most financial studies, precisely because the goal of investing is to generate returns (that is, to make profit). Two reasons underpin this empirical focus [87]. First, for investors, return of an asset is a complete and scale-free summary of the investment opportunity. Second, the nonstationary nature of asset prices commonly makes the statistical

analysis difficult. Financial returns exhibit characteristics of (a) being almost unpredictable, in tandem with the efficient market hypothesis, (b) surprisingly large number of extremes (fat tail distributions), and (c) episodes of high and low volatilities (volatility clustering).

2.2. Why does Volatility Matter?

Since Black's [21] seminal presentation on stock price volatility changes, the phenomenon known as 'volatility clustering' has excited academics, market participants (traders or investors) as well as regulators. Not only is volatility clustering regarded as one of the most important characteristics of financial data, but also the perception that it potentially produces a more realistic estimate of risk has influenced its incorporation in stochastic models in finance. The notion of volatility clustering is evident from the prognosis that today's volatility is positively correlated with yesterday's volatility. The implication is twofold: (a) if yesterday witnessed high volatility, today is also likely to experience high volatility, vice versa; and (b) volatility is a conditional phenomenon, where yesterday's volatility is necessary and sufficient condition for today's volatility. Over the years, volatility clustering has been investigated by modelling the price process with the ARCH-type model. The two classical methods used in the ARCH genre are the autoregressive conditional heteroscedasticity (ARCH) and the generalized autoregressive conditional heteroscedasticity (GARCH) models [44,88,89]. Studies have highlighted the link between stock return volatility, firm performance, and stock returns [90]. Volatility information is useful to market participants, especially traders, as a determinant of the market's investment outlook. The information enables traders to formulate arbitrage strategies to profit from a falling market or identify possible reversals. Volatility affects stock prices in two directions. On the one hand, volatility signals movement of stock prices such that the more volatile a market is, the larger the price moves, which can provide greater opportunities to cash in profits, vice versa. On the other hand, increased market volatility leads to riskier market outcomes, an upshot of which is steeper decline in returns.

Recent work, including Akter and Nobi [91], proposes that volatility is necessary to determine the performance of a stock because it represents how risky a stock is and therefore its risk profile. When volatility increases, risk increases and returns decrease. Lower volatility implies a higher probability of a rising market and a higher volatility signifies a higher probability of falling market. Thus, as the stock market rises, volatility tends to decline, vice versa. As volatility increases, risk increases and returns decrease. Basically, a high stock risk implies high return, vice versa. Volatility has different uses or applications for different market participants as investors respond to the uncertainty in markets and in countries. As a signal of the movement of stock prices, volatility serves a variety of purposes: trading, investing and predicting the direction of the stock market. In this respect, volatility plays an important role in the economy, even if it has frightening implications for individuals and organisations. For example, traders use volatility to determine the investment outlook of the market, to enable them formulate arbitrage strategies in a declining market or identify possible reversals. Predicting

the market's direction potentially enables traders or investors to formulate a good expectation of the economy. So, the application of volatility goes beyond the stock market. In some cases, volatility is expressed in terms of a single major stock and its performance becomes a benchmark indicator of stock market trends and a sign of what is expected as it is used to compare other stocks in the market. For traders and investors, price volatility presents opportunities to buy assets cheaply and sell when overpriced [81].

2.3. The Asymmetry of Stock Returns Volatility

Stock returns volatility rises more following stock price declines (bad news) than it does with stock price increases (good news). As the pricing of securities depends on the volatility of each asset, an increase in stock market volatility brings a large stock price change in up-and-downward swings of the stock value. Investors interpret the upswing as an increase in the risk of equity investment and this may trigger movement of investments away to less risky assets. On the other hand, investors interpret the plunge in stock market volatility as a decline in the risk of equity investment which may activate a large flow of investments into the assets. This reaction has an impact on business investment spending and economic growth. In their study of the effects of good and bad news on volatility in the Indian stock markets using the two common asymmetric volatility models (EGARCH and TGARCH models) during the global financial crisis of 2008-09, Goudarzi and Ramanarayanan [25] found returns series to react to the good and bad news asymmetrically. They also found the presence of the leverage effect, implying that the negative news has a greater impact on volatility than a positive news.

