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Volatility Risk-Pricing and Stock Returns In Emerging Market: Evidence from Nigeria

Saidi Atanda Mustapha[1], Bibiana Oluhukwu Njogo[2] and Lawrence Imeokparia[3]

The paper investigates the role of both systematic volatility (SVol) and idiosyncratic volatility (IVol) in asset pricing over the sample period 2005 to 2017 in the Nigerian Stock Market. Systematic volatility is measured by the standard deviation of past daily price returns and idiosyncratic volatility is measured by the standard deviation of residuals from the Augmented Fama and French three (A-FF3) factor model. The paper adopts a parametric methodology consisting of the least square estimation technique (Fully Modified-OLS and OLS). Findings suggest that investors could increase their portfolios' returns by using IVol strategy to sort stock portfolios rather than using SVol strategy, the reason is that the effects coming from macroeconomic factors outweigh that of the market factors. The paper also validates the positive relationship between idiosyncratic volatility (systematic volatility) and stock price returns for Nigeria, this is in line with the results of Malkiel and Xu (2006) and Fu (2009) using US stocks, and Drew et al (2002) and Brockman et al (2009) both for Hong Kong stock market. The policy implications of these findings reveal that investors (domestic and international) can increase portfolio returns, rather than dropping stocks, by going long on high IVol stocks and short on low IVol stocks in the Nigerian Bourse.

Keywords: Systematic and idiosyncratic volatilities, stock returns, asset pricing, multifactor models, Nigerian stock market.

1. Introduction

Stock returns are often susceptible to volatility which tends to influence the value of assets in financial markets. The volatility in stock returns plays a crucial role in determining portfolio holdings and investors' confidence, especially during periods of financial crisis that often distort trajectory of stock prices. This may have strengthened attention to understanding stock volatility and the need for effective portfolio risk management by investors across global financial markets.

The global financial crisis, which is traceable to default in the United States' subprime mortgage lending in 2008, quickly deepened and moved across assets, markets and economies. On the back of the crisis, investors are no longer confident about expected returns from their stock portfolios due to high associated risk that became prominent in stock market. Specifically, domestic investors' participation in the Nigerian Stock Market declined precipitously from 85.2% in 2007 to 40.1% in 2012, after falling to 83.5% in the wake of the 2008 global financial crisis (NSE factbook, 2012). This represents about 48% decline in domestic participation in less than five years. Between

[1]Dr. Saidi Atanda Mustapha, Corresponding Author: Mobile - +234-803-517-2471, Email: satanda4345@gmail.com
[2]Dr. Bibiana Oluhukwu Njogo, Senior Lecturer, Department of Economics, Accounting and Finance, College of Management Sciences, Bells University of Technology, Ota, Ogun State, Nigeria.
[3]Dr. Lawrence Imeokparia, Head of Department, Department of Economics, Accounting and Finance, College of Management Sciences, Bells University of Technology, Ota, Ogun State, Nigeria.

2013 and 2017, the investors' participation was bedeviled by the increased volatility; average volatility during these periods was above 20% at the market level and rising at the industry level.

The All-share index recorded 5,752.90 points in January 2000 and rose significantly to 53,110.91 points in August 2008, but declined to 27, 866.51 points in December 2012 (NSE, 2012). This portrays that about 47.5% of investment in stocks had been eroded between 2008 and2012. Up till 2017, the all-share-index has never attained the 2008 feet.

The aftermath of the crisis intensified concerns by investors to diversify their stock holdings in a bid to minimize risk emanating from price discontinuities. Investors often times are rational in their decision and would opt to put their funds in stocks that earn high returns and with minimal associated risk. However, this contradicts Sharpe (1964) assertion that a positive relationship exists between risks and returns, such that high systematic risk in the stock market is compensated by high expected returns. Investors' diversification strategies will necessitate either searching for stocks that will increase portfolio returns, despite the rising volatility risk or divesting from the Exchange. The latter strategy is what was experienced immediately after the global financial crisis started, specifically in 1999. The poor performance of the market experienced was highly detriment to the development of financial sector of the country. So, the latter was not a better strategy. The former strategy therefore, becomes a preferable option to retain investors' participation and uphold the recent performance trend of the market. This therefore, makes the research that presents the relationship between volatility risks and stock returns paramount to investors. More so, the paper also examines the pricing of idiosyncratic volatility risk to enable investors to determine the premium to demand for holding particular stocks/portfolio.

The volatility of stock price returns at the firms' level is classified into systematic volatility and unsystematic (idiosyncratic) volatility. The former encapsulate the volatility coming within the market while the later refers to the volatility generated outside the system.

Volatilitythathastheirsourceoutsidethesystem(idiosyncraticvolatility)isproclaimedto have huge influence on the systematic volatility at the firms' level (Goya and Santa Clara, 2003). More so, recent research interest has explored this area in developed countries but none is aware to focus attention on firm level volatility for Nigeria[4].

Idiosyncratic volatility (IVol.) is simply put as the relative responsiveness of firm's stock price returns to its specific events. It is said to be measured in two ways, direct and indirect decomposition approaches[3]. The later one has been criticized on the basis of overshooting idiosyncratic volatility for stocks (Malkiel and Xu, 2003). Moreover, Investors tend to prefer firms with lower exposure to volatility as this reduces the degree of uncertainty contained in their future consumption and/or returns. Firms with lower volatility therefore enjoy lower cost of capital as investors' appetite to invest increases in such firm, hence, higher firm's value.

