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Effect of Drawdown Strategy on Risk and Return in Nigerian Stock Market

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Abstract. *The study examined effect of drawdown on return in the Nigerian stock market. The study covered the period of 2005 to 2020. Purposive sampling was employed and the sample size comprising 90 regularly traded stocks were used for the analysis. Monthly data sourced from the CBN statistical bulletin and Nigeria Stock Exchange on stock prices, market index, risk-free rate ownership shareholdings, market capitalization, book value of equity, earnings before interest and taxes, total assets and drawdown were used for study. The Fama-MacBeth two-step regression method was employed. The study found that the drawdown has a negative and significant effect on stock returns but has a positive and significant effect on risk in the Nigerian stock market over the whole sample period. Findings also revealed that the sub-period are not stable in terms of the magnitude of effect and significance on risk and return. Our findings contradict the a-priori expectation that drawdown could improve performance through risk minimization and return maximization in the Nigerian stock market. Based on the findings investors and other market participant are encouraged to use drawdown as one of the investment performance measures to guide investors' expectation and their tolerance on the size of stock market disruption or crashes or rallies in Nigeria.*

Keywords: drawdown, risk premium, return, volatility, positive news, negative news

JEL Classification: G11 G12.

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Introduction. The proposition of mean-variance optimisation theory by Makowitz in 1952 was based on maximising the expected return while minimising the risk. This serves as a general goal of every investor which aims at optimal portfolio. In view of this, every investor seeks to maximize their utility (satisfaction) by maximising expected return and minimising risk (variance). The issue on portfolio performance is an important and widely debated phenomenon in the finance literature since the advent of Modern Portfolio theory in 1952. However, there is no consensus among the scholars on appropriate performance measure and whether the choice of such measures matter or not.

Traditionally, foremost researchers such as Sharpe (1966), Krausnand Litzenberger (1976), Dittermar (2002) among others used sharpe ratio, coskewness, kurtosis etcetra as performance measures under the assumption that return have a normal distribution and investors have quadratic utility function. This shows that these performance measures are appropriate under an elliptically symmetric distribution. Contrary to this, Liu (2015) who expressed that drawdown is the primary concern of investors because it distinguishes between the buying and not buying approach and reveals that small maximum drawdown follows high cumulative returns. In addition, it was considered as a strategy that encapsulates the downside risk dimension of asset and portfolio return and complemented investors' risk instinct and hypothesis (Shah, etal, 2019). Drawdown is one of portfolio management that does not only provides dynamic measure of risk, but also be viewed as giving measure of relative regret (Valle & Beasley, 2019). Valle and Beasley (2019) opined that drawdown signals the time when the investor may choose to change his/her investment position, which depends on his/her perception of future moves of the market and his/her risk aversion. Thus, investors in the investment process are very concerned about the drawdown of investment stocks because market drawdowns do not only lead to portfolio losses and liquidity shocks, but also indicate potential imminent recessions.

In the light of this importance, several studies have investigated the drawdown strategy and portfolio performance in respect to mean-variance relationship (Pruchnicka-Grabias, 2016; Rudin & Marr, 2016; Almahdi & Yang, 2017; Mendes & Lavrado, 2017; Canbin, 2018; Kim, 2018; Zhou *et al*., 2019; Inghelbrecht, 2019). Thus, empirical evidences have shown that portfolio optimisation can be achieved through drawdown but most of these studies were carried out mostly in the developed countries while few of the studies were conducted in the emerging economies such as Nigeria. In view of this, one of the propelling forces for this study is to examine effect of drawdown on risk and return in the Nigerian stock market. The contribution of this paper to the existing body of knowledge is in three folds. Firstly, it represents an examination of the effect of drawdown on risk and return within the context of Nigerian stock market. Secondly, use of Fama-MacBeth two step regression approach under the Fama and French five factor model in Nigeria. Thirdly, the study considered effect of drawdown as a useful tool of investment performance strategy under the long and short periods. The remaining part of this study proceeds as follow: section two brought out the review of relevant literature while section three spelt out the methodology. Section four presented the findings while the conclusion was given in section five.

1. Literature Review

Cibulskiene and Brazauskas (2016) opined that drawdown accounts for losses that occur across the investment period, and it reflects the maximum loss an investor can expect over a certain time period. The study categorized drawdown as a downside risk and a risk management strategy. As a result, one of the indicators of downside risk is drawdown, and the phrases can be used interchangeably. In spite of this, there are several studies on drawdown and risk and return which include but not limited to the following; Okpara (2015) used standard GARCH, EGARCH and TARCH models to analyse the downside risk in the Nigerian stock market. The result showed that the Nigeria stock market has a considerable downside risk measured in terms of VaR in the long position. Thus, it can be concluded that investors and portfolio managers in the Nigeria stock market have long trading position or can buy assets with concern on when the asset prices will fall. One of the weaknesses of the methodology is that distributional error assumptions was not carried out under Gaussian, Student-t and the Generalized Error Distribution in order to select the appropriate model for the estimation. Kim (2018) examined whether Value at Risk (VaR) and Maximum drawdown (MDD) contained any additional information to volatility in individual stocks. The study found that the VaR and MDD do not capture additional risk factors after conditioning volatility. The study concluded that the VaR and MDD were not different from volatility in the Korean stock market. However, the study only considered different sources of risk measurements without checking the relationship between each measurement and return. Chen, Chiang and Hardle (2018) investigated the downside risk-return relation in an integrated market framework. The study used fractional cointegration (long-run) and vector autoregression (short-run) FCVAR model. It was found that downside risk forms a cointegration relationship with the world market in the long run except in Japan. However, the study fails to conduct information criteria such as Akaike information criterion, Bayesian information criterion and likelihood ratio in order to select appropriate ranks and lags of the model. Fargo and Tedongap (2018) used monthly returns over a period of time to examine the impact of downside risk on asset prices (July 1964 to December 2016). The performance of their three-factor and five-factor models was examined using the generalized method of moments (GMM) and established that, in addition to market returns and market volatility, downside factor and volatility factor represent consistent pricing. It was concluded that expected returns on various asset classes reflect a premium for bearing unwanted exposure to these factors. Canbin (2018) in his own study examined both the magnitude and duration of drawdown. Drawdown duration was captured with the time of the last peak of the cumulative profit series while the maximum drawdown duration was represented by the largest drawdown duration. The study found that the group with the lowest average historical maximum drawdown has a better performance than the group with the largest one. However, one of the weaknesses of the study is that the methodologies used are more of descriptive in nature because they cannot show the predictive relationship between drawdown and return.