Njimante [92] alludes the negative relationship between stock returns and volatility to natural time variation in the risk premium on stock returns. In other words, an unexpected increase in volatility today leads to upward revisions of future expected volatility where such revisions of the risk premium are expected to compensate for the greater risk. The author further argues that a higher risk premium prospectively leads to a greater discounting of future expected cash flows, holding the cash flows constant, and reduces stock prices or present negative returns. As for Izz, Qasim and Ahmed [93], the negative relationship between changes in stock return variances and stock returns stems from the fact that the relationship between volatility today and returns today is actually strongly positive, but that between the day after today's volatility and returns today is negative. This regularity is true for large and small capitalization firms and similar for firms with little or no financial leverage. In addition to debunking the leverage and risk premium hypothesis for the asymmetric effect in volatility, the authors added that growth opportunities are "real options" on future cash flows from assets in place and firms with greater volatility would have more valuable growth opportunities and higher equity values.

2.3.1. Volatility Impact in Market Returns

As surmised by Griffin, Nardari and Stulz [94], the dynamic relation between market-wide trading activity and stock returns has important implications, not least that

many stock markets exhibit a strong positive relation between turnover and past returns. The relation enhances our understanding of the determinants of trading volume, liquidity, and stock returns. Importantly too, the relation potentially helps (i) market-makers and liquidity providers obtain forecasts of trading intensity; (ii) portfolio managers devise efficient trading strategies, and (iii) regulators and policymakers find ways to improve the liquidity and efficiency of financial markets. The findings of Wagner and Marsh [95] about a strong relationship between volatility and market performance support the evidence that volatility tends to decline as the stock market rises and increases with a fall in stock market. An increase in volatility leads to an increase in risk and a decrease in returns. The greater the dispersion of returns from the mean, the larger the drop in the compound returns. This corresponds with the modern portfolio theory that the higher the standard deviation, the greater the dispersion of returns and the higher the risk associated with the investment. Volatility creates risk that is associated with the degree of dispersion of returns around the mean.

2.4. The Volatility of Stock Model

There is a large literature on modelling and forecasting stock returns volatility, although empirical focus on the NSE has not been systematic. Magnus & Oteng-Abayie [46] are in agreement that the growing interest in financial markets is not unconnected with the recognition by market participants, analysts and policy makers and regulators of the increasing impact of financial market variables on the economy and on economic policies. To be sure, the behaviour of financial market variables is important in determining the risk levels, asset pricing, stock returns and portfolio choice and weighting. As Magnus and Oteng-Abayie [46] have observed, the empirical interest of researchers is the ability to model and forecast future movements in stock returns based on the information content of historical trading activities. In the present study, we model and quantify volatility of returns in the NSE using different types of GARCH models. The Autoregressive Conditional Heteroscedasticity (ARCH) proposed by Engle [88] and its generalization, the GARCH model by Bollerslev [89], provide a convenient framework for empirical assessment of time-varying volatility in financial markets.

The presumption of the standard GARCH models is that positive and negative error terms have a symmetric effect on the volatility [54]. That is to say that good and bad news have the same effect on the volatility in this model. In practice, however, this assumption is often violated, in particular by stock returns because volatility increases more after bad news than after good news. Paul [96] canvasses the suitability of the ARCH family of models for describing volatility of stock markets. Their appropriateness for analysing volatility of stock markets is based on their capacity to estimate asymmetric impact of good news (market rally) and bad news (market retreat) on volatility transmission with a high level of accuracy, a view also shared by Magnus and Oteng-Abayie [46]. Christos [29] reports that GARCH is the best among several models in describing and forecasting stock market volatility and future returns volatility. The conditional variance in the GARCH model responds to positive and

negative residual (t-1) in the same manner, with high level of accuracy.