With the huge divestments that apparently characterized the Nigerian stock exchange

[4]Studies on stock volatility for Nigeria focused on aggregate volatility and its systematic components (Emenuga, 1994; Kalu, 2008; Olowe, 2009, Aliyu, 2011 and Mustapha, 2015). Most of these works neglect discussion on volatility at the firm level which forms the basis of aggregate volatility and reveals other sources of asset volatility.

during the period of increased and decreased volatility, it is obvious that there is urgent need to provide responses to the following questions that might affect investors' confidence on the Exchange as a result of volatility risks. First, are there relationships among types of volatility and stock returns earned by investors? Second, is volatility especially, idiosyncratic volatility priced? Based on the questions raised above, the following research questions can be formulated:

i. What is the effect of systematic volatility on stock returns in Nigeria?
ii. What is the effect of idiosyncratic volatility on stock return in Nigeria?
iii. Is idiosyncratic volatility priced in an emerging stock market like Nigeria?

The paper found that systematic volatility/idiosyncratic volatility have positive and significant effect on cross section of stock returns. These findings show that investors should demand for premium to hold stocks with volatility irrespective of the types. This supports the findings of Goya and Santa Clara (2003) and Wei and Zhang (2005) and contradicts the finding of Ang et al. (2006). Our findings provide exclusive reaction between volatility types and cross-section of stock returns, as it uses al listed stocks on the exchange and also considers the period of global financial crisis that can influence the direction of the effect. Therefore, our study provides sustainable estimators that circumvent challenges of selection bias in sample and over-shooting of the estimators. This made the study significantly difference from existing studies that have similar findings. More so, our positive effect of idiosyncratic volatility on cross-section of stock returns is quite puzzling as it contradicts the findings of Ang et al (2006, 2009).

The paper is organized into five sections. Apart from section one which comprises of the introductory aspect of the report, section two consists of the review of related literature. Section three presents the theoretical framework, model specification and methodology. Section four reports and discusses the findings, while section five concludes the paper and provides policy recommendations.

2. Brief Review of Related Literature

The empirical review is presented in two major headings; the first heading discusses empirical works on total (systematic) volatility while the second presents related literature on idiosyncratic volatility.

2.1 Relationship between Systematic Volatility and Stock Returns

The systematic volatility is one of the most crucial factors consider by rational investors as it affects the pattern of returns and risk. Empirical literature makes use of the standard deviation of stock returns as a measure total volatility. The trend of the total volatility especially asset such as stock, is a major concern as it determines the level of uncertainty in its returns. Malkiel and Xu (1997) presents that volatility at the firm's level has increased tremendously in recent time, which suggest that knowing the trend of volatility is mostly important in its research.

Previous studies on the upward trend of the total volatility report an increase in the behavior of volatility trend at the firm level. Malkiel and Xu (1997) suggest that market volatility has increased over time at the firm level but observe no trend at the market level, which shows the benefit of increasing diversification of portfolio, that is, for a portfolio to be well diversified, such portfolio should contain little stocks. Campbell et al.

(2001) uses monthly data with robust methodology as they considered the influence of market crash experienced in 1987 by fixing the number of firms in the sample and using both weekly and monthly stock returns instead of daily returns observation to estimate volatility. Their findings indicate that no significant trend in market volatility; and volatility at the firm level is high and significantly positive during the period of study. Goyal and Santa Clara (2003) found an upward trend of the average stock volatility during the sample period (1962 to 2000). They were able to show that average stock volatility were very high during recessions and about 85% of the aggregate volatility is explain by idiosyncratic volatility when compute by the CAPM model and about 80% when they used the Fama French three factor model. Campbell (2001) and Goyal and Santa Clara (2003) analyses were based on the US stock markets. Bali et al. (2006) identify zero relationship between the equal weighted average stock volatility and the value weighted portfolio returns on the New York Stock Exchange (NYSE) stocks from 1963 to 2001, respectively.

Wei and Zhang (2005) report that the positive relationship observe between value weighted average market returns and the equal weighted volatility is driven by data, thus they conclude that the relationship between the value-weighted average returns and average volatility is insignificant and negative. They make use of large monthly data sample which was divided into two sub samples that ranges from 1963.08 to 1989.12 and the whole sample size 1963.08 to 2002.12, respectively.

Ang et al. (2006) present a negative relationship between average stock returns and aggregate volatility. The findings establish that control variables like size, value, and momentum; volume and liquidity ratio have significant impact on the estimation of idiosyncratic volatility. They further explained that the price aggregate volatility risk is negative, and that stocks with high volatility risk should generate low average returns. The intuition behind the later result is that investors are mostly risk averse, rational and likely to hedge the specific risk of their securities against the stock market volatility (Campbell, 1996).

Empirical literature on volatility clustering for Nigeria can be backed on the work of Olowe (2009), and Aliyu (2011). Olowe (2009) investigates the relation between stock returns and volatility in Nigeria adopting exponential GARCH in mean model. He used daily returns with the sample size that ranges from 4 January 2004 to 9 January 2009. His major work was on volatility persistence and risk-return relationship for the Nigerian stock market. His results report volatility persistent and positive but insignificant relationship between stock return and risk. Aliyu (2011) employs the GARCH and the quadratic GARCH models to access the impact of inflation on stock returns and volatility using monthly time series data for Nigeria and Ghana. The study reveals that bad news exert more adverse effect on stock market volatility than good news in the Nigerian stock market, however, an opposite of this result was discovered for Ghana.

2.2 Relationship between Idiosyncratic Volatility and Stock Returns: An Overview

This subsection presents the three different idiosyncratic volatility trends and relationships mentioned in the literature (The idiosyncratic volatility trends can be an upward trend (Malkiel and Xu, 1997 and Campbell et al., 2001), while Hamao et al., 2003 and Brandt et al, 2009 reported a downward trend. Bakaert et al., (2009) shows that there is no trend). Campbell et al (2001) argues that the total volatility for the period of 1962 to 1997 increased at the firm level, while the idiosyncratic volatility increase during this period but the market volatility has zero direction for its trend in this same sample space. Campbell et al (2001) conclude that the increase in idiosyncratic volatility trend is due to the unforeseen shock on the expected future cash flow, discounted at a constant rate andas well as shock to the discount factor. Malkiel and Xu (2003) report positive and significant idiosyncratic volatility trend for the post World War II and also found increased volatility in the 1990s during the oil shock and that the 1987 US stock market crash is a catalyst to increased volatility. Bali et al (2008) notice the existence of upward trend in the idiosyncratic volatility during the period of 1962 and 1997, however, comparative data source was also tested and their findings reveal that an uptick in the idiosyncratic trend is more prominent for the NASDAQ stocks and relatively low for the NYSE/AMEX and NYSE.