To price downside risk, Shah, Khan, and Raza (2019) used the monthly stock returns of 199 companies listed on the PSX and 1073 companies listed on the NYSE. The analysis covered 1997 to 2017 and used augmented downside risk arbitrage pricing theory (DR-APT). In comparison to the traditional APT model, the study found that DR-APT was a better model for pricing stock returns in volatile developing and developed markets. As a result, fund managers, investors, economists, and corporate executives were advised that the findings of this study would be valuable in assessment of risks and firm values. The study, however, did not undertake a fitness test to assess the model's estimation output. Raza, Hasan and Rashid (2019) investigated the comparative relationship between the downside risk adjusted CAPM and traditional CAPM. Monthly data on six major stock markets of the world (Brazil, Russia, India, China, South Africa and Pakistan) were sourced from June, 2000 to June, 2018. The study employed Fama and Macbeth (1973) regression analysis as the estimation technique. It was documented that there is a positive relationship between the risks (downside and traditional beta) and the expected return. The study concluded that downside CAPM has a better predicative power than the traditional models, especially in emerging economies. One of the weaknesses of the study is that it failed to subject the models estimation to diagnostic test and the results of the estimate may be bias and spurious. Chiang (2019) examined the risk-return relations for ten Asian stock markets by employing conditional volatility, local downside risk, regional downside risk, and world/U.S. downside risk. The study employed GARCH-M model as the estimation technique. The study revealed positive and significant intertemporal relations between excess stock returns and various risks for different Asian markets. The study concluded that positive risk-return relations exist across ten (10) Asian markets after controlling for the lagged dividend yield, higher moments of stock returns, and exchange rate variations. One of the weaknesses of the methodology is that distributional error assumptions was not carried out under Gaussian, Student-t and the Generalized Error Distribution in order to select the appropriate model for the estimation. Zhou, Zhong, Leng, Li, and Xiong (2019) proposed the conditional crash rate (CCR) to examine financial market crisis and evaluated the risk of financial market crash, based on maximum drawdown and escape rate. The study employed Heston model to obtain drawdown time series, Kernel density estimation, Black–Scholes model and least square method of the probability density distribution function of stock price returns. It was found that the CCR of stock price in financial market is equivalent to the escape rate of the drawdown time series. The study concluded that the parameter variation induces the appearance of noise enhancement stability in the function of CCR and amplitude of volatility fluctuation. One of the weaknesses of the study is that the methodologies used are more of descriptive in nature because they cannot show the predictive relationship between drawdown and return.

Su, Mo and Yin (2020) investigated the impact of downside risk in the oil market on the expected stock returns in China's A-share market. The study employed the fractional integration vector autoregressive model to capture whether the downside risk of oil returns exhibits the long memory property. It was found that downside risk positively influences the expected stock returns, and the positive relation is consistent across industries. The study concluded that the positive relation can be explained by the global risk aversion of investors who are averse to downside risk in the oil market and demand compensation in the form of higher expected returns for holding stocks. However, the study failed to conduct information criteria such as Akaike information criterion, Bayesian information criterion and likelihood ratio to select appropriate ranks and lags of the model. Rad-Kaftoudi, Gholizadeh, and Fadaei (2020) in a similar study investigated the relationship between upside risk, downside risk, and stock market volatility using descriptive and applied statistical methods. To verify the idea, the researchers used a regression model, which revealed that both upside and downside risks have positive and significant impact on volatility. As a result, upside and downside risks were found to be strong predictors of stock market volatility. However, the study does not run diagnostic tests to verify the model's assumptions. Wang and Yan (2021) did a comparative research on the downside risk strategy and overall volatility strategy in order to improve performance using the Fama-Macbeth two step regression and spanning regression analyses. It was demonstrated that strategies scaled by downside volatility outperform strategies scaled by total volatility. As a result, it was concluded that downside volatility-managed portfolios outperform total volatility-managed portfolios at lower trading costs, but the outperformance fades at greater trading costs. One of the study's flaws is that it does not subject the model estimation to diagnostic testing; meaning that the estimates may be biased and erroneous. Shah, Raza, and Hashmi (2021) examined the influence of the Covid-19 pandemics on the downside risk-return volatility in the four stock markets of the United States, the United Kingdom, China, and Pakistan. Vector autoregressive and generalized autoregressive conditional heteroscedastic models were used for the estimation. The study established that the downside risk has a greater value during Covid-19, which indicates that the maximum possible loss for each of the four countries was quite high during this time period. Due to this, the study came to a conclusion that investors' reactions were positive and strong in the event of positive news/outbreaks and negative and weak in the event of negative news/outbreaks. The study did not however, use information criteria like the Akaike information criterion, Bayesian information criterion, or Likelihood ratio to choose the proper ranks and lags for the model.

