



Impact of Cryptocurrency Volatility on Stock Market Performance in Nigeria

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ABSTRACT

Cryptocurrencies have gained popularity and are increasingly used in the global financial system, despite their volatile nature. They have become an attractive financial instrument for individuals and corporations due to their potentials for high returns, decentralized nature, and exemption from strict government regulations. This study aims to investigate how cryptocurrency volatility affects the performance of companies listed on the Nigerian Exchange Limited (NGX). The study uses an ex post facto research design and the GARCH (1,1) model. Weekly data on Bitcoin and Ethereum were obtained from www.ng.investing.com and used to construct a cryptocurrency composite index with principal component analysis (PCA). The All-Share Index data were extracted from the Security and Exchange Commission (SEC) statistical bulletin between January 2017 and December 2021. The result of the mean equation shows that cryptocurrency trading in Nigeria responds more to positive sentiment and good news than bad news, while the variance equation reveals that current conditional volatility of cryptocurrencies and companies' performance is influenced by their previous shocks and past volatility conditions. The study also found evidence of volatility clustering in companies' performance on the NGX. Therefore, investors are advised to exercise caution in an expanding cryptocurrency market, while regulators and policymakers should use relevant indicators to avoid contagion risk that could spread to the stock market. This paper is significant and relevant to achieving the Nigerian government's plan to introduce an official virtual currency.



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1. Introduction

Since 2018, the widespread use and popularity of cryptocurrencies in the financial system across the global have been on the rise despite their volatile nature. Investors and corporations find them attractive owing to decentralization, high return expectations, and relief from stringent governmental regulations and advantages in terms of tax treatment (Aydoğan, Vardar, & Taçoğlu, 2022). Cryptocurrencies are digital currencies encrypted with the intention of serving as a substitute for fiat currencies (Majumder, Routh, & Singha, 2019). They emerged to solve global economic problems such as rising inflation, overdependence on government-backed monetary systems, and lack of transparency (Halaburda, Haeringer, Gans, & Gandal, 2022). Thus, cryptocurrency was designed to

eliminate third parties such as financial institutions and regulatory authorities from the transaction process, making it more efficient (Ajayi, Oloyede, & Oluwaleye, 2022).

The blockchain technology used by cryptocurrencies enables the documentation, access, and verification of transactions without requiring an intermediary to update balances or monitor the custody of virtual units (Albayati, Kim, & Rho, 2020; Krishnan, 2020). This technology eliminates intermediaries that often drive inflation, which results in zero transaction costs, even for cross-border transactions. Additionally, it facilitates community-based financial systems such as crowd-funding. In 2009, Satoshi Nakamoto introduced Bitcoin as the inaugural decentralized cryptocurrency in his Whitepaper. Bitcoin is a peer-to-peer electronic cash system that facilitates online payments and electronic transactions between parties with no need for a financial institution (Agu & Kindgom, 2020; Smales, 2022).

Cryptocurrency has gained significant importance in the global financial system, with its potential to play an even more significant role in many emerging markets. While its adoption has been comparatively low, the interest from central banks, governments, and investors globally has resulted in exponential growth and increased market capitalization in 2021. Cryptocurrency is increasingly seen as a suitable tool for hedging against inflation, with the added benefit of providing access to various other digital assets which presents more advantageous choices. The rising popularity of cryptocurrency among Nigerian youth as a means of conducting business transactions and creating wealth has resulted in the country securing the second position in the world for cryptocurrency trading. In 2020, Nigeria witnessed a trading volume of over \$400 million, which rose to \$2,912,371 in March 2021 (Adesina, 2021).

However, cryptocurrency has been hindered by high volatility in its price, which limits its use as a medium of exchange and a store of value (Thompson et al., 2020). In addition to the already acknowledged drawbacks, prior studies suggested that cryptocurrency has led to more problems than it aimed to solve, particularly for developing countries, as it has contributed to capital flight, money laundering, and exchange rate crises. In countries like Nigeria, these factors have resulted in rising inflation rates (Sobhanifard & Sadatfarizani, 2019). As a result, the Central Bank of Nigeria placed a restriction on cryptocurrency transactions through a circular addressed to banks and other financial institutions in February 2021, citing the challenges of non-regulation around its usage and high volatility in exchange rate, with the aim to prevent further damage to the Nigeria stock market and the economy at large (Kalu, 2021).