Brockman and Yan (2008) present a significant negative result in terms of the idiosyncratic volatility trend in the US stock markets. The analysis was done on a data strength ranges from 1926 and 1962. More so, their negative trend result is robust with the inclusion of the Depression and World War II dummy variables, their analysis include both equal and value weighted observations. The implication of their past-1962 period was as a result of the decreasing level of large foreign ownership which could actually fall stock market's volatility. Bekaert et al (2010) found significant zero uptick in the trend of idiosyncratic volatility in developed world from 1964 to 2008, they were able to establish that idiosyncratic volatility trend is receptive to the sample size and that there subsist an upward trend, they further confirms that idiosyncratic volatility is highly correlated across countries and that this correlation increases with time. This result buttressed their former findings in 2009 for 23 developed stock markets, including the US, with data strength of approximately 41 years. Nartea and Ward (2009) also confirm Bekaert et al. (2009) results with their application on the Philippine stock market and data ranges from 1992 to 2007,respectively.

Malkiel and Xu (2006) argues that if a group of investors fail to hold the market portfolio, other groups of investors will not be able to demand for such market portfolio. The intuition here is that idiosyncratic volatility is priced. Their findings show that idiosyncratic volatility is important in explaining excess portfolio returns, especially for their sample period (1935-1968). They also noticed that idiosyncratic volatility has a higher goodness of fit or explanatory prowess of stock portfolio returns than any other factor, this result is robust after controlling for size, book to market and liquidity effect. There results were buttressed by the findings of Drew et al (2006) considering the German and UK stock markets with data ranges from 1991 to 2001 and Dempsey et al (2001) using the Australian stock market. Goyal and Santa Clara (2003) report significant positive relationship between idiosyncratic volatility and value-weighted excess portfolio returns in the US stock markets over the period of 1963 to2008, which is supported by Wei and Zhang (2005) and Gao et al (2010) findings in the same stock markets. Fu (2009) argues that the lagged idiosyncratic volatility might not be a good estimate of the expected idiosyncratic volatility. Fu further argues that Ang et al's (2006) empirical findings of high idiosyncratic volatility stock portfolios have lower return than low idiosyncratic volatility stock portfolios, are driven by monthly return reversals. This is supported by Bali and Cakici (2008) findings.

Based on the research questions, the following null research hypotheses are formulated:

1. H0: There is no relationship between systematic volatility and stock returns;

2. H0: There is no relationship between idiosyncratic volatility and stock returns; and
3. H0: Idiosyncratic volatility is not priced.

3. Methodology

The paper adopts the Fama French three factor model which builds on the Capital Asset Pricing theory (CAPM). The Fama and French three factor model is adopted to generate the idiosyncratic volatility. This is more appropriate than the capital asset pricing model (CAPM) and arbitrage pricing theory (APT) because it considers firm-level characteristics and easy to interpret it's estimators. The firm-level characteristics are part of the drivers of idiosyncratic volatility (see Goyal and Santa-Clara, 2003; and Ang et al., 2009). Hence, the need for Fama and French three factor model.

The consumption based theory serves as the underlying theory. This is however, done with some augmentation to incorporate major features of developing countries especially, the Nigerian market. These features include the macroeconomic factors (*J. H. Cochrane (2005) "Several authors have used macroeconomic variables as factors in order to examine directly the story that stock performance during bad macroeconomic times determines average returns. Jagannathan and Wang (1996) and Reyfman (1997) use labour income; Chen, Roll and Ross (1986) use industrial production and inflation among other variables. Cochrane (1996) uses investment growth. All these authors found that, average returns line up against betas calculated using these macroeconomic indicators" page 445*)as described in relevant literature (Chen, Roll and Ross, 1986; Cochrane, 1996; Jagannathan and Wang, 1996 and Lettau and Ludvigson, 2001) to be crucial and have significant influence on asset price (Bailey, 2005; Pedersen, 2005 and Bekaert et al,2007).

The major implication of the augmentation of the framework in this paper is to reconstruct for policy changes and market news; and to recognize that investment opportunity set is not constant, thereby, including market specific and macroeconomic factors into a consumption function. Equation (1) is then enhanced with these factors as a state variable to close the Hamiltonian process;

$$U(C_t, C_{t+i}) = U(C_t, \sigma_j, \sigma_D) + U(C_{t+i}, \sigma_j, \sigma_D) \qquad (1)$$

Where σ_j *and* σ_D are measures of specific factors, which influences consumption; enjoyed by investor from their various investments. Following the wiener process for investor in this economy;

$$\sum U(C_{k,t}, C_{k,t+i}) = \sum \left[U(C_t \sigma_j, \sigma_D) + U(C_{t+i}, \sigma_j, \sigma_D) \right] \qquad (2)$$

For further derivation on the framework (see Mustapha, 2013). Adopting the modeling of Mustapha (2013), the model framework is specified alongside the random variables as follows:

$$E(r_{i,t}) = \alpha_0 + \beta_r \alpha_{r,t} + \beta_s \alpha_{s,t} + \beta_b \alpha_{b,t} + \beta_{macro} \alpha_{macro,t} + \beta_{Dummy} \alpha_{Dummy,t} + \mu_{i,t} \qquad (3)$$

Equation (3) is the augmented Fama and French three factor model, it is then followed from equation (3), the paper specified equation (4) that forms the basis estimations made in the paper. Hence, equation (4) is specified below:

$$E(R_{j,t}) = \beta_0 + \beta_i\left(E(R_{m,t}) - R_{f,t}\right) + \beta_k SMB_{k,t} + \beta_l HML_{l,t} + \sum_{\eta=1}^{N} \beta_\eta MAV_{\eta,t} + \sum_{\lambda=1}^{\Lambda} \beta_\lambda Dum + \mu_{j,t} \quad (4)$$

Equation (4) is the model used to generate the idiosyncratic volatility (IVOL) of each of the stocks considered.