2.5. Empirical Review

The recent global economic meltdown indeed revealed that stock return volatility has the potential to undermine a country's financial stability as well as the global economic status quo. With increased role of financial markets as an avenue of intense risk, investors have become very cautious of highly volatile equity markets or the intensity of volatility of episodes in the market. This occurrence can dent consumer and business confidence, which in turn, could threaten the stability of national and global stock markets, depending on the global status of the stock market in question⁴. Before and after the 2008 global economic meltdown, there have been studies on volatility of stock returns in both developed and emerging markets. The focus of the investigations was on the time series behaviour of stock prices, in terms of volatility and information symmetry, using variations of GARCH models. For example, Glosten, Jagannathan and Runkle [41] examined the relationship between stock prices and volatility of stock returns and found that unexpected stock market returns are negatively related to unexpected changes in volatility. While arriving at similar results with Glosten et al. [41], Campbell [97] concluded that an increase in stock market volatility raises required stock returns and lowers stock prices. Glosten, et al. [41] further observed that unanticipated returns result in reduction in a conditional volatility, while negative unanticipated returns lead to upward movements in conditional volatility.

Kim and Kon [98] noted a significant foreign influence on the time-varying risk premium for US stocks but no significant relationship between the conditional expected excess returns and conditional volatility on S&P 500. Richard [99] observed a higher volatility clustering in a number of emerging markets. He argued that market liberalization demonstrates that investment flows from developed markets are very sensitive to changing economic conditions in developing countries and thus increase market volatility. Baillie and Gernaro [100] found no relationship between mean returns on a portfolio of stocks and variance or standard deviation of stock returns. Wang and Liv [101] recorded volatility clustering and conditional non-normality in the Chinese stock market. This corroborates an earlier result by Bai, Russell and Tiao [102] that volatility clustering and conditional non-normality contribute symmetrically and non-linearly to the overall kurtosis. Long [103] reported that the ARCH model shows a statistically high persistence of volatility in the stock returns but when the iterated cumulative sums of squares (ICSS) algorithm is employed, the highly persistent volatility in return rate is reduced. He further reported that financial liberalization has a negative influence on the volatility of stock returns, more so with a large number of IPOs in the domestic equity market. Arora, Das and Jain [104] examined stock returns and volatility in 10 emerging markets of Asia and recorded the presence of volatility clustering in all the 10 markets and leverage effect in 4 of

⁴ For more information go to: <https://www.ft.com/content/8b88b8a0-5ace-11e5-9846-de406ccb37f2>, and The Financial Times [117], "Why market volatility is growing more intense".

the 10 markets. Emenike [59] modelled the volatility of stock returns in NSE using GARCH models and recorded volatility persistence in the market. Onwukwe, Bassey and Isaac [60] did the same in four Nigerian companies using GARCH (1.1) and noted volatility clustering and leverage effects in the companies. Osazevbaru [63] used TGARCH and monthly stock data to investigate the impact of market news on volatility in Nigeria but noticed no asymmetry (leverage effect).

Fang and Ngyuon [105] used GARCH to examine the risk-return trade-off in Vietnam stock market and found that idiosyncratic risk is unimportant in stock pricing while systematic risk dominates asset returns in the market. Cai, Chen, Hong and Jiang [106] used GARCH models to forecast Chinese stock market volatility with some economic variables and found that the probability of the stock market volatility improved with the combination of information on all economic variables, same as Akter and Nobi [91]. Okicic [107] used ARIMA and GARCH to analyse stock returns and volatility in the stock markets of Central Eastern Europe and South East Europe and found ample evidence of the existence of leverage effect. Sungh and Kishor [108] used EGARCH to analyse stock returns volatility effect on BRIC (Brazil, Russia, India, and China) markets and recorded a significant difference in the stock return volatility across the markets. Anusakumar, Ali and Woori [109] used various GARCH models to study the effect of investor sentiments on stock returns in emerging Asian markets and detected substantial country to country variations in the influence of market-wide sentiments on stock returns. They concluded that specific stock sentiment may have a greater influence on returns than market specific sentiment. Aziz and Ansari [110] examined the idiosyncratic volatility puzzle in the Indian stock market using GARCH model and noticed a positive relation between idiosyncratic volatility and future stock returns, but this relation is sensitive to the choices of portfolio weighting schemes, types of stocks (small, medium, and large), model specifications, and sample periods. Lucey [111] used GJR-GARCH and OLS to study the asymmetric linkages among the fear index and emerging volatility indices and found a strong relationship between fear index and emerging market returns volatility in China and Brazil [112].