Hassan, Chowdhury, Balli, and Hasan (2021) investigated how Covid-19 triggered maximum drawdown in Islamic and conventional markets. According to the study which used ordinary least square as its analytical tool, higher returns are associated with smaller maximum drawdowns, while higher volatility is associated with larger maximum drawdowns. Islamic markets have also proven to be more resilient than their non-Islamic counterparts. As a result, it was shown that Islamic markets outperformed the traditional markets, which may be due to the high caliber of the underlying assets. Since the study is contrasting the Islamic and mainstream markets, it did not adequately account for industry effects in the model. Wei-Zhang, Xiong, and Wang (2021) investigated the impact of downside risk on the cross-sectional return of cryptocurrencies. The Fam-Macbeth regression method was employed. Future bitcoin returns were found to have a positive relationship with downside risk, which is consistent with limit-to-arbitrage theory and the risk-return trade-off theory. Findings that investors might still receive compensation for assuming greater downside risk refutes the claim that bitcoin traders only trade because they like to take risks. The estimates in the study could be biased and erroneous because the models were not put through diagnostic tests. Alrabadi, Alwaked, Al-Qadi and Bakhit (2022) investigated the effect of downside risk on stock return. The study employed panel regressions for the estimation, and it was revealed that there is a statistically significant positive effect of downside risk on stock returns in ASE while upside risk has significant effect on stock returns. The study concluded that that downside risk is a source of systematic risk in ASE. However, the study failed to subject the models used to further diagnostic tests to confirm their validity.

No doubt, several studies such as Pruchnicka-Grabias (2016), Rudin *et al*. (2016), Almahdi and Yang (2017), Mendes and Lavrado (2017), Canbin (2018), Kim (2018), Zhou *et al*. (2019), Inghelbrecht (2019) and so many others have investigated the drawdown strategy and portfolio performance in respect to mean-variance relationship. However, many of the studies only focused on downside risk as an indicator of drawdown and its effect on the expected return in various stock markets without considering the risk-return relationship. It is also worth noting that studies on this topic are very few and scanty in Nigeria. These knowledge gaps solicit for investigation; hence, the motivation for the study.

The only hypothesis (H_0) to be tested in this study states 'Drawdown has no significant effect on risk and return in the Nigerian stock market'. The study is anchored on modern portfolio theory. The theory emphasised that every investor seeks to maximise their utility (satisfaction) by maximising expected return and minimising risk (variance).

2. Methodology

The population of the study consists of 161 companies stock listed on the Nigerian Stock Exchange (NSE) as of December 2020, and an expo-factor research design was employed. Purposive sampling technique was used and sample size of 90 regularly traded stocks were used for the analysis. The monthly stock prices, market index, risk-free rate (which was substituted with the treasury bill rate), ownership shareholdings, market capitalization, book value of equity, earnings before interest and tax, and total assets were the data used in this study. The whole sample period covered from 2005- 2020 which was grouped into sub-sample period; 2005–2008, 2009–2012, 2013–2016, and 2017–2020. The data were obtained from the websites of the Nigerian Group of Exchange (NGX), the Central Bank of Nigeria (CBN), and Standard and Poor. The study used ordinary least square through two-step Fama-MacBeth regression method. Consequently, the baseline model chosen for this investigation was Five-Factor Fama and French model and this is specified as follows:

$$Rit - Rft = ai + bi(Rmt - Rft) + Si(SMBt) + hi(HMLt) + ui(RMWt) + vi(CMAt) + \varepsilon it \tag{1}$$

Where: R_{it}-Rf_t is the excess return of the individual assets. Rm_t - Rf_t is the excess market return, SMB_t is the size factor premium, HML_t is the value factor premium, RMW_t is the profitability factor premium, CMA_t is the investment factor premium, a_i is the intercept, b_i is the regression parameter, S_i is the loaded factor of the size, h_i is the loaded factor of the value, u_i is the loaded factor of the profitability, v_i is the loaded factor of the investment and ε_{it} is the residual term. This model is augmented by incorporating drawdown and that led to equation 2.

$$Rit - Rft = ai + bi(Rmt - Rft) + Si(SMBt) + hi(HMLt) + ui(RMWt) + vi(CMAt) + fi(DRt) + \varepsilon it \quad (2)$$

Where: DR_t is the simulation drawdown premium, f_i is the loaded factor of the drawdown. The model specification takes a lead from the Maximum drawdown-CAPM specified by Baghdadabad and Glabadanisdis (2012) having controlled for size, value, profitability, and investment factors. To capture the effect of drawdown on risk in the Nigerian stock market, the drawdown incorporated in the Glosten, Jagannathan and Runkle Generalized Autoregressive Conditional Heteroscedasticity (GJR-GARCH). This showed the effect of drawdown on risk in the Nigerian stock market and presence of asymmetric information. The model is expressed in equation 3.