The E(R) is the expected returns on each of the stocks, E(Rm)-Rt is the excess market return factor and SMB is the size factor of stocks sampled with their market capitalization, the HML is the value factor. The value factor is the ratio between the book value of the firm and the capitalization of the firm. MAV is the macroeconomic variables included in the model, while Dumm is the dummy that serves as proxy for company specific news such as zero returns, zero volume, and payment of dividend among others. The betas are measures of sensitivity of each factor in the augmented version of the model.

The paper formed sub-portfolios through sorting stocks into high, medium and low degrees using SVOL and IVOL. After this, the paper obtained value and equal weighted portfolio of raw returns on monthly basis, this is in line with existing empirical work of Ag et al (2006). Base on this data generation, Equation (4) was extended and therefore, equation (5) is presented:

$$R_{j,t} = \beta_0 + \beta_i\left(E(R_{m,t}) - R_{f,t}\right) + \beta_k SMB_{k,t} + \beta_l HML_{l,t} + \sum_{\eta=1}^{N} \beta_\eta MAV_{\eta,t} + \sum_{\lambda=1}^{\Lambda} \beta_\lambda Dum + \beta_m VOL_{m,t} + \mu_{j,t} \quad (5)$$

The VOL represents the volatility types and beta is the sensitivity measure of returns to average changes I volatility types. The model specified was estimated through the Fully Modified Least Square (FM-OLS) and the least square techniques. The paper also examines the pricing behavior of stock volatility, specifically idiosyncratic volatility. This was conducted by sorting the portfolio with idiosyncratic volatility. The model is specified in equation (6).

$$R_{j,t} = \beta_0 + \beta_i(Mrisk) + \beta_k SMB_{k,t} + \beta_l HML_{l,t} + \sum_{\eta=1}^{N} \beta_\eta MAV_{n,t} + \sum_{\lambda=1}^{\Lambda} \beta_\lambda Dum_{\lambda,t} + \partial\left(IVOL_{high} - IVOL_{low}\right) + \mu_{j,t} \quad (6)$$

In equation (6), the pricing factor is delta. If the delta is significantly different from zero with a positive sign, it then suggests that, the idiosyncratic volatility is priced. The multifactor pricing model is estimated through the Least Square (LS) approach, the estimated coefficients are corrected for autocorrelation ad heteroskedasticity. The model specification and estimation techniques follow Drew et al., (2004) and Mustapha, (2013).

3.1 Data and Control Factors

The dataset for this study is based on secondary data and extends from January 2005 to December 2017. It incorporates 200 stocks that are listed on the Nigerian stock exchange. The daily prices, volume and capitalization of these firms are collected from the Nigerian Stock market. The market capitalization and all share index and both stock and market returns are generated from these data. The underlying data for control variables like stock momentum, market size, trading speed and trading quantity are also sourced from the NSE while manipulations of the index is carried out by the author; these manipulations and formula used are presented in Appendix4-B. The study further considers variables like money supply, real interest rate, inflation and exchange rate to measure macroeconomic risks, these had been justified to be relevant in previous studies (Chen, Roll and Ross, 1986; Jagannathan and Wang, 1996, Adeleke, 2011 and Mustapha, 2015). These data sets are sourced from Central Bank of Nigeria and National Bureau of Statistics on monthly basis.

Two sets of risk free rates are used in this study, i.e. daily risk free rate and monthly risk free rate. The daily risk free rate is proxy with the prime lending rate; while that of the monthly risk free is the Nigerian interbank or the yield on 3-month treasury bills, both rates will be gotten from Financial Market Dealers Association formerly called Nigerian Money Market.

4. Research Results: Presentation and Discussion

4.1 Descriptive Statistics and Stationary Tests

Table 4-A in the Appendix shows that the descriptive statistics and stationary test results for four volatility series namely, the equal and value weighted firm level systematic volatility (SVOLew, SVOLvw) and the equal and value weighted idiosyncratic volatility (IVOLew and IVOLvw) across the 200 firms listed on the Nigerian bourse.

Panel A reports that SVOLew has greater mean and median compared to SVOLvw. Conversely, SVOLew has lower coefficient of variation than SVOLvw, which suggests that SVOLvw varies rapidly than SVOLew. Idiosyncratic volatility accounts for larger part of the systematic volatility in Nigeria. IVOLew claims 53% of SVOLew and IVOLvw accounts for 37% of SVOLvw. This is somewhat consistent with the findings of Goyal and Santa-Clara (2003) where they proclaim that 80% of the firm level SVOL is attributed to IVOL. This implies that small firms are more volatile than big firms, which conforms to that of Campbell et al. (2001) for the United States (US) stock markets. The correlation statistics were reported in panel B, interestingly, there are positive relations among the volatility series.

Although, the correlation values between SVOLvw and SVOLew; and IVOLvw and IVOLew are higher positive correlation with 80% and 84%, respectively. Other correlation statistics exist with moderate positive relations which suggest that efficient diversification is possible through volatility by increasing the number of Nigerian stocks in investors' portfolio. The unit root tests in panel D reject the presence of unit root for all the volatility series in both regressions and at levels. Hence, the analysis of volatility will be in levels and does not require differencing.

4.2 Nigerian Stock Volatility: Nature and Linear Trend

The estimated time trend coefficient, its t-statistics and probability values are reported in Table 4.1. The standard t-test indicates positive trend for all volatility series in the full sample. Positive trend in both IVOLew and IVOLvw are support by the descriptive analysis and partly consistent with works of Malkiel and Xu (1997) and Campbell et al., (2001) for the US stocks. They report that firm level idiosyncratic volatility increased, respectively. The trend coefficient for SVOLew is positive and statistically significant at 5%, implying that SVOLew increased over the full sample period. However, SVOLvw have a flat trend given its insignificant trend position. Compared with increased trend of SVOLew, the flat trend of SVOLvw implies that systematic volatility of large stocks was relatively stable compare to small stocks.