In addition, the volatile nature of the cryptocurrency market creates fear among investors, deterring them from investing (Mazikana, 2018). Also, cryptocurrency involvement in most countries lacks legal protection, which makes it particularly risky, especially in developing economies like Nigeria (Agu & Kindgom, 2020; Fakunmoju, Banmore, Gbadamosi, & Okunbanjo, 2022). In response, several countries, including Canada, Germany, Australia, Switzerland, New Zealand, Finland, Israel, Singapore, Denmark, Sweden, United Arab Emirates (UAE) and Taiwan have opted to regulate transactions involving cryptocurrencies by applying existing laws. While countries like Mexico, Venezuela, Mauritius and Indonesia have introduced new legislation to govern their use. However, China banned the use of cryptocurrency for payment purposes (Law library of Congress, 2019). The lack of government regulation of cryptocurrency could lead to decrease in investment in the Nigerian stock market, ultimately leading to a decline in economic growth and development. Considering these problems, this study seeks to explore cryptocurrency volatility-stock performance nexus of quoted companies on the NGX and provide answers to the research question: to what extent does cryptocurrency volatility affect stock performance on the NGX?

The rest of the paper is organised as follows: Section 2 reviews the theory and existing literature by discussing existing studies from developed and emerging markets. Section 3 outlines the data and methodology used in this study. Section 4 reports the results followed by conclusion and recommendations in Section 5.

2. Literature Review

The cryptocurrency volatility and stock market performance nexus can be explained in the context of the technological disruption theory. The central idea of the theory is that cryptocurrencies have the potential to disrupt traditional financial systems and offer faster, cheaper, and more secure ways of conducting transactions. As such, they represent a significant threat to traditional banks and financial institutions, which may lead to a shift in stock market performance. Moreover, research has shown that companies that adopt cryptocurrency and blockchain technology may experience positive stock market performance. Furthermore, cryptocurrency and blockchain technology have the potential to disrupt industries beyond the financial sector, such as real estate, healthcare, and supply chain management. These disruptions could result in changes in stock market performance for companies in those industries. In conclusion, the technological disruption theory of cryptocurrency suggests that the adoption and use of cryptocurrencies and blockchain technology may have significant implications for stock market performance. While research has produced mixed results, the potential for disruption and innovation in various industries suggests that the relationship between cryptocurrency and stock market performance warrants further investigation. Studies such as (Böhme, Christin, Edelman, & Moore, 2015; Li, 2019; Nie, Lu, & Wang, 2019) among others provide strong support for the technological disruption theory alongside empirical evidences indicating that cryptocurrency volatility has significant impact on the performance of companies listed on the NGX.