3. Data and Methodology

Our objective is to establish the joint existence of volatility clustering and leverage effect (asymmetry) in the Nigerian stock market. The study used the daily All Share index (ASI) of the NSE over a 7-year period, 2010-2016, offering 1509 time series observations to estimate the variables. The required data were also validated by the Securities and Exchange Commission's (SEC's) daily ASI for the period, 4th January 2010 through 2nd August 2016. This historical period reflects long-term movements in the volatility of the asset returns. The period comprises a diversity of the market trends and turmoil.

3.1. Model Specification

We follow the GARCH model specifications of Bollerslev [89] to accommodate infinite impulse response

for the estimation of volatility clustering and Lucey's [111] GJR GARCH model to estimate the asymmetric linkage in emerging market volatility. The present study combines descriptive statistical method, GARCH (1.1) and GJR-GARCH (1.1) models to estimate the data. The descriptive statistics involve the analysis of the mean, standard deviation, variances, skewness, minimum and maximum returns of the daily all shares index (ASI) in the NSE. Thus, the descriptive statistics for volatility is given as:

$$\sigma^2 = \sqrt{\frac{N}{\sum_{i=1}^N} \left(\frac{R_i - R}{n-1} \right)^2}, \quad (1)$$

for Asymmetry (skewness), it is given as:

$$S_K = \frac{1}{N} \sum_{i=1}^N \left(\frac{\sigma}{R_i R} \right)^3. \quad (2)$$

Where

σ = Standard deviation.

N= The number of observations.

R= The sample mean of R_i .

R_i = The returns.

S_k = The skewness of asymmetric distribution.

Using the GARCH (1.1) in assessing volatility, the model is specified as:

$$\sigma_t^2 = \alpha_0 + \alpha_1 \varepsilon_{t-1}^2 + \beta_1 \sigma_{t-1}^2. \quad (3)$$

Where:

σ_t^2 = The conditional variance.

α_0 = The constant term.

α_1 = News about volatility from the previous forecast measured as the lag of the squared residual from the mean equation ε_{t-1}^2 (ARCH term).

β_1 = News about volatility on the last period variance σ_{t-1} (GARCH term).

The asymmetric nature of stock returns in the NSE is modelled with GJR-GARCH (1.1) as:

$$\sigma_t^2 = \alpha_0 + \alpha_1 \varepsilon_{t-1}^2 + b_1 \sigma_{t-1}^2 + d \varepsilon_{t-1}^2 + I_{t-1}. \quad (4)$$

Where:

σ_t^2 , α_0 , α_1 , ε_{t-1}^2 , β_1 are as explained in equation (3). I_{t-1} is a dummy variable and implies that:

$$I = \begin{cases} 1 & \text{if } \varepsilon_{t-1} < 0 \longrightarrow \text{bad news} \\ 0 & \text{if } \varepsilon_{t-1} \geq 0 \longrightarrow \text{good news} \end{cases}$$

The coefficient d is known as the asymmetry or leverage parameter. When d = 0, the system collapses to the standard GARCH. When shock (d) = positive (good news), the effect on volatility is α_1 but when the shock (d) is negative (bad news), the effect is $\alpha_1 + d$. The statistical P-value and T-value at 95% confidence level for a sample size above 120 observations are 0.05 and 1.98, respectively. When the ARCH and GARCH coefficients (α_1 & β_1) are greater

than zero and their P & T parameters are less than 0.05 for the P-value and greater than 1.98 for the T-value, the null hypothesis of no volatility clustering is rejected, but if the values are the other way round, the null hypothesis is accepted. Asymmetry is determined by the positive or negative value of its coefficient. When the coefficient has positive value, it implies that negative shock (bad news) has leverage effect (asymmetric) on the conditional mean. Thus, the null hypothesis of no leverage effect (asymmetric) is rejected.

