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STOCK MARKET VOLATILITY: DOES OUR FUNDAMENTALS MATTER?

This study used EGARCH estimation techniques to examine the impact of the systematic risk emanating from the macroeconomy on stock market volatility based on monthly data sourced from 1985 to 2013 on the Nigerian economy. Our results show that all the macroeconomic variables tested exerts on stock market pricing and that the stock market pricing is most influenced by exchange rate volatility. We thus recommend that policy makers on the one hand should pay close attention to the innovations in the macroeconomic variables when formulating macroeconomic or financial stability policy. On the other hand, market practitioners should calibrate volatility of macroeconomic variables in their portfolio decision making process.
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1. Introduction

Prominent in the contemporary finance and economics literature is the debate on the connection between the real sector proxy by macroeconomic variables and the financial sector proxy by either or both the stock market and the banking sector. This debate is becoming too appealing based on the observed role macroeconomic variables plays in determining company cash flows and overall unavoidable risk. Financial economics theories such as the Dividend Discount Model (DDM), Endogenous growth model, Capital Asset Pricing Model, the Arbitrage Pricing Theory among others provides the framework through which macroeconomic variables are factored into the stock market pricing mechanism. According to these theories, any anticipated or unanticipated arrival of new information about the Real Gross Domestic Product (RGDP), inflation rate, interest rate, exchange rate among other variables do alter stock prices via the impact on expected dividends, the discount rate or both (Fama, 1981; Bernanke and Gertler, 2000, 2001; Chen,

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2007, 2009; Chiarella et al., 2002, 2006; Alagidede and Panagiotidis, 2010, 2012; Chinzara, 2011).

The essence of this study is to examine if macroeconomic variables volatility exerts on stock market prices in Nigeria? What variable instrument(s) most exert on stock market behavior in Nigeria? Answering these questions is important to virtually all the various economic agents especially the policy makers on the one hand and market practitioners on the other hand. Policy makers will find the results useful in making adequate policy that will accommodate macroeconomic volatility when developing financial stability framework. The market practitioners will also find the results of immense value as it will aid in formulating hedging strategies that will aid portfolio selection choices fit for good profit making.

The rest of the paper is structured as follows: Section two provides the literature review; it consists of an overview of the Nigerian economy, the theoretical review and empirical review. Section three deals with data and methodology; Section four provides the results and interpretations while Section five concludes the work with recommendations.

2. Literature review

2.1. Overview of the Nigerian economy

The section gives a brief overview of the Nigerian economy; it discussed the state of the economic, her political life, her human capital resources, her mineral resources or sources of national revenue, her stock market among other things.

The nation Nigeria is the giant of Africa with a population figure as at 2014 estimates quiet above 170 million people. It has the largest markets in Africa and is one of the topmost nations of the world that guarantee high return on investment (NEEDS, 2004). The Nigerian economy in the 1960s was predominantly an agrarian economy with over seventy per cent (70%) of her total revenue sourced from agriculture produces and over ninety per cent (90%) of her workforce are either directly or indirectly engage in agriculture (NBS, 2008).

The end of the Nigerian civil war of 1970 to 1973 marked the beginning of a paradigm shift from agricultural based economy to oil exporting economy for Nigeria. Ever since the mid-1970s, oil continues to occupy the dominant position in the Nigeria revenue streams. Until the recent, the nation is predominantly a mono-cultured economy with oil revenue serving as the giant source of revenue with a contribution of over eighty per cent (80%) of the nation's total national revenue or GDP (NBS, 2008).

The economy in the past has suffered a number of challenges resulting from several political unrest and conflict, corruption, misappropriation, poor leadership and governance among others, for instance, the June 12th, 1993 presidential election annulment threw the country into untold crisis both within and from global point of view as the country was sanctioned by the United Nation Organization and other multinational institutions. These sanctions had great consequences on the economy. During this period, the GDP growth rate

dropped to 2% in 1998 from 8.45% in 1992, the exchange rate increased from N17:30 in 1992 to N92:70 in 1999, the official inflation rate stood at 30.9% in the year 1999 (CBN, 2012). Worst still, all of the nation's refineries were either completely dead or partially working, oil pipe vandalisation was the order of the day, crime rate increased and cases of publicly motivated killing was on the increase. The year 1999 marked the end of politically motivated crisis in Nigeria as the country returned to civil rule. The new democratic regime embarked on a holistic economic reform where key sectors such as agriculture, industry, finance, power, culture, communication among others were selected as arrowhead to move the economy forward. In addition, in order to achieve sustainable economic growth and development the new administration embarked on privatization of her publicly owned enterprises, adopted open trade policy targeted at attracting foreign investors, institutionalization of anti-graft agencies like the Economic and Financial Crimes Commission (EFCC) and the Independent Corrupt Practices Commission (ICPC), value re-orientation, big government/ budget deficits among others. These efforts aimed at boosting the economy attracts the sympathy of the international community, and it fuel the debt relief package granted the nation in the year 2006.