The paper conducted both pre-crisis estimate that ranges from January 2005 to July 2008 and post-crisis regression that span from January 2011 to December 2017. The results show that the trend parameters for all the volatility series were lower than the full sample. The trend coefficient of value weighted systematic volatility was found to be negative in the pre-crisis regression. This implies that before the global financial crisis, the value weighted systematic volatility have decreasing trend. More so, the trend parameter of value-weighted idiosyncratic volatility in the post-crisis era is nearly five times smaller than the full sample period. Above all, the idiosyncratic volatility coefficients for all estimations was positive; this suggests monotonic increase in the trend across all estimation bundles.

Table 1: The Nigerian Stock Market Volatility Series: Time Trend and Relevant Statistics

	Pre-Crisis			***Post-Crisis***			***Full-Sample***		
	2005: 01 - 2008:07			2010: 01 - 2017:12			2005:01 - 2017:12		
Details	Linear Trend	t-Stat	P-Value	Linear Trend	t-Stat	P-Value	Linear Trend	t-Stat	P-Value
SVolew	2.23	3.81	0.005	1.74	2.04	0.043	8.45	6.15	0.027
SVolvw	-0.72	-2.93	0.012	0.33	3.12	0.026	1.73	0.55	0.751
IVolew	3.76	7.42	0.000	2.98	2.01	0.052	7.16	11.39	0.000
IVolvw	0.25	2.03	0.017	0.19	2.93	0.038	0.98	1.07	0.862

**The Linear Trend coefficients are multiplied with10^-5*

Source: Authors Estimations, underlying data are from Nigerian Stock Exchange (NSE)

4.3 Relationship between Volatility and Cross Section of Returns

Table 2 shows the results of the relationship between cross section of stock returns and systematic volatility. The results indicate that high systematic volatility portfolios have higher raw returns than low systematic volatility regardless of whether the raw returns are equal or value weighted. More importantly, the positive relationship is supported by a monotonic reduction in A-FF3 beta of the market risk factor from high to low systematic volatility portfolios. Panel A presents a statistically significant negative equal weighted beta of -0.008% for medium volatility per month. There is positive relationship between high and low systematic volatility portfolios. This is consistent with traditional finance theory, which states that under-diversified high risk portfolios are expected to generate higher returns than low risk portfolios. The findings support the work of Goyal and Santa-Clara (2003) which documents a significant positive relationship between the total risks and expected returns. Meanwhile, Blitz and Vliet (2007) found that low volatility stocks globally outperform high volatility stocks by 5.9 annually with high frequency data (1985-2007). A positive equal and valued weighted beta spread was observed (see Table 2). The paper estimated the robustness test(see Table 5-B in the Appendix section).

Table 2: Nature of Volatility from Nigerian Stock Portfolios sorted by systematic source

Risk Exposure	***Raw Return***		***A-FF3Model***					
	Mean	Std. Dev	□market	□size	□value	□N/$	□trdspd	□price
Panel A:Equal-Weighted								
HighSVol	0.0124	0.1379	0.0318	1147.19	1.072	-1.482	-0.006	-0.003
	(3.125)		(7.492)	(12.783)	(13.097)	(3.761)	(2.905)	(8.126)
MediumSVol	-0.0028	0.0762	-0.0084	4211.76	1.1322	-1.36	-0.011	-0.005
	(-0.693)		(-3.245)	(22.431)	(10.004)	(1.576)	(2.005)	(1.902)
Low SVol	-0.0041	0.0421	-0.0119	5339.04	0.982	-2.755	-0.097	-0.251
	(-1.230)		(-5.904)	(19.732)	(15.588)	(3.002)	(1.992)	(2.108)
Panel B:Value-Weighted								
HighSVol	0.0448	0.1563	0.0532	1294.43	1.9252	-1.384	-0.059	-0.018
	(5.982)		(9.291)	(16.811)	(29.593)	(-2.81)	(-2.101)	(1.095)
MediumSVol	0.0309	0.1142	0.0064	3019.33	1.2634	-1.488	-0.048	-0.022
	(4.011)		(2.207)	(20.142)	(27.956)	(-2.60)	(-2.004)	(1.478)
Low SVol	0.0115	0.0853	0.0701	6892	1.1484	-2.097	0.009	-0.098
	(2.894)		(9.842)	(21.389)	(26.406)	(-2.90)	(1.065)	(1.784)

Source: Authors' computation and compilation, underlying output contains several regression results.

Note that the values in parentheses represent the t-statistics, N/$ represents currency risk factor proxy with exchange rate, trdsp represent trade speed, the coefficient of trading speed is obtained from observing number of zero volume, and Price is the coefficient of price risk factor. The study considers stock momentum, short and medium terms reversals and trading quantity but they have insignificant coefficients, which is the major reason or their omission in the report.

The results of the IVOL series are presented in Table 3. The results show that high idiosyncratic volatility portfolios receive higher raw returns regardless of whether the raw returns are equal or value weighted. The positive relationship also is confirmed by a monotonic reduction in A-FF3 market risk beta from high to low IVOL portfolios. The table reports a significant positive equal weighted beta spread of 2.81% per month between high and low idiosyncratic portfolios. Panel B endorses the positive relationship between high and low idiosyncratic volatility portfolios with a significant beta spread of 3.82%. The positive results uphold the findings of Brockman et al (2009) and Drew et al (2002) both studies focus on Hong Kong stock market and Nartea et al (2011) concentrates on ASEAN emerging stock market. The findings contradict the puzzling negative IVOL effect of Ang et al (2006 and 2009) for US stocks and 22 other developed markets.