3.2. Description of Research Variables

The daily stock index for the study period is individual time series observations in level form (non-stationary). The daily All Shares Index (ASI) were transformed to daily returns using natural log.

$$R_{mt} = LN (S_t - S_{t-1}). \quad (5)$$

Where:

R_{mt} = Daily returns for ASI for period (t).

S_t = Daily ASI for period (t).

S_{t-1} = Daily ASI for period (t-1).

As stock returns are not always stationary, using non-stationary time series data in financial models produces unreliable and spurious results, misleads the research conclusion, and leads to poor understanding and forecasting. This problem is overcome by transforming the time series data to make it stationary. The data were converted to their stationary levels using natural log. This makes research results and predictions based on stationary data stand for periods beyond the estimation period of the study [113].

4. Results and Discussion

4.1. Descriptive Statistics

A useful starting point in modelling the stock market return and its volatility is to first undertake diagnostic statistical tests to check the distributional properties of the NSE return series over the 7-year study period, from 4 January, 2010 through 2 August, 2016. The price series are converted to return series and the basic statistics of NSE return series are presented in Table 1. The price changes of NSE have a very low positive mean, indicating that, on average over these seven years, the Nigerian stock market prices were slowly, but not substantially, rising⁵. As the table shows, while the mildly positive skewness of the distribution, with asymmetric tail extending towards positive values, falls within the acceptable range between -2 and +2 for normal univariate distribution [114], however, the more than Gaussian positive kurtosis indicates that the distribution is leptokurtic, that is, has sharper peaks (heavy-tailed) than Gaussian distribution.⁶

⁵ This is a feature of non-stationary processes without a drift (a slow steady change).

⁶ The Gaussian distribution, commonly called the normal distribution and described as a bell-shaped curve, has skewness of 0 and kurtosis of 3. Hence, a normal distribution is both symmetric and mesokurtic.

Table 1. Descriptive Statistics of the NSE Daily Stock Rate of Return

Statistics	NSE Daily Return
Mean	0.000093
Standard Deviation	0.010543
Variance	0.000111
Minimum	-0.08741
Maximum	0.1175836
Kurtosis	17.012608
Skewness	0.759303
Jarque-Bera	18342.83011
Probability	0.000000***
Observations	1509

4.2. Trend of the Return Series

The relationship between the log-index and first difference of stock return series in the NSE is exhibited in Figure 1. This shows the degree at which the log-index wanders away from the mean distribution.

The figure illustrates that the log-index does not show any tendency to return to the mean but the first difference of the return series shows the tendency and actually returns to the mean. This is the reason for the differencing.⁷ [115]

4.3. Testing for Volatility Clustering in NSE

The test for volatility clustering in the NSE is done by the estimation of GARCH (1,1) as contained in equation (3). The result is presented in Table 2.

Table 2. GARCH (1,1) Estimation of NSE Return Series 4/1/2010-2/8/2016

Variable	Coefficient	Std. Error	T-stat	Significance
Mean	0.253532493	0.027874966	9.09535	0.00000000
Constant(α_0)	0.111360397	0.030647580	3.63358	0.00027952
ARCH (α_1)	0.255556761	0.044458182	5.74825	0.00000001
GARCH (β_1)	0.648879664	0.063792437	10.17173	0.00000000
($\alpha_1 + \beta_1$)	0.904436425			

4.4. Testing for Leverage Effect (Asymmetry) in NSE

The test for leverage effect (asymmetry) in the stock returns of the NSE is estimated using the GJR-GARCH (1,1) as specified in equation (4), and the result presented in Table 3.

Table 3. GJR GARCH (1,1) Estimation of NSE Return Series 4/1/2010-2/8/2016

Variable	Coefficient	Std. Error	T-stat	Significance
Mean	0.255932769	0.028655712	8.93130	0.00000000
Constant(α_0)	0.130103983	0.038847957	3.34906	0.00081087
ARCH (α_1)	0.250522166	0.042804456	5.85271	0.00000000
GARCH (β_1)	0.608073653	0.080140078	7.58763	0.00000000
Asymmetry (d)	0.059763987	0.070524864	2.84742	0.039676259

⁷ If the non-stationary process is a random walk with or without a drift, it is transformed to stationary process by differencing [115,118].

