Cryptocurrency Price Volatility and Stock Market Performance in Nigeria

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Abstract: This study examined the effects of volatility in the prices of cryptocurrencies on stock market performance in Nigeria using monthly data for the period 2016 to 2024. The study was based on the financial contagion theory. The Autoregressive Distributed Lag, Dynamic ARDL and Granger causality tests were employed to analyse the data. Cointegrating long-run relationship was found exists between stock market performance and volatility in cryptocurrency prices. The regression results indicate that the effect of cryptocurrency price volatility on stock market performance was positive for all cryptocurrencies except Ripple. Additionally, the short-run effects were more pronounced compared to the long-run effects. Evidence of spillover effects from volatility shocks in the cryptocurrency market to the stock market was observed, with the stock market responding positively to positive shocks in cryptocurrency volatility and vice versa. A bi-directional causality was also found between volatilities in Bitcoin, Ethereum, Binance Coin, and stock market performance, while no causality was observed between Ripple and stock market performance. Policymakers should develop comprehensive guidelines for cryptocurrency trading and integration with the financial market to mitigate volatility risks and their spillover effects between the cryptocurrency market and the stock market, to improve financial market stability. Also, investors and portfolio managers should promote portfolio diversification strategies to capitalize on short-term gains from cryptocurrency-induced stock market surges while cushioning against potential volatility-driven losses.

Keywords: Cryptocurrency, Stock market performance, Volatility,

Introduction

Financial markets have become increasingly important drivers of economic activity. The development, stability and efficiency of financial markets is a critical priority for emerging economies (Yiming et al. 2024). The financial markets are institutions that facilitate capital mobilization for investment purposes to drive sustainable economic growth. An integral part of the financial market is the stock market, which serves as a platform for companies to raise capital through equity financing and for investors to participate company growth and contribute capital accumulation and increased investment (Yaya et al. 2024). Across the globe, the sphere of investment opportunities, has recently expanded to include a new class of digital assets, cryptocurrencies, which are increasingly being considered as alternative investment to traditional stocks (Ajayi et al. 2022). Although cryptocurrencies enhance potential returns through innovative financial instruments and offer new opportunities for investors to diversify portfolios, there is