Table 3: Nature of Volatility from Nigerian Stock Portfolios Sorted by Idiosyncratic Source

RiskExposure	***RawReturn***		***A-FF3Model***					
	Mean	Std. Dev	□market	□size	□value	□N/$	□trdspd	□price
Panel A:Equal-Weighted								
HighIVol	0.0227	0.1177	0.0381	920.63	1.4028	-1.039	-0.004	-0.031
	(3.615)		(8.649)	(15.943)	(31.038)	(-2.1)	(-3.504)	(-2.78)
MediumIVol	-0.0084	0.0857	-0.0251	2038.16	1.1472	-1.086	-0.018	-0.004
	(-0.793)		(-5.237)	(28.075)	(35.254)	(-2.3)	(-4.212)	(-1.90)
Low IVol	-0.0054	0.0591	-0.0132	7192.14	1.0925	-1.997	-0.206	-0.017
	(-1.199)		(-7.452)	(32.718)	(38.118)	(-3.0)	(-5.882)	(-2.00)
Panel B:Value-Weighted								
HighIVol	0.0543	0.1746	0.0635	920.63	1.4028	-1.348	-0.095	-0.108
	(6.782)		(10.952)	(15.943)	(31.038)	(-2.2)	(-2.011)	(-1.06)
MediumIVol	0.0321	0.1033	0.0053	2038.16	1.1472	-1.848	-0.084	-0.042
	(3.708)		(1.652)	(28.075)	(35.254)	(-2.3)	(-2.404)	(-1.01)
Low IVol	0.0161	0.0913	-0.0036	7192.14	1.0925	-2.905	-0.019	-0.018
	(2.588)		(-7.974)	(32.718)	(38.118)	(-2.9)	(-1.839)	(-0.98)

Source: Authors' computation and compilation, underlying output contains several regression results. Note that the values in parentheses represent the t-statistics, N/$ represents currency risk factor proxy with exchange rate, trdsp represent trade speed, the coefficient of trading speed is obtained from observing number of zero volume, and Price is the coefficient of price risk factor. The study considers stock momentum, short and medium terms reversals and trading quantity but they have insignificant coefficients, which is the major reason or their omission in the report.

4.4 Pricing Behaviour of Idiosyncratic Volatility in Stocks

The analysis of the pricing follows the concept of Drew et al., (2004). The paper added another factor termed the high minus low (*HIVMLIV*) factor, which relates to the *Fama-French three* factor model. The HIVMLIV factor is the return of high IVOL minus Low IVOL portfolio. Therefore, HIVMLIV is the return of a zero investment factor portfolio for IVOL. The result is presented in Table 4. The result shows that the HIVMLIV beta increases monotonically from low to high idiosyncratic volatility portfolios for all categories. For instance, in Panel A, the beta increases from -0.1011 to 0.4195 among the big size portfolios, more so, betas in Panels B and C also follow the same pattern. In sum, the result shows that idiosyncratic volatility is priced in Nigerian stocks. This implies that high idiosyncratic volatility portfolios are being rewarded with high returns.

Table 4: Multifactor Pricing Model Based on Idiosyncratic Volatility Sorted Portfolios

Dependent Variable: Returns (R_t)

	Coefficient			Probability		
	HIVol	*MIVol*	*LIVol*	*HIVol*	*MIVol*	*LIVol*
Panel A: Big sizeportfolios						
Constantterm	-0.0027	-0.0065	-0.0087	0.1004	0.0003	0.0007
Marketfactor	0.3089	0.4969	0.9155	0.0001	0.0000	0.0002
Size factor	-0.7136	-0.1027	0.1236	0.1247	0.1958	0.0004
Valuefactor	0.0498	0.0717	0.0972	0.0351	0.0613	0.0055
Exchange riskfactor	-2.8831	-3.2529	-6.859	0.0046	0.0052	0.0011
Real Interest Ratefactor	0.9783	0.8771	1.0982	0.0572	0.0344	0.0109
Trading speedfactor	0.0544	0.01474	0.0094	0.0000	0.0005	0.0249
Momentumfactor	0.0037	0.0099	0.0106	0.6275	0.4712	0.0722
Reversalfactor	0.0985	0.1422	0.1667	0.0229	0.0144	0.0351
zero returnfactor	0.0011	0.0008	0.0004	0.4309	0.6112	0.0023
High Minus Lowfactor	**0.4195**	**0.0527**	**-0.1011**	**0.0001**	**0.0257**	**0.0110**
Adjusted R-squared	0.8104	0.7827	0.7986			
BG-LMtest				0.0176	0.0001	0.0571
ARCHtest				0.0000	0.0000	0.0047
Panel B: Medium sizeportfolios						
Constantterm	0.0076	-0.0158	-0.0101	0.0143	0.0041	0.0000
Marketfactor	0.6831	0.7542	0.5469	0.0000	0.0000	0.0000
Sizefactor	0.2604	0.4382	0.5381	0.0004	0.0002	0.0031
Valuefactor	0.2349	0.1577	0.0864	0.0112	0.0039	0.0015
Exchange riskfactor	0.7783	0.5171	0.9961	0.0302	0.0344	0.0291
Real Interest Ratefactor	0.0413	0.0477	0.0328	0.0045	0.0022	0.0009
Trading speedfactor	0.0091	0.0102	0.0178	0.0511	0.4608	0.0002
Momentumfactor	0.0517	0.0022	0.0067	0.1229	0.0044	0.0751
Reversalfactor	0.0825	0.0243	0.0041	0.0001	0.0014	0.0051
zero returnfactor	0.0115	0.0801	0.0394	0.0009	0.0012	0.0143
High Minus Lowfactor	**0.8475**	**0.1875**	**-0.0846**	**0.0000**	**0.0311**	**0.0003**
Adjusted R-squared	0.8895	0.7742	0.7119			