The concept of cryptocurrency has captured the attention of scholars worldwide. However, there is a shortage of studies specifically focused on the Nigerian context. As such, there is a need for more research to be conducted in this area to provide a better understanding of the potential effects of cryptocurrency volatility on the performance of the Nigerian stock market and its economy. Empirically, the nexus between cryptocurrency and macroeconomic factors such as monetary policy, exchange rate, inflation, money supply, among others has long been established. For instance, Oh and Nguyen (2018) integrated cryptocurrency in his equation on money supply. The study established a linear relationship between cryptocurrency adoption and money supply. Ilham, Sadalia, Irawati, and Sinta (2022) showed that the returns from cryptocurrency and gold are positively related to changes in inflationary expectations in the USA after controlling for uncertainty in economic policy and financial markets. The result implied that cryptocurrencies could be an alternative option to gold in hedging inflation only in limited circumstances. According to Nguyen, Nguyen, Nguyen, and Pham (2019), there were significant reactions of Bitcoin and three other cryptocurrencies, to the tight monetary policies in China. On the other hand, the returns of cryptocurrency are not significantly affected by monetary policies of the United States. In a study by Choi and Shin (2022), it was discovered that Bitcoin's value increases in response to inflation shocks, thus confirming the claim made by investors that it serves as a hedge against inflation. However, unlike gold, the price of Bitcoin decreases in response to shocks related to financial uncertainty, indicating that it does not possess the safe-haven characteristic. Mohammed, Hayewa, Shuaibu, and Bunu (2022) found that inflation was positively linked with cryptocurrency, money supply, and exchange rate, while monetary policy rate had a negative association. However, their variance decomposition analysis showed that although cryptocurrency had a minor impact on inflation variance during the study period, money supply and exchange rate exerted a more considerable effect on the high volatility of inflation. Examining the impact of cryptocurrency on exchange rate, Erdas and Caglar (2018) found that there was no causal relationship between the prices of Bitcoin and exchange rates. Thus, no correlation was found between exchange rates and Bitcoin prices in either direction, suggesting that fluctuations in the value of the US dollar do not influence the investment decisions of Bitcoin investors.

In contrast, Almansour and Inairat (2020) discovered that how exchange rates influence returns on Bitcoin is dependent on currency type. According to the research conducted by Mallick and Mallik (2023), the correlation between cryptocurrencies and exchange rates across major world currencies is not uniform and is influenced by the strength of the currency. Specifically, their findings indicated a noteworthy negative correlation between the Japanese YEN and Ethereum at a 5% significance level. This could be due to the substantial number of Japanese trading in cryptocurrency. Additionally, their results also demonstrated a significant correlation between the US dollar and Binance Coin and Litecoin. Similar studies carried out by Hussain (2020) found that there is no significant

effect of cotton price, exchange rate, oil price, and gold price on Bitcoin. In conclusion, the association between cryptocurrency and macroeconomic variables is dependent on specific economic characteristics and nature of each economy.

Few studies investigated the impact of cryptocurrency on real world market-specific indicators. For instance, KUZUBOV, SHASHLO, and RODIONOV (2018) established a connection between cryptocurrency market activities and economic potential, and inferred that the security provided by blockchain technology could enable the use of digital currency for financial transactions in the near future. Using Sovbetov (2018) discovered that cryptocurrency prices were influenced by market beta, trading volume, and currency attractiveness. According to Sami and Abdallah (2022), there was a direct relationship between cryptocurrency market and the stock performance. Additionally, Jimoh and Oluwasegun (2020) discovered that the fluctuation in Ethereum price and Bitcoin price greatly impacts stock prices in Nigeria than the exchange rate. On the other hand, López-Cabarcos, Pérez-Pico, Piñeiro-Chousa, and Šević (2021) suggested that Bitcoin may serve as a safe haven when stock market volatility is high, while it becomes an attractive financial instrument for speculation markets when the stock markets are stable.

Other studies tested the efficiency of the cryptocurrency market in relation to cryptocurrency volatility. For instance, Zargar and Kumar (2019) conducted several variance ratio tests to evaluate the efficiency of Bitcoin and discovered that inefficiencies were only observed when data frequency. They attributed the inefficiencies to the lack of reliable information and the endogenous factors in emerging market, which limited the presence of fundamental traders. (2019); Ma and Tanizaki (2019) observed that Bitcoin's return and volatility is higher on Mondays, and was independent of other financial markets like bonds and commodities. Also, Mbanga (2019) research did not find support for the weekend effect in Bitcoin price, despite price clustering being stronger on Fridays than on other weekdays. In addition, Bundi and Wildi (2019); Corbet, Eraslan, Lucey, and Sensoy (2019) found evidence to reject the market efficiency in the Bitcoin market, revealing positive and serial correlations in the market. They also noted that certain trading strategies, such as momentum, moving average, and neural nets, produced notable returns. By using GARCH models to examine the cryptocurrency volatility, (Charles & Darné, 2019; Fakhfekh & Jeribi, 2020) discovered that high volatility persistence and asymmetric effects existed. They also found that negative shocks elicited a weaker response than positive shocks. Lastly, Abdul-Rahim (2021) categorized cryptocurrencies based on their characteristics and found that utility and privacy altcoins had the highest total returns, while Bitcoin had the lowest. However, when adjusted for risk, utility altcoins, payment altcoins and privacy altcoins yielded the greatest returns in relation to the amount of risk involved.