$$ht = a0 + \sum_{i=1}^{n} a_{1j}\, ht - j + \sum_{i=1}^{m} a_{2i}\varepsilon_{t-i}^{2} + a_{3i}M_{t-i}\varepsilon_{t-1}^{2} + \theta 1DRt + \varepsilon t \quad (3)$$

Where a_1, a_2, a_3 are the parameters to be estimated. The conditional volatility is positive when $a_1 > 0$, $a_1 \geq 0$, $a_1 + a_3 \geq 0$, $a_2 \geq 0$, i = 1…., n and m =1….,q, if $\varepsilon_t < 0$, and otherwise 0. ε_{t-1} is the ARCH term while h_{t-1} is the GARCH term. The sum of the coefficient of ARCH and GARCH terms measures the level of persistence in volatility. The volatility is persistent when $a_1 + a_2 \geq 1$. The $a_3M_{t-1}\varepsilon^2_{t-1}$ was introduced in to the GARCH framework to measure the asymmetric effect. That is, volatility's response to new information. It proves that when there is a negative news, volatility rises, but when there is a good news, volatility falls. As a result, M_{t-1} serves as a dummy variable with a value between 0 and 1. It is 1 when t is negative (indicating good news), and 0 when t is positive (an indication of bad news). If the parameter a_3 is significantly different from zero, an asymmetric effect exists; otherwise, it does not.

The maximum drawdown is expressed in the equation 4.

$$Dt,j = \frac{Mt,j - St,j}{Mt,j} \quad (4)$$
$$MDDt = M\,ax\,D\,t,j$$

Where: $D_{t,j}$ represents the drawdown in each day, $M_{t,}$ is the maximum asset price in each day and S_t is the valley of asset price in each day. MDDt is maximum drawdown in each day. This measurement conforms with the approach of Uslu and Evren (2018).

3. Results and Discussion

This section presents the result and discussion of the study. The result start from the descriptive statistics present in Table 1.

Table 1. Descriptive Statistics

Statistics	AVR	B	S	H	R	C	DD
Mean	0.014080	0.717871	-0.097828	-0.358627	0.130323	0.180324	-0.336688
Median	0.011067	0.749233	-0.122264	-0.360414	0.158229	0.087921	0.000000
Max.	0.092572	2.013677	2.078426	9.281946	8.121966	8.696328	0.000000
Mini.	-0.006740	-0.199242	-4.791040	-12.71657	-5.937704	-3.340886	-3.970283
Std.Dv.	0.016928	0.407010	0.807487	1.830331	1.248830	1.270236	0.564151
Skew	2.741394	0.500754	-1.935529	-1.859732	1.376769	4.119644	-3.299227
Kurt.	12.24622	3.590288	14.37403	32.63727	26.53697	28.90493	20.17016
J.Bera	433.3256	5.067970	541.3263	3345.758	2105.892	2771.068	1268.827
Prob.	0.000000	0.079342	0.000000	0.000000	0.000000	0.000000	0.000000

Note: AVR, B, S, H, R, C and DD represents average return, market risk, value risk, profitability risk, investment risk and drawdown strategy respectively.

Source: Authors' Computation, (2022).

The results depicted in Table 2, reveals the average values of average return, estimated risk premium-market, size, value, profitability and investment, and drawdown. It is overt that average return has a tendency to increase with market risk premium, profitability risk premium and investment risk premium. On the other hand, the size risk premium, value risk premium and drawdown have tendency to decrease during the sampling. The return values range from -0.006740 to 0.092572 which implies that there are tendencies of making loses and capital gain on the market trading activities within the sample period. This indicates that there is presence of active securities on the market. The values of market risk premium range from -0.199242 to 2.013677 and this suggests that the investors are not always rewarded. The values of size risk premium range from 2.078426 to -4.791040 and this implies that the investors are not always rewarded for the size of their portfolio. The value risk premium has a minimum value of -4.791040 and the maximum value of 2.078426 and this implies that at some point in time the co-skewness tends to be less volatile than the market but at some other times it tends to be more volatile than the market. The profitability risk premium value ranges from -5.937704 to 8.121966 and this implies that. The investment risk premium values range from -3.340886 to 8.696328. The values of drawdown range from 0 to -3.970283 and this shows that the tolerance level of risk in the market is at 3.97 which guide investors against stock market crisis.

The standard deviation in the Table indicates that value risk premium is the most volatile among the variables while the least volatile variable among the variable is the average return. Looking at the score of skewness, it reveals that the systematic risk, profitability risk premium, investment risk premium and average return are positively skewed while the size, value risk and drawdown are negatively skewed. The scores of kurtoses show that the variables are platykurtic in nature and they are not normally distributed as shown by the associated probability values of the Jarque bera. Having described the characteristics of the variables the study proceeds to conduct the correlation analysis to show whether the assumption of multicollinearity is refuted among the variables or not.

Table 2 Correlation Analysis

Variables	B	S	H	R	C	DD
B	1	-0.4964	-0.2753	0.0907	0.4218	0.0487
S	-0.4964	1	0.8365	-0.4981	-0.2365	0.0521
H	-0.2753	0.8365	1	-0.8341	-0.1417	0.0123
R	0.0907	-0.4981	-0.8341	1	0.2311	-0.0051
C	0.4218	-0.2365	-0.1417	0.2311	1	-0.1163
DD	0.0487	0.0521	0.0123	-0.0051	-0.1163	1

Source: Authors' Computation, (2022).