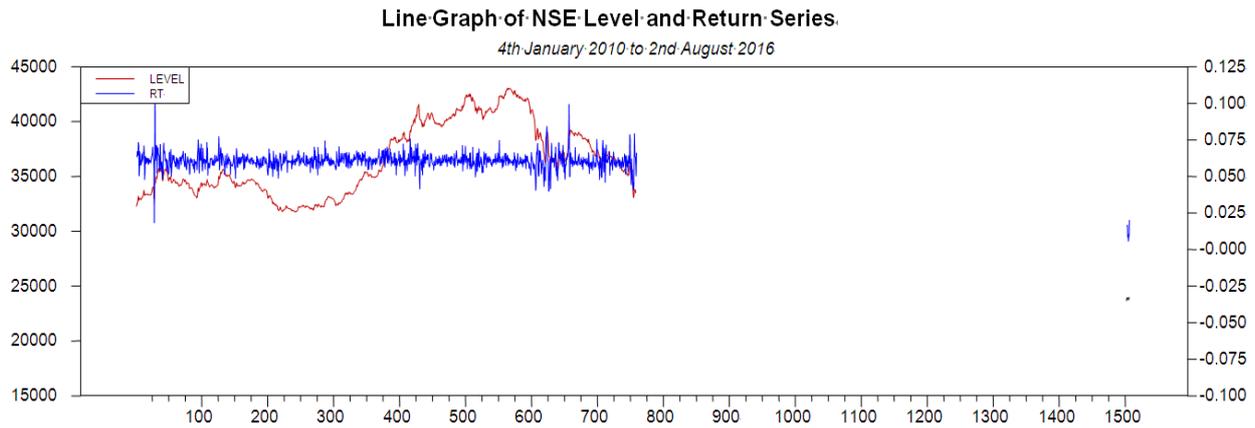


Figure 1. Relationship between log-index and first difference of stock return series in the NSE

4.5. Discussion

From the parameter estimates of the conditional variance equation in Table 2, the ARCH (α_1) and GARCH (β_1) coefficients are positive and fulfil the condition of the model. The 0.649 substantive positive value of the GARCH term (β_1) is greater than zero and indicates a long moment in the current variance. This implies that there is a strong GARCH effect in the Nigerian stock exchange (NSE). Also, the coefficient of the lagged conditional variance ARCH term (α_1) with the value of 0.256 is positive and greater than zero, signifying the impact of historical news on the volatility of the NSE. The GARCH and ARCH effects point in the same direction with the graph of the return series as observed in various levels in Figure 1. All these values indicate that there is volatility clustering in the Nigerian stock exchange. For both indices, the sum of ARCH (α_1) and GARCH (β_1) coefficients is 0.904 which is approximately one (1), indicating that the volatility clustering is quite persistent. The T-values of α_1 and β_1 variables are 5.748 and 10.172, which, in each case, is greater than the table value of 1.98. The coefficients of ARCH (α_1) and GARCH (β_1) are statistically highly significant ($P < 0.001$). These corroborate the descriptive statistics in Table 1, with standard deviation of 1.1% and a wide gap between minimum and maximum returns (from -8.74% to 11.76%), which reflect a high level of volatility (risk level) in the market. Juxtaposing these results with stationary time series of the data and a very strong presence of heavy tails leads to a conclusive evidence of strong volatility clustering in the NSE which is persistent. This indicates the rejection of the null hypothesis of no volatility clustering in the NSE.