In Nigeria, research on cryptocurrency is limited. For instance, Salawu and Moloi (2018) conducted a study on the legislation of cryptocurrency using descriptive statistics and found that professional accountants expressed willingness to participate in cryptocurrency markets if appropriate legislation was provided by the Nigerian government. Likewise, Agbo and Nwadiolor (2020) found that cryptocurrency was less explored in African countries compared to European countries. Ebelogu, Oriakhi, Ojo, and Agu (2019) suggested that despite the Nigerian government's position, cryptocurrency has the potential to replace fiat currencies and serve as a development tool in the near future. Erdas and Caglar (2018) claimed that regulating cryptocurrency could improve stock market performance and promote exchange rate stability, given the nature of the country's exchange system. (Jimoh & Oluwasegun, 2020) concluded that the instability of the cryptocurrency market does not significantly impact stock market prices in Nigeria. (Fakunmoju et al., 2022) found a significant adverse impact of cryptocurrency and monetary corruption practices on economic performance of Nigeria. Ajayi et al. (2022), on the other hand, stated that Litecoin, Bitcoin and Ripple had a favorable influence on the rate of exchange, whereas Binance coin and Ethereum had an unfavorable effect. The study also found that changes in cryptocurrency have only a small effect on the present value of the exchange rate. However, none of the aforementioned studies investigated how cryptocurrency volatility influences the performance of companies listed on the NGX, hence, a void is created in literature to be filled by this study.

3. Methodology and Data

This study used the NGX30 index which comprises top 30 companies in terms of liquidity and market capitalisation and applied principal component analysis (PCA) to create a composite index for Bitcoin and Ethereum used as proxy for the cryptocurrency volatility index. The methodology adopted in this study was the GARCH (1,1) model, which was first introduced by (Bollerslev, 1986; Engle, 1982). Studies such as Aydoğan et al. (2022); Rastogi and Kanoujiya (2022) used this model noting that volatility is high in cryptocurrency market. The GARCH (1,1) model helps to analyse the volatility characteristics of a dataset, especially financial data, based on their unique characteristics of heteroscedasticity and volatility clustering. However, this study deviates from previous studies which used different single measures of cryptocurrencies by employing composite index that combined the biggest two cryptocurrencies by market capitalization. Also, NGX30 index was used as the proxy for stock market performance. The model can be expressed as follows:

$$NGX30IDX_t = \alpha_0 + \beta_0 Y_{t-1} + \beta_1 CRYPTOIDX_{t-1} + u_t \quad (1)$$

$$NGX30IDX_t^2 = \omega_0 + \sum_{i=1}^q \alpha_i \varepsilon_{t-i}^2 + \sum_{j=1}^p \beta_j \sigma_{t-j}^2 + \beta_1 CRYPTOIDX_{t-1} \quad (2)$$

Equation (1) represents the mean equation and includes an error term. On the other hand, equation (2) expresses the conditional variance in terms of three components: a constant; ω ; the ARCH term, ε_{t-i}^2 which measures the previous period's volatility as the squared residual lagged from the mean equation; and the GARCH term, σ_{t-j}^2 , which reflects the forecasted variance of the previous period. Where, Y_t represents the volatility index, Y_{t-1} shows the lagged values of index risk adjusted volatility, while $CRYPTOIDX_{t-1}$ and $NGX30IDX_{t-1}$ represent the lagged cryptocurrency composite index and lagged of the standard deviation of all share index (ASI) in the mean and conditional variance equation to capture the role of cryptocurrency in explaining the volatility of the Nigerian stock market. β_0 represents the coefficient of the model, α_i is the coefficients of the lagged square residuals and β_j is the lagged conditional variance. The coefficients to be estimated are: α , and β respectively, with $\omega > 0$, $\alpha \geq 0$, $\beta \geq 0$, $\alpha_i + \beta_j < 1$.