BG-LMtest				0.1726	0.0508	0.2944
ARCHtest				0.0215	0.0002	0.0000
Panel C: Small sizeportfolios						
Constantterm	-0.0089	-0.0603	-0.0088	0.0008	0.0001	0.0066
Marketfactor	0.7243	0.9837	0.7201	0.0201	0.0007	0.0033
Sizefactor	1.3042	0.9108	0.9642	0.0044	0.0001	0.0040
Valuefactor	0.0743	0.1501	0.1656	0.7262	0.0377	0.0005
Exchange riskfactor	1.0367	1.6332	0.8799	0.0025	0.0420	0.0155
Real Interest Ratefactor	0.0621	0.0411	0.0349	0.0144	0.0039	0.0256
Trading speedfactor	0.0142	0.0382	0.0633	0.0001	0.0683	0.0109
Momentumfactor	0.0672	0.0413	0.6702	0.0031	0.0379	0.2312
Reversalfactor	0.0503	0.0332	0.1475	0.0173	0.0008	0.0442
zero returnfactor	0.0204	0.0416	0.0847	0.0169	0.0422	0.0561
High Minus Lowfactor	**0.7218**	**0.1233**	**-0.2491**	**0.0011**	**0.0016**	**0.0391**
Adjusted R-squared	0.96360.843		0.7235			
BG-LMtest				0.0017	0.0125	0.4161
ARCHtest				0.0000	0.0147	0.0003

Source: Authors' computation and compilation, underlying output contains several regression results in order to arrange the data for use, portfolios are first sorted by size (market capitalization) and then sorted by idiosyncratic volatility. Size categories are big (BIG), medium (MED) and small (SMA); idiosyncratic volatility categories are high (HIV), medium (MIV) and low (LIV). Rt is the portfolio return, B-G LM is the Breusch Godfrey serial correlation LM test value.; ARCH is the Autoregressive Conditional Heteroskedasticity test value. For cases with significant serial correlation and/or heteroscedasticity, the study employs M-L-ARCH and the re-estimated coefficients are reported.

From the foregoing analysis, it is evident that there are positive relationships between volatility types (systematic and idiosyncratic volatilities) and stock returns. Hence, the paper refutes the null hypothesis that there are no relationships. Again, the result shows that in Nigeria stock exchange market, idiosyncratic volatility is priced and thus, suggests that investors holding stocks with idiosyncratic volatility should demand for higher returns. This contradicts the null hypothesis that states that idiosyncratic volatility is not priced. Therefore, the paper accepts the alternative hypothesis and concludes that idiosyncratic volatility is priced.

5. Conclusion

The study concludes on three grounds that message to both domestic and foreign investors, governing bodies and policy makers. First, the study found that investors could have increased portfolio returns by going long on high IVol stocks and short on low IVol stocks. Moreover, investors could increase their portfolios' returns by using IVol strategy to sort stock portfolios rather than using SVol strategy in the Nigerian stock market. Again, the average correlation among Nigerian stocks has increased over the study period. This suggests that the benefit of diversification in the Nigerian stock market has decreased, that is, the numbers of stocks in a portfolio to achieve a certain level of diversification has increased going by the study period. Thus, institutional and domestic investors should invest in more stocks than before so as to diversify the idiosyncratic risk in their portfolio.

Second, the global financial crisis of the late 2008 is seen to negatively influence high *EWSVol*firms' returns through equal weighted systematic volatility and low *EWIVol*firms' returns through equal weighted idiosyncratic volatility, however, high and medium *EWIVol*firms earns increasing returns with the positive effect of equal weighted idiosyncratic volatility, likewise, high *VWIVol*firms. It implies that institutional investors can take the advantage of *specific events* to increase their returns by investing in stocks with high equal and value weighted idiosyncratic volatility.

Third, if investors determine to invest on the Nigerian Exchange using sector indices then they could generate excess returns from financial services, oil and gas and consumer goods sectors as they possess higher return spillover effect on other sectors with increased volatility transmissions. However, conglomerates sector has lower volatility transmission to other allied sectors; therefore, investors investing with conglomerates sector index must consider the negative feedback of volatility persistence and negative effect of asymmetric news. This is not true for agriculture and healthcare sectors with positive volatility transmission and unidirectional return spillover coming from financial services, oil and gas and consumer goods sectors. Government, policymakers and Investors should watch happenings that could arise in the financial services, oil and gas and consumer goods sectors as they could easily influence returns on investment and overall activities on the NSE.

The findings of the paper are centered on three broad areas:

a) **Policy Rate Determination:** In order to take position in policy rates such as interest rate, lending rate corridor, and other access to credit rates, the monetary authority should consider most importantly the developments in the Nigeria's stock market. This became crucial, as the effect of access to credit is noticeable on investors' returns through idiosyncratic volatility. Also, the desirability of a more market determined exchange rate process is reliable; however, it should be balanced against the associated potential increase in the cost of capital of Nigerian firms that could affect their performance.

b) **Risk Assessments:** The systematic volatility should be a baseline for risk measure and also for bargaining premium by investors on the Nigerian Stock Exchange. This can be done by estimating portfolio systematic risk through the firm level. It is notwithstanding that; the idiosyncratic volatility is also a good risk metric however the impact of the latter risk is much higher than the former risk metric.

c) **Trading Strategy:** The paper shows that the effect of high idiosyncratic volatility stocks outweighs that of the low idiosyncratic volatility stocks. Therefore, investors (domestic and international) can increase portfolio returns, rather than dropping stocks, by going long on high *IVol* stocks and short on low *IVol* stocks in the Nigerian Bourse.

Study Limitation and Suggestion for Further Research

The paper is limited by a number of factors. First, the research examined the relationship between systematic and idiosyncratic volatility on a cross section of stock returns traded on the Nigerian stock exchange. However, firms that do not have sufficient data were not considered in the analyses. Second, underlying assumptions stated to guide the framework used to generate the idiosyncratic series are great improvement, but changes in these assumptions may impinge on the findings. Third, variables such as industrial production and monthly GDP data were excluded in our analyses due to inadequate data set and these data had been proved to provide positive and significant effect on the framework. Based on the limitations, the paper suggests that when there is information on the amount of share holding by institutional investors, the estimation exercise can be revisited. More so, future studies may have to test for the causes of the increased level of idiosyncratic volatility in the Nigerian stock exchange market.