The result shows the correlation coefficients in-between each risk premium and drawdown. The first column shows the correlation between market risk premium, size risk premium, value risk premium, profitability risk premium, investment risk premium, and drawdown. The first pair has the correlation coefficient of -0.4964, the second pair has -0.2753, the third pair is 0.0907, the fourth pair is 0.4218, the fifth pair has 0.0487. The implication of this is that market risk premium move in the same direction with profitability risk premium, investment risk premium and drawdown. The second column reveals that size risk premium is linearly correlated with value risk premium and drawdown, but size risk premium moves in opposite direction with market risk premium, profitability risk premium and investment risk premium.

The correlation coefficients in the third column show that value risk premium has linear correlation with size risk premium, and drawdown but it has negative correlation with market risk premium, profitability, and investment risk premium. The fourth column shows correlation coefficient with the following coefficients values; 0.0907, -0.4981, -0.8341, 0.2311, -0.0051, -0.0027 and -0.0027. This signifies that profitability risk premium moves in the same direction with market risk premium and investment risk premium but it moves in the opposite direction with size risk premium, value risk premium, and drawdown. The fifth column of the correlation matrix shows that investment risk premium moves linearly with market risk premium, and profitability risk premium, but it moves in opposite direction with size risk premium, value risk premium and drawdown. Also, the result shows that drawdown has linear correlation with market, size and value risk premium but it moves in the opposite direction with profitability risk premium, and investment risk premium. The result shows that the coefficients of correlation of among the variables are very low except in the case of 0.8365 and -0.8341 and this implies that the assumption multi-collinearity can be refuted. This simply means the variable can be estimated in the specified models.

Having documented the pre-estimation tests, the study proceeded to the estimation of the models and their interpretations which is used to test the formulated hypotheses and discussion of findings and relating them with previous studies. The estimation was documented in whole sample period and sub-sample periods which were grouped into 2005–2008, 2009–2012, 2013–2016, and 2017–2020. The first sub-period of this study is four years, which starts from 2005 to 2008. This period was characterized with recapitalization and consolidation and global financial meltdown which may have altered the full market result. The second sub-period of this study is four years, which starts in 2009 and end in 2012. This period is characterized with post global financial meltdown and this study examined whether the result of this period may differ from the full market result. The third sub-period is four years, which starts in 2013 and ends in 2016. This period is characterized with stagflation and economic recession. The fourth sub-period of the study is four years, which starts in 2017 and ends in 2020. This period is characterized with Corona Virus (Covid-19) outbreak and the study examined whether the result of this period is different from the full market result.

Table 3. Drawdown and Expected Return

Variables	$FF5F^1$	$FF5F^2$	$FF5F^3$	$FF5F^4$	$FF5F^5$
α	0,009	0,0524	-0,0143	-0,001	-0,0098
	-2,1928	-9,6059	(-3.4213)	(-0.4988)	-2,9023
	[0.0311]	[0.0000]	[0.0010]	[0.6192]	[0.0048]
b	0,0004	-0,022	0,0105	-0,0071	0,0077
	-0,0939	(-4.6869)	-0,6724	(-1.8592)	-1,2893
	[0.9254]	[0.0000]	[0.5032]	[0.0665]	[0.2009]
s	0,0006	0,0294	-0,0152	0,001	-0,046
	-0,1137	-4,5784	(-0.8765)	-0,6757	(-4.4636)
	[0.9097]	[0.0000]	[0.3833]	[0.5011]	[0.0000]
h	-0,0044	0,0036	-0,0043	-0,0032	0,0335
	(-1.1897)	-0,8588	(-0.7910)	(-1.7686)	-3,3988
	[0.2375]	[0.3929]	[0.4312]	[0.0806]	[0.0011]
r	-0,0045	0,0089	0,0108	0,0043	0,0103
	(-1.2942)	-2,0146	-1,9191	-1,5026	-4,3357
	[0.1992]	[0.0472]	[0.0584]	[0.0000]	[0.0000]
c	0,0044	0,0255	0,0067	-0,0144	0,0072
	-2,8062	-7,1368	-1,356	(-5.0630)	-1,6508
	[0.0062]	[0.0000]	[0.1788]	[0.0000]	[0.1027]
Drd	-0,0088	0,0443	4,62E-05	-0,0028	1,28E-11
	(-3.0804)	-7,0404	-7,0404	(-2.4891)	-0,9583
	[0.0028]	[0.0000]	[0.0811]	[0.0148]	[0.3407]
R^2	0,2764	0,792	0,7107	0,7969	0,8253
Adj-R^2	0,2241	0,7769	0,6898	0,7823	0,8123
P(F-Stat)	0,0001	0	0	0	0

Note: The figures in parentheses () are the standard error and the one in square brackets [] are the probability values. $FF5F^1$-$FF5F^5$ represents the estimation of Fama-French five-factor model under whole sample, 2005-2008, 2009-2012, 2013-2016 and 2017 -2020 sub-periods respectively.

Source: Authors' Computation, (2022).