This study constructed a cryptocurrency composite index with the aid of principal component analysis (PCA) using two major cryptocurrencies (Bitcoin and Ethereum), the choice of which is based on the sum of their market capitalization, accounting for 60% of the total cryptocurrency market. The study uses daily data covering the period 2016-2021. The data for Bitcoin and Ethereum were obtained from investing.com. While all share index were extracted from the Security and Exchange Commission Statistical Bulletin. The period 2017 to 2021 was chosen because cryptocurrency received the greatest attention and adoption in Nigeria within these periods since its inception and due to data availability.

4. Data Analyses and Interpretation of Results

Table 1

Data Description

Variables	Average	Std. Dev.	Max.	Min.
NGX30IDX	7626.889	1690.279	11085.91	4260.090
CRYPTOIDX	-7.49E-17	1.388848	4.457034	-1.113634

Source: Author's Computations (2023)

From table 1, descriptive statistics revealed that the mean for NGX30IDX is 7626.889 with the maximum at 4260.090 and minimum at -1.1136. The mean of 7626.889 indicates that the average performance of companies listed on the NGX is positive.

Table 2

Unit Root Test

Variables	Level			First Difference		
	t-stat	p-value	Status	t-stat	p-value	Status
NGX30IDX	1.8136	0.7700	I(0)	30.0327	0.0000	I(1)
CRYPTOIDX	1.3524	0.9119	I(0)	-4.6151	0.0000	I(1)

Source: Author's Computations (2023)

The results of the Augmented Dickey-Fuller unit root test are presented in Table 4.2, demonstrating that both the cryptocurrency composite index and NGX30 index became stationary when the first difference was taken.

Table 3
Principal Components Analysis of Cryptocurrency Proxies

Component	Eigenvalue	Difference	Proportion	Cumulative Eigenvalue	Cumulative Proportion
BTC	1.9215	1.8430	.9608	1.9215	0.9608
ETH	0.0785	-	.0392	2.0000	1.0000

Source: Author's Computations (2023)

The cryptocurrency composite index, produced by the principal component analysis, exhibits some favorable characteristics. First, the two indicators included in the final equation reflected the anticipated signs, with negative values indicating a decrease in volatility and positive values indicating an increase in volatility. Secondly, each of the indicators entered the equation at the anticipated timing, reflecting changes in volatility.

Table 4
Johansen Test for Cointegration

Unrestricted Cointegration Rank Test (Trace)				
Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	5% Critical Value	1% Critical Value
None *	0.07494	20.021	15.4947	19.93711
At most 1 *	0.00031	0.0003	3.84146	6.634897
Unrestricted Cointegration Rank Test (Maximum Eigenvalue)				
Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen Statistic	5% Critical Value	1% Critical Value
None *	0.07494	19.943	14.2646	18.52
At most 1 *	0.00031	0.07824	3.84146	6.6349

Source: Author's Computations (2023)

The rejection of the null hypothesis is demonstrated in Table 3, which presents the results of the Johansen cointegration test. The trace statistic values exceeding the critical value at the 1% and 5% significance levels imply the presence of at least one cointegration relationship among the variables. The existence of at least one cointegrating vector indicates that the Nigerian stock market being studied is stationary in at least one direction. In sum, the Johansen test suggested that there is evidence of a persistent equilibrium relationship between stock volatility and cryptocurrency index. Based on these results it can be said that cryptocurrency volatility influences stock performance in the Nigerian stock market. Hence, alternative hypothesis is favored over the null hypothesis of no cointegration, with a rejection at both 1% and 5% critical levels. This implies that, the variables exhibit a coordinated movement in the long-term.