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Appendix

Table 5A: Descriptive Statistics of Volatility Series

Panel A: Summary Statistics

Details	Mean	Median	StdDev	Coef.V	Max	Min
SVolew	0.0241	0.0203	0.0102	0.2783	0.1045	0.0123
SVolvw	0.015	0.0134	0.0073	0.3674	0.0827	0.0104
IVolew	0.0143	0.0126	0.0054	0.3106	0.0549	0.0112
IVolvw	0.0056	0.0042	0.0026	0.2984	0.0378	0.0062

Panel B: CorrelationStatistics

	SVolew	SVolvw	IVolew	IVolvw
SVolew	1			
SVolvw	0.8016	1		
IVolew	0.8439	0.5533	1	
IVolvw	0.7155	0.7921	0.7309	1

Panel C: AutocorrelationTa

	SVolew	SVolvw	IVolew	IVolvw
$\rho 1$	0.524	0.457	0.723	0.689
$\rho 3$	0.446	0.343	0.682	0.622
$\rho 6$	0.208	0.198	0.514	0.595
$\rho 9$	0.195	0.124	0.483	0.479
$\rho 12$	0.183	0.153	0.43	0.374

Panel D: Stationary Test(t-statistics)

	Constant	1%	Constant	1% CriticalValue
SVolew	-12.329	-3.451	-12.245	-3.99
SVolvw	-8.756	-3.451	-8.289	-3.99
IVolew	-11.821	-3.451	-11.618	-3.99
IVolvw	-5.7078	-3.451	-5.894	-3.99

The t-Statistics for both constant and constant with trend regressions were reported. The study adopts the AugmentedDickey

Table 5B: Nature of Volatility from Double Sorted Nigerian StockPortfolios

	Equal-Weighted			***Value-Weigthed***		
	HIVol	*MIVol*	*LIVol*	*HIVol*	*MIVol*	*LIVol*
Panel A: Double sort on size andIVol						
BIG	0.0253	-0.0121	-0.0104	0.0396	-0.0043	-0.0085
	(6.735)	(-4.296)	(-6.197)	(7.498)	(-1.938)	(-4.307)
MED	0.0471	-0.0108	-0.0116	0.0607	-0.0101	-0.0175
	(8.901)	(-2.606)	(-6.251)	(10.844)	(-2.341)	(-6.481)
SMA	0.0209	-0.0174	-0.0157	0.0576	-0.0131	-0.0117
	(4.624)	(-4.823)	(-5.549)	(9.747)	(-3.280)	(-5.667)
Panel B: Double sort on momentum andIVol						
WIN	0.0365	-0.0091	-0.0157	0.0405	0.0057	0.0208
	(6.048)	(-2.049)	(-5.104)	(6.765)	(1.658)	(6.441)
MID	0.0208	-0.0095	-0.0124	0.0396	0.0062	-0.0095
	(5.769)	(-2.801)	(-4.071)	(6.319)	(1.703)	(-4.342)
LOS	0.0387	-0.0103	-0.0178	0.0683	-0.0025	-0.0195
	(5.642)	(-4.059)	(-5.012)	(8.503)	(-0.692)	(-5.679)
Panel C: Double sort on Short-Term Reversal andIVol						
WIN	0.2087	0.1311	0.0747	0.2141	0.1416	0.0784
	(23.414)	(30.314 `	(26.079)	(26.865)	(27.875)	(27.903)
MID	-0.0073	-0.0036	-0.0075	-0.0054	-0.0067	-0.0075
	(-2.624)	(-3.021)	(-3.295)	(-2.301)	(-2.131)	(-3.992)
LOS	-0.1445	-0.1704	-0.0778	-0.1841	-0.1206	-0.0788
	(-24.858)	(-31.497)	(-23.696)	(-33.286)	(-28.422)	(-20.943)
Panel D: Double sort on Trading Speed andIVol						
HTS	0.0312	-0.0108	-0.0163	0.0478	-0.0032	-0.0131
	(6.125)	(-3.654)	(-7.463)	(7.346)	(-1.192)	(-5.183)
MTS	0.0271	-0.0089	-0.0134	0.0398	-0.0027	-0.0163
	(5.976)	(-2.609)	(-4.021)	(7.113)	(-0.657)	(-5.092)
LTS	0.0251	-0.0072	-0.0107	0.0378	0.0065	-0.0107
	(4.754)	(-1.992)	(-3.984)	(7.047)	(2.176)	(-3.946)

Source: Author's computation and compilation, underlying output contains several regression results.

At the end of each month over the sample period, stocks were double sorted three by three (3x3), first by the control factor (size, momentum, reversal and trading speed) into three portfolios and then within each portfolio the study sort stocks again by idiosyncratic volatility measured with respect to the Augmented Fama-French three factor model (A-FF3). The beta of each equal and value weighted portfolio is presented with t-statistics in parenthesis. Beta here refers to the A-FF3 model beta (i.e. coefficient) using the full sample of monthly equal and value weighted returns for each portfolio. To control for a particular factor, the study averaged the beta within each idiosyncratic volatility category with three portfolios with dispersion in idiosyncratic volatility but contain all values of the factor being controlled. Size is the firm's market capitalization at the end of month t; momentum at time t is the stock's 11-month past return lagged one month; reversal is stock's past month return. LIV, MIV and HIV refer to low, medium and high idiosyncratic volatility portfolio. BIG, big size; MED, medium size; SMA, small size; WIN, winner; MID, middle; LOS, loser; HTS, MTS and LTS refer to high, medium and low trading speed, respectively.