The underlying logic of asymmetry or leverage effect is that stock returns volatility rises more following stock price declines (bad news) than it does with stock price increases (good news) of the same size. The descriptive statistics in Table 1 recorded the value of skewness as 0.759 which is positive instead of zero (0) and implies that the return series is asymmetric (leverage effect). From the values of the parameters as contained in Table 3; the asymmetric coefficient “d” is 0.06. This value is positive ($d > 0$) and statistically significant. This implies that downward movement of the stock returns is followed by higher volatility than upward movement of the same magnitude. The same asymmetric parameter “d” recorded a T-value of 2.85

against the table value of 1.98 and a P-value of 0.0396 against the 0.05. The T value is observed to be greater than the table value and the P-value is also seen to be less than the table value which implies that the results of the study are significant at 5% level. The positive values of α_1 & β_1 (0.25 & 0.61) imply that both historical (past) and current news respond asymmetrically to the stock returns volatility of the Nigerian stock exchange (NSE) even at 1% level, but the response is more pronounced on current news than historical news. These results satisfy the conditions to reject the null hypothesis (H_0) of no leverage effect (asymmetry) and the alternate accepted. The volatility (measured as a standard deviation) is 0.010543 with mean daily return of 0.000093. The positive skewness indicates that the return series is asymmetric, that is, has leverage effect.

5. Conclusion

The behaviour of financial market variables is an important determinant of the risk levels, asset pricing, stock returns and portfolio weighting. This study investigated the existence of volatility clustering and leverage effect (asymmetry) in the Nigerian stock market (NSM). The results confirm the existence of volatility clustering in the stock returns of the NSM and that the clustering is persistent. Volatility denotes the risk profile (that is, the extent to which daily, weekly or monthly stock prices change from the average) in the stock market. Volatility represents not just a measure of total level of financial risk but raises anxiety for investors and regulators. Investors tend to have irrational response to any capital market that has the character of making the values of their portfolios move more violently and decrease in value. The leverage effect is an important part of the modelling of the conditional variance of stock returns in the NSM. This study confirms the presence of leverage effect (asymmetry) in the stock returns of the NSM. The volatility of stock returns in the NSM also followed the conceptual pattern: higher during declining price days than during rising price days. Investors and other market watchers in the NSM are naturally more sensitive to bad news than good news. This observation means that stock markets that exhibit negative leverage effect will outperform those with positive leverage effect such as the NSM.

The results of our study are relevant in several respects. First, the study augments the volatility literature in SSA

which is important for increasing our understanding of the significance of idiosyncratic volatility and its microeconomic and macroeconomic implications. Understanding the sources and patterns of volatility and leverage effect in equity markets is fundamentally important in portfolio management and capital market regulation. Second, consistent with the risk-return trade-off, investors seek premium for idiosyncratic risk investments, that is, a higher rate of return for investing in high risk firms and in inefficient, uncompetitive and unstable markets. Consequently, the valuations of companies in these markets are expectedly comparatively lower. Additionally, the firms would possibly have lower cash flow and higher cost of capital relative to firms operating in more efficient and stable environments. Third, the joining of these market factors with inhospitable operating/industrial environment exacerbates not just high idiosyncratic stock volatility but masks the systematic nature of the real underlying uncompetitiveness of Nigerian and other SSA economies.

Finally, the policy implications of these findings draw attention to the regulatory importance and policy expediency of tracking the triggers and patterns of volatility in the stock market as well as the events that cause or activate bad news and systematic risk (such as insecurity, instability, high inflation rates, and policy mismatch). For example, the threats that triggered the recent divestments and withdrawals from Nigeria by several multinationals, including Procter and Gamble, HSBC, UBS and others, have been ascribed to the instability in the foreign exchange rate, policy inconsistency, poor electricity supply, acute infrastructure deficit, regulatory and security issues. These concerns have been widely echoed by several commentators. Speaking at the 2018 International Investment Conference, *Promoting Investment, Connecting Business*, organised by the Lagos Chamber of Commerce and Industry (LCCI), in Lagos (November 6, 2018), the US Consul-General, Mr. John Bray, “decried that American investors have problems with the inconsistencies of policies which are made and altered at will, lamenting that the threats have the tendency to discourage investors into the country as there seems not to be a clear-cut obedience to rule of law to protect investors”. Further bemoaning the lingering image crisis of Nigeria which advisedly must be addressed urgently, the US Diplomat said that an estimated \$1.3 billion American businesses in Nigeria were currently under threat for these concerns. The dearth of competitive infrastructure is enough frustration to citizens and businesses. These are instrumental forces that aggravate uncertainty and volatility in the Nigerian and other SSA financial markets and economies.

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