Table 5
Estimated GARCH (1,1) Model
Dependent Variable: NGX30IDX

Parameters	Coefficient	t-statistic	p-value
ω	7685.18	122.03	0.0000
CRYPTOIDX	759.64	16.90	0.0000
Variance Equation			
ARCH (α)	0.79283	3.068	0.0022
GARCH(β)	-0.10256	-2.581	0.0099
$\alpha_i + \beta_j$	0.91187	177.38	0.0000

Author's Computation (2023)

Table 5 displays the outcome of the GARCH (1,1) model. At a significance level of 1%, the results from the mean equation provide proof that the performance of NGX30 is positively influenced by CRYPTOIDX. The positively significant effect of CRYPTOIDX on stock volatility implies that bullish sentiment of cryptocurrency trading creates higher volatility in the Nigerian stock markets. This result aligns with the conclusions drawn by Jimoh and Oluwasegun (2020), who similarly observed a substantial relationship between the volatility of Bitcoin and Ethereum and the stock prices in Nigeria. Also, the positive relationship of cryptocurrency volatility

indicates that cryptocurrency trading in Nigeria is more responsive to positive news than negative news (Akkuş & Çelik, 2020; Ardia, Bluteau, & Rüede, 2019). That is, volatility in cryptocurrency market was amplified to a greater extent by positive information shocks than negative information shocks. In addition, the statistical significance of CRYPTOIDX reveals that cryptocurrency trading activities captures the volatility persistence of the NGX30. This finding is in opposition to the conclusions drawn by (Abakah, Gil-Alana, Madigu, & Romero-Rojo, 2020; Gupta & Chaudhary, 2022; Sensoy, Silva, Corbet, & Tabak, 2021) who found that both Bitcoin and Ethereum displayed an asymmetric impact in their volatility, whereby the presence of unfavorable news tend to escalate their volatility. This phenomenon bears similarity to what is commonly observed in stock markets, where volatility typically rises with negative news.

One the other hand, findings obtained from the analysis of conditional variance indicate that the conditional volatility of cryptocurrency market, specifically Ethereum and Bitcoin, and stock markets, is influenced by both their own prior shocks and the past conditional volatility. The statistical significance of the coefficients for the ARCH (α) and GARCH (β) parameters has been established. Moreover, the sum of $\alpha + \beta$ is almost equivalent to one, indicating the stability of the GARCH (1,1) model. This is an indication of high persistence of volatility, that is, cryptocurrency volatility in the previous periods affects the current period's volatility. This shows the importance of unexpected shocks generated by cryptocurrency trading activities in explaining the volatility of the NGX30. Likewise, the positive and statistically significant coefficient of the GARCH parameter (β) suggests the existence of volatility clustering in the Nigerian stock market's performance. The persistence parameter ($\alpha + \beta$) is close to unity, showing an evidence of volatility persistence in the performance of the Nigerian stock market. Furthermore, it is worth noting that all the parameters are statistically significant. This implies that the current volatility can be explained by past shocks, with previous period's volatility being the primary contributor. Any shock to current volatility will have an impact on the anticipation of volatility for numerous periods in the future.

5. Conclusion

In conclusion, this study examined the effect of cryptocurrency volatility on stock performance of quoted companies on the NGX with the aid of GARCH (1,1) model with cryptocurrency index incorporated using weekly data covering the period 2017 to 2021. The study concludes that volatility of cryptocurrencies was found to have a significant and positive impact on the performance of stocks. Also, conditional variance provides evidence that the conditional volatility of cryptocurrencies and stock performance is influenced by their individual past shocks, as well as their respective past performance and volatility.

Drawing from the results of this study, it was recommended that potential investors should exercise caution in their investment decision to invest in the volatile and speculative cryptocurrency market. In addition, policymakers should continually monitor the market for potential contagion risks in order to develop appropriate policies that protect against the spread of potential volatility to the stock market.

Authors Contribution

Ibrahim Bello Abdullah: Supervised and proofread the paper.

Stephen Alaba John: Prepare the paper under the supervision of Ibrahim Bello Abdullah.

Conflict of Interests/Disclosures

The authors declared no potential conflicts of interest w.r.t the research, authorship, and/or publication of this article.

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