The Table 3 shows that drawdown has negative but significant effect on return. This is because the probability value is almost 0 percent and this lesser than 0.05 per cent. However, the alpha value is positive and significant and this is shown by associated probability value that it almost 3 per cent. The result also reveals that the systematic risk is positive but insignificant because the probability value is almost 92 per cent. This implies that the convention of slope hypothesis and positive risk-return trade-off hold. The non-market risks shows that size risk has positive coefficient value and a corresponding probability value of 11 per cent and this implies that size has positive but insignificant effect on return while investment risk has positive coefficient value and a corresponding 0 per cent probability value and this means that investment risk has positive and significant effect on return. On the other hand, the coefficients of value risk and profitability risk are -0.004468 and -0.004516 with associated probability values of 23 and 19per cent respectively. This means that value risk and profitability risk have negative and insignificant effect on return. The study shows that the model is significant at 5 per cent because the probability values of F-statistics are almost zero (0) per cent.

Under the Sub-period 2005 to 2008, the estimation of the model shows that alpha, size risk, profitability risk, investment risk and drawdown coefficient values are 0.052477, 0.029479, 0.008945 and 0.025577 with associated probability values of 0, 0, 4 and 0 per cent respectively. This denotes that alpha, size risk, profitability risk, investment risk and drawdown have positive and significant effect on return. The coefficient values of systematic risk is -0.022004 with a corresponding probability value of 0 per cent and this implies that systematic risk has negative but significant effect on return and value risk has positive but insignificant effect on return because it has a coefficient value of 0.003649 and associated probability value of 39 per cent which is larger than 0.05 per cent. The co-efficient of determination shows that the model that the model has higher explanatory power and this supported by the adjusted coefficient of determination. The model is significant at 5 percent because the associated probability value of F-statistic is 0 per cent which is lesser than 5 percent.

Under the 2009 to 2012, the result shows that drawdown has a coefficient value of 4.62E-05 with corresponding probability value of 8 per cent and this indicates that drawdown is positive but insignificantly priced under the model at 5 per cent level of significant suggesting that investors are not rewarded for taking such risk. However, under the FF5F model, drawdown is significant at 10 per cent level of significance. The estimation of the model reveals that the alpha value has a coefficient value of -0.014303 and probability value of almost 0 per cent and this signifies that the alpha has a negative but significant effect on return while the size risk and value risk have coefficient values of -0.015204 and -0.004364 with probability values 38 and 42 per cent respectively. This means that size and value risks have negative but insignificant effect on return. On the other hand, systematic, profitability and investment risks have coefficient values of 0.0105, 0.010802 and 0.006782 with probability values of 50, 5.8 and 17 per cent respectively and this denotes that profitability and investment risk have positive and insignificant effect on return. The probability value of F-statistic is 0.0000 which is lesser than 0.05 and this suggests that the model is significant at and generalization can be drawn from it.

In the sub-period of 2013 to 2016 shows that the coefficient of drawdown -0.002862 with corresponding probability value of almost 1 per cent and this means that drawdown has negative but significant effect on return. Also, the coefficient values of systematic risk is -0.007150 with associated probability value of almost 6 per cent and this implies that systematic risk has negative but insignificant effect on return. The alpha value has coefficient of -0.001026 with probability value of almost 61 per cent and this implies that alpha has negative and insignificant effect on return. The coefficient value of size risk is 0.001043 which correspond with probability value of 50 per cent and this means that size risk has positive but insignificant effect on return. In addition, the value risk has coefficient value of -0.003260 with corresponding value of 8 percent value risk has negative but insignificant effect on return. The coefficient values of profitability risk and investment risk are 0.004322 and -0.014424 which correspond with probability values of 0 per cent and this implies that profitability has positive and significant effect on return while investment risk has negative but significant effect on return. Also, it is shown from the result that the null hypothesis that are coefficients are equal to zero is rejected because the probability value of F-statistic is almost 0.00 which is lesser than 0.05.

In the sub-period of 2017 to 2020, the coefficient value of drawdown is 1.28E-11 with corresponding values of 34 percent and this means that drawdown has positive but insignificant effect on return. The coefficients value of alpha and size risk are -0.009857 and 0.007766 which correspond with the probability values of almost 0 and 20 per cent respectively. This means that the alpha has negative but significant effect on return while the systematic risk has positive but insignificant effect on return. Also, the coefficient of size risk, value risk, profitability risk and investment risk are -0.046024, 0.033515, 0.010328 and 0.007293 which correspond with probability values of 0, 0, 0 and 10 per cent respectively. This denotes that value risk and profitability risk have positive and significant effect on return while the size risk has negative but significant effect on return. On the other hand, the investment risk has positive but insignificant effect on return. More so, the result shows that the null hypothesis that the model has no predictive capability is rejected because their associated probability value to F-statistic is 0 which is lesser than 0.05. The study presents the diagnostic tests in the Table 4.

Table 4. Diagnostic Tests for the whole Sample Period

Statistics	FF5F Whole	FF5F (2005-2008)	FF5F (2009-2012)	FF5F (2013-2016)	FF5F (2017-2020)
LM Test	1.5951	2.4235	0.4279	2.6878	0.2052
(F-statistic)	(0.2092)	(0.0950)	(0.6533)	(0.0741)	(0.8149)
Chi-squared	3.4103	5.0816	0.9411	5.6013	0.4548
	(0.1817)	(0.0788)	(0.6246)	(0.0608)	(0.7966)
BPG Test	1.4873	1.8133	1.0512	0.9610	1.6561
(F-statistic)	(0.1926)	(0.1064)	(0.3986)	(0.4568)	(0.1425)
Chi-squared	8.7370	10.4302	6.3562	5.8464	9.6160

Table 4. Diagnostic Tests for the whole Sample Period

	(0.1889)	(0.1077)	(0.3845)	(0.4406)	(0.1418)
Normality Test	596.6643	1.4273	0.1674	8.4313	0.0397
(Jarque Bera)	(0.0000)	(0.4898)	(0.9196)	(0.01476)	(0.9803)

Source Authors' Computation, (2022).