The Nigeria Stock Exchange which started in 1961 as Lagos Stock Exchange had grown to be one of the largest emerging markets stock exchange in the world with total market capitalization standing at over N14 trillion as at the end of year 2014. The Nigeria Stock Exchange play significant role in advancing the economy.

A major blow was given to the nation's economy in the year 2008/2009. The global financial crisis or economic meltdown affected the economic severely, for instance the Nigerian Stock Exchange total market capitalization fell from N13, 294.6 billion naira in 2007 to N9, 672.6 billion naira by the end of 2011. The global economic crisis also have a fair share effect on all the macroeconomic variables, for instance, the foreign reserve fell from $53 billion in 2007 to $32 billion. In addition, the exchange rate which was N145:000 to $1 as at December 2007 grew to N165:00 at the end of 2009 (CBN, 2013).

In 2010, like most emerging economies, the Nigerian economy shows a measure of recovery with positive changes on her macroeconomic indicators for instance, the GDP increased from N24 billion in 2009 to N37 billion in 2012. The World Bank (2014) shows that the Nigerian economy moved from being the second largest economy in Africa (after that of South Africa) to become number 1 as at the end of 2013, making Nigeria ranked 25th largest economy in the world with South Africa ranking 33rd. The Nigerian Stock Exchange market capitalization rose from N9, 672.6 billion in 2009 to over N14 trillion as at the end of 2013. The recent report from the government statistics shows that the nation has been able to achieve sustainable growth in her diversification effort as oil revenue contribution to the national income base dropped from over seventy per cent 70% in the late 1990s to just about forty seven (47%) by the end of the year 2014. The question is does changes in macroeconomic variables have significant effects on stock market in Nigeria? This is the core objective of this paper.

2.2. Theoretical framework

The theoretical framework that connects the stock market with the macroeconomic aggregates can be traced to the endogenous growth theory developed independently by Romer (1986) and Fry (1988). The theory explains that capital and output grows indefinitely, and that the growth rate in an economy is endogenously determined through savings and investments. The theory stresses that the entirety of an economy policy regime including the growth rate of her financial development, structure, markets, regulations and macroeconomic innovations are mainly endogenously determined with a view of achieving long term growth (Lawal, 2015; Chizea, 2012; Umar, 2010; Lucas, 1998; Pagano, 1993). Ever since its introduction, a number of studies have been conducted to examine the validity of the model with diverse results from diverse empirical analysis, for instance, Greenwood and Jovanovic (1990) used dynamic programme methods to expand the theory by calibrating financial intermediation framework to the model. According to these authors, both financial intermediation and the rate of economic growth are endogenously determined within an economy. They observed that through research, collection and analysis of information, economic resources flows are enhanced thereby promoting economic growth and development. This framework was further examined by Bencivenga, Smith and Starr (1996) who used overlapping generation models to document that stock market development enhances reduction in transaction cost, thus facilitating rapid transaction of stock, which will in turn promotes economic growth and development. Greenwood and Smith (1997) further observed a strong theoretical linkage between the two (macroeconomic variables and the stock market pricing) in that stock market play significant role in efficient allocation of resources by promoting specialization, reducing the cost of mobilization and channeling of funds to productive borrowers thereby enhancing economic growth and development.

Given that a strong theoretical connection exist between the stock market and economic growth, it is important to examine the impact of innovations in macroeconomic aggregates on stock market pricing and returns mechanism in Nigeria. As noted by Chinzara (2011), Chowdhury (2004), Chowdhury *et al* (2006) among others, studies that inquire into the impact of economic growth on stock market behavior can be broadly classified into two literature strands. The first strand being studies that inquire into the relationship between the two at a direct or surface level, such studies used estimation techniques like Vector Autoregressive (VAR), Autoregressive Distributed Lag (ARDL), Johansen-Juselius cointegration tests, Engle-Granger tests, Granger Causality tests among others. The second strands on the other hand looked beyond the facial connections but inquire into the impact of the volatility of each of these variables on one another. The proponents of the second strand of literatures are of the view that since the theoretical foundation on the connections between the macroeconomy and the stock market had been established by many theories (see for instance the Arbitrage Pricing Theory by Ross, 1976; Quantity Theory of Money by Fisher(1928), Friedman, (1956); Hick IS-LM hypothesis by Hicks, 1937; Fama Market Efficiency Theory by Fama(1965); Capital Asset Pricing Model by Sharpe (1964) Among others), emphasis should be on the sources of systematic risk or volatility, as any shock in macroeconomic variables will constitute a source of systematic risk that affects market portfolio whether or not they are well diversified (Arnold and Vrugt, 2006; Beltratti and Morana, 2006; Diebold and Yilmaz, 2007; Teresiene et al., 2008). Studies that inquire into

the relationship at second moment are very rare in Nigeria and most developing Africa Sub-region economies. Examining this relationship is the focus of this study.

2.3. Empirical literature

Acikalin et al (2008) documented the existence of a long run relationship between stock market index and each of Gross Domestic Product (GDP); exchange rate; interest rate and current account balance for the Turkish economy. The study used cointegration tests and Vector Error Correction Model to analysis data sourced on quarterly bases from 1991Q4 to 2006Q4. The authors observed from the results that a unidirectional relationship exist between macroeconomic variables and the stock market in Turkey. It recommends that investors pay keen attention to this relationship when making investment decisions.

For Ghana, Kumornu and Owusu-Nnatovi (2011) used the full information maximum likelihood estimation techniques to examine the relationship between macroeconomic variables and the stock market returns. The study used monthly data sourced from January 2002 to December 2008, and observed that a significant relationship exist between stock market returns and each of inflation rate, exchange rate and treasury bill rate with inflation rate having positive effects and each of Treasury bill and exchange rate having negative effect. The study recommends that policy makers should pursue strong stock market development whose returns will be higher than the Treasury bill rate returns through the formulation and implementation of sound monetary and fiscal policies.

For the South African economy, Mauex (2011) examined the co-movement and existence of volatility among the US and South African stock market index. The study used GARCH-BEKK and VAR models to analysis daily data sourced from April 1st, 2005 to March 31st 2011, and observed that evidence abound on the presence of return spillover from the US stock market index proxy by the NYSE to the South African stock market proxy by JSE. The study also noted that volatility spillover persistence exist between the US and the South African stock markets. The study recommended that policy makers as well as market practitioners should factor in the relationship between the two when making investment decisions.

Kalu and Friday (2012) used the EGARCH (1, 1) and GJR-GARCH (1, 1) models to examine the response of negative and positive news about economic variables on stock market price in Nigeria. The study used daily closing prices of the Nigerian Stock Exchange (NSE) based on data sourced from 2nd January, 1996 to December 30th, 2011 and observed that evidence of existence of strong asymmetric effect with no leverage are visible in the stock returns behavior in Nigeria. A major flaw of this study lies in its inability to provide any theoretical framework upon which the study is built. Besides, the study was unable to make any reasonable recommendation that will aid either stock market development or the economy as a whole.

Onakoya (2013) examined the impact of stock market volatility on economic growth in Nigeria for the period 1980 to 2010 through the use of EGARCH estimation techniques. The study observed that volatility shocks is quiet persistent in Nigeria and this might distort growth in the economy. A major flaw of the study lies in the originality of its data, in that

the study used data set from 1980 whereas stock market data became publicly known in the year 1985. Besides, the study does not provide any significant finance or economics theory to support or oppose its findings.

Atoi (2014) advanced literature on the Nigeria economy by introducing the impact of error distribution in modeling stock market volatility so as to enhance the efficiency of the model. The study estimated the first order symmetric and asymmetric volatility models using the Normal Students' test and the generalized error distributions so as to select the best forecasting volatility models with the most appropriate error distribution. The study observed the presence of leverage effects; this implies that volatility responds more to bad news than it does to good news even with the same magnitude. Like existing literatures before Atoi's study, it lack theoretical foundations from economics or finance point of view.

The flaws identified in the existing literatures on Nigeria as it relates to data and the theoretical framework coupled with the need to have a true understanding of the relationship between the stock market index and macroeconomic variables motivates the authors in carrying out this research endeavour.

3. Data and methodology

Data for this study was sourced from the publications of the Central Bank of Nigeria (CBN) various issues. The macroeconomic variables used are Inflation rate, Interest rate and exchange rate. The All Share Index was employed as a proxy of the stock market behaviour. The data cover a period of about twenty eight (28) years i.e. 1985 to 2013. The base year (1985) was chosen because data on stock market index became publicly known in year 1985, while the end period 2013 is the most recent data on macroeconomic variables in Nigeria.

3.1. Methodology

For this study, we employed the use of Exponential Generalized Autoregressive Conditional Heteroskedasticity (EGARCH) estimation technique to examining the impact of macroeconomic variable volatility on stock market behaviour in Nigeria. The EGARCH model was developed by Nelson (1991) as an extension of the Generalized Autoregressive Conditional Heteroskedascity adjudge in the literature as the most appropriate estimation techniques to measure volatility.