Table 4 reveals that the residuals of the models comply with the assumption of no autocorrelation assumption because their associated probability values of the statistics (F-statistic and Chi-squared) are larger than 0.05 under each models. This complies with the a priori expectation of the models. The assumption of homoscedastic is not violated under each models because the probability values of the statistics (F-statistic and Chi-squared) are larger than 0.05. This implies that the residuals of the models are constant over the time. However, the normality assumption hold under each models except under whole sample because the probability value is lesser than 0.05 but under the sub-periods the probability values are larger than 0.05.

Having documented the findings of the study on the estimation of drawdown on return, the study proceeds to examine the effect of drawdown on risk. The study employs the GJR-GARCH model to estimate the effect of drawdown on risk in the Nigerian stock market. This method is chosen because it also reveals the effect of asymmetric information on the risk. Thus, for proper estimation the study conducts some pre-estimation tests before fitting the data for estimation under whole sample and sub-periods sample.

Table 5. Pre-estimation Test on GJR-GARCH Model

Statistics	**FF5F[1]**	**FF5F[2]**	**FF5F[3]**	**FF5F[4]**	**FF5F[5]**
	Whole	(2005-2008)	(2009-2012)	(2013-2016)	(2017-2020)
LM Test	1,5951	2,4235	0,4279	2,6878	0,2052
(F-statistic)	-0,2092	-0,095	-0,6533	-0,0741	-0,8149
Chi-squared	3,4103	5,0816	0,9411	5,6013	0,4548
	-0,1817	-0,0788	-0,6246	-0,0608	-0,7966
BPG Test	1,4873	1,8133	1,0512	0,961	1,6561
(F-statistic)	-0,1926	-0,1064	-0,3986	-0,4568	-0,1425
Chi-squared	8,737	10,4302	6,3562	5,8464	9,616
	-0,1889	-0,1077	-0,3845	-0,4406	-0,1418
Normality Test	596,6643	1,4273	0,1674	8,4313	0,0397
(Jarque Bera)	0	-0,4898	-0,9196	-0,01476	-0,9803

Source: Authors' Computation, (2022).

The Table 5 reported that the normality assumption is rejected under the whole sample period and sub-periods as shown by the probability values lesser than 0.05. However, the unit root tests show that the null hypothesis is rejected at 0.05 level of significance since the P-value is less than 0.05. This implies the whole sample and sub sample returns have no unit root i.e. stationary. The study presents the autocorrelation using Ljung-Box Q-Statistic test since it is assumed to be more powerful due to its consideration for the overall correlation coefficients from lags. The p-values from the Q-Statistic test were not significant for all lags under the sub-periods except the whole sample. The results show persistence in return series and presence of serial correlation under the whole period and this is an indication of non-random returns in the whole sample period.

The probability (chi-square) of the observed R-square in the table is based on a 5 per cent significance level to reject or accept the null hypothesis of the ARCH effect. The p-value of observed R-square is 0.0007 under the whole sample which is lesser than 0.05 and this implies that the residuals of the Nigerian stock market return have ARCH effect. This complies with the assumption of estimating GJR-GARCH model. Also, the result reveals that the p-value of the observed R-square is 0.0001 which is lesser than 0.05 and this means that the residuals of the stock market volatility have arch effect in the sub-period 2005 to 2008. Similarly, the arch effect also present under the 2009 to 2012 sub-period since the associated P-value of observed R-square is less than the 0.005. However, this contradict the result of under the periods of 2013 to 2016 and 2017 to 2020 because the associated P-values are larger than 0.05. The results indicate that the return of the whole sample and sub-period of 2005 to 2008 violate the homoscedasticity assumption which suggests that innovations in the returns are heteroscedastic, and these tests allow the returns to be modeled on GJR-GARCH model which assume that the variance of the errors is not constant. However, the GJR-GARCH cannot be applicable to the sub-periods of 2013 to 2016 and 2017 to 2020.

Table 6. Effect of Drawdown on Risk

Variable	Whole Sample	2005-2008	2009-2012
Constant	0,00111	0,0002	0,0003
	-0,0004	-0,0002	-0,0002
	[0.0201]	[0.2390]	[0.2957]
Drawdown	1,76E-06	0,0006	-7,00E-07
	-4,70E-106	-0,0006	-1,36E-06
	[0.0000]	[0.3392]	[0.6059]
ARCH(Alpha1)	0,2059	0,2333	-0,1843
	-0,0627	-0,1034	-0,0968
	[0.0010]	[0.0241]	[0.0569]
GARCH(Beta1)	0,4974	1,0154	1,0375
	-0,1713	-0,0253	-8,10E-102
	[0.0037]	[0.0000]	[0.0000]
GJR(Gamma1)	0,0099	-0,6649	-0,1052
	-0,132	-0,2226	-0,4007
	[0.9399]	[0.0028]	[0.7929]
Diagnostic ARCH	1,5412	2,2009	0,0215
	[0.2144]	[0.1379]	[0.8832]
Q-Statistics	8,9264	7,8298	9,4
	[0.539]	[0.645]	[0.495]

Note: The figures in parentheses () are the standard error and the one in square brackets [] are the probability values.