The EGARCH model is stated as follows:

$$log\ h_t = w + \beta\ log\ h_{t-1} + \gamma \frac{\varepsilon_{t-1}}{h_{t-1}^{1/2}} + \alpha \left[\frac{|\varepsilon_{t-1}|}{h_{t-1}^{1/2}} - \sqrt{\frac{2}{\pi}} \right] \quad (1)$$

Where h_t connotes the conditional variance for year *t*; $h_t^{1/2}$ connotes the conditional volatility prediction for year *t;* $\frac{\epsilon_t}{h_t^{1/2}}$ is the standardized shock for year *t*. It is the number of standard deviation that ϵ_t has deviated from its mean and ϵ_t is the error term of a prediction model of a time series.

We determine the combined impact of both the α and γ, by using equations (2) and (3) defined as follows:

$$h_t = h_{t-1}^{\beta} \times e^{\left(w - \sqrt{\frac{2}{\pi}}\alpha\right) + (\gamma+\alpha)\frac{\epsilon_{t-1}}{h_{t-1}^{1/2}}} \quad \text{when } \epsilon_{t-1} > 0 \qquad (2)$$

and

$$h_t = h_{t-1}^{\beta} \times e^{\left(w - \sqrt{\frac{2}{\pi}}\alpha\right) + (\gamma-\alpha)\frac{\epsilon_{t-1}}{h_{t-1}^{1/2}}} \quad \text{when } \epsilon_{t-1} \qquad (3)$$

4. Analyzing and interpretation of results

This section provides the interpretations of the results of the estimates when we conduct both the unit root tests and applied the EGARCH model.

4.1. Unit root test

In examining the order of integration of the variables, we employed the use of ADF t-statistics. Table 1 presents the unit root test results of the variables, our results shows that interest rate is level non-stationary but stationary after first difference. Other variables shows the absence of unit root at the level form, thus we concluded that all the variables are at least stationary at *I* (1) series.

Table 1

Unit Root Test

Variables	ADF t-statistics	Critical values	Probability	Lag	Inference
ASH	-6.155885	-3.450411**	0.0000	0	I(0)
INF	-18.01916	-3.449738	0.0000	0	I(0)
EXC	-18.41846	-3.449738	0.0000	0	I(0)
INT	-17.89661	-2.571925	0.0000	1	I(1)

Source: Authors' Computation using Eviews 7.2.

4.2. EGARCH estimation techniques result

The results of the estimated volatility impact of the variables are presented in Table 2. From the results, it can be deduced that the impact of the volatility of inflation on All Share Index

is positive and significant. An indication that the All Share Index responds to large innovations in inflation. The negative sign of the γ (though not significant) further support our findings that the All Share Index response sharply to shock in inflation.

Table 2

Results of the EGARCH estimates

Parameters	ASI	ρ	INF	ρ	INT	ρ	EXC	ρ
ω	0.4409	0.0510	-0.0699	0.6850	-0.0927	0.5812	-0.06167	0.7263
α	0.7701	0.0000	0.7168	0.0000	0.7340	0.0000	0.70973	0.0000
β	-0.0391	0.6382	-0.147	0.0614	-0.1552	0.0498	-0.14540	0.0646
γ	0.7010	0.0000	0.8568	0.0000	0.8594	0.0000	0.85630	0.0000
α+β	1.4712		1.5737		1.05934		1.05660	
SIC	6.0766		6.0226		6.0100		6.02665	
AIC	6.0083		5.9315		5.9289		5.94695	

Source: Authors Computation 2015.

The result of the interest rate as shown in the Table also shows that both the coefficients of the α and γ are positive, but only the α is significant. This implies that large shock in interest rate irrespective of its signs exert significantly on the All Share Index

For the exchange rate, both the coefficients of the α and γ are positive and significant at 1%level of significant. The implication is that the All Share Index responds to both the asymmetries impact and size of shock in exchange rate.

Given the above observations, it can be deduced that exchange rate volatility exert on All Share Index mostly of all the macroeconomic variables study, it is therefore recommended that efforts should be made by policy makers on the one hand when formulating macroeconomic/ financial stability policy to factor in innovations in the exchange rate so as to achieve stock market growth and development. The market practitioners on the other hand should pay close attention to all the macroeconomic variables especially the volatility of the exchange rate when formulating portfolio decisions.

5. Conclusion, findings and recommendations

This study examined the impact of volatility of macroeconomic variables on stock market behaviour in Nigeria. It employed the Exponential GARCH model on examine monthly data sourced from 1985 to 2013. The empirical result shows that all the macroeconomic variables investigated exert on stock market pricing in Nigeria with volatility of the exchange rate playing the leading role. The study therefore recommends that policy makers should factor in volatility of these macroeconomic aggregates when formulating macroeconomic or financial stability framework. The market practitioners on the other hand are advised to pay keen attention to fluctuations in exchange rate when making portfolio selection decisions.

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