Source: Authors' Computation, (2022).

The drawdown is positive and significantly influenced risk under the whole sample period because the 1.76E-06 and corresponding probability value 0 per cent. The result of the sub-period of 2005 to 2008 and 2009 to 2012 shows that the coefficients values of drawdown have 0.0006 and -7.00E-07 which correspond with probability values of 33 per cent and 60 per cent respectively. This shows that drawdown is positive but has insignificant effect on risk under sub-periods. Also, the sub-periods shows that the shock of the drawdown is persistent on the risk in the Nigerian stock market. The coefficient of Gamma is positive but insignificant under the whole sample and the sub-period of 2005 to 2008 and this suggests that there is positive symmetric effect of drawdown on risk. This also implies that the stock market risk responds indifferently to both bad news and good news of drawdown. On the other hand, the sub-period of 2009 to 2012 reveals that the Gamma is positive and significant, and this indicates that the drawdown has positive asymmetry effect on risk. The positive asymmetry effect reveals that bad news associated with drawdown has lower effect on risk compared to good news. The diagnostic tests also confirm that the model is fit, and meaningful interpretation can be drawn from the model.

4. Discussion of Findings

The evidence from the whole sample shows that drawdown has a negative but significant effect on return in the Nigerian stock market. This conforms to the results reported in the sub-period from 2013-2016. However, the result of the sub-period between 2005 and 2008 contradicts the whole sample period because it reveals that drawdown has a positive and significant effect on return in the Nigerian stock market. The results of the sub-periods 2009 to 2012 and 2017 to 2020 show that drawdown has a positive but insignificant effect on return in the Nigerian stock market. Thus, the level of significance of drawdown and their magnitude on return is not stable over time, and this can be traced to various uncertainties or economic shocks which affect the economy in general and the stock market. Hence, the findings of this study could still be discussed in line with previous studies, which include but are not limited to Fargo and Tedongap (2018), which found that downside risk is significantly priced and improves expected return in the US market. This finding conforms to the findings of this study in the 2005 to 2008 sub-period but contradicts the whole sample period and other sub-periods.

In addition, Baghdadabad (2018) used average drawdown as a market timing strategy compared with traditional timing to improve performance, and it was found that average drawdown yielded better performance in the portfolio construction than traditional timing. Also, Shah *et al*. (2019) confirmed that investors are rewarded for the introduction of downside risk as a tool of risk management because it has a positive and significant effect on return in Pakistan and the USA. Similarly, the study of Alrabadi *et al*. (2022) found that downside risk has a positive and significant effect on stock returns on the Amman Stock Exchange. However, the study found that drawdown has no significant effect on risk in the Nigerian stock market. The drawdown has a positive and significant effect on volatility under the whole sample, while the result of the sub-period reveals a positive but insignificant effect on volatility. This is contrary to a priori expectations because drawdown, as an indicator of downside risk, should have a negative effect on stock return volatility. The result of this study supports the findings of Fargo and Tedongap (2018), who documented that the downside is correlated with stock market return volatility. Similarly, Rad-Kaftoudi *et al*. (2020) affirmed that downside risk has a positive and significant effect on stock market volatility.

Conclusions and Recommendations

In line with the empirical findings, the drawdown has a negative and significant effect on return, and it has a positive and significant effect on risk in the Nigerian stock market over the whole sample period. Also, the results of the sub-periods are not stable in terms of the magnitude of effect and significance on risk and return. The study concluded that the findings contradict the *a-priori* expectation that drawdown could improve performance through risk minimization and return maximization in the Nigerian stock market, and this may be due to the fact that the Nigerian stock market is still an emerging market, which is characterized by high volatility, uncertainties (such as economic policy uncertainty, macroeconomic uncertainty, global uncertainty, etc.), and anomalies, among others. Since the drawdown has a positive and significant effect on risk, it can then serve as a benchmark or an indicator for investors during a stock market crisis. Based on these findings, investors and other market participants are encouraged to use drawdown as one of the investment performance measures which guides investors' expectations and their tolerance on the size of stock market disruption or crashes /rallies in Nigeria. One of the limitations of the study is inaccessibility of high frequency data on daily or hourly basis. The study suggests that further studies should be carried out on the effects of drawdown strategies on risk and return within the industrial sectors of the Nigerian stock market.

Author Contributions

Conceptualization: Adaramola, A. O. and Oyedeko, Y.O.; **methodology:** Adaramola, A. O. and Oyedeko, Y.O.; **software:** L Adaramola, A. O. and Oyedeko, Y.O.; **validation:** Adaramola, A. O. and Oyedeko, Y.O.; **formal analysis:** Adaramola, A. O. and Oyedeko, Y.O.; **investigation:** Adaramola, A. O. and Oyedeko, Y.O.; **resources:** Adaramola, A. O. and Oyedeko, Y.O.; **data curation:** Adaramola, A. O. and Oyedeko, Y.O.; **writing-original draft preparation:** Adaramola, A. O. and Oyedeko, Y.O.; **writing -review and editing:** Adaramola, A. O. and Oyedeko, Y.O.; **visualization:** Adaramola, A. O. and Oyedeko, Y.O.; **supervision:** Adaramola, A. O. and Oyedeko, Y.O.; **project administration:** Adaramola, A. O. and Oyedeko, Y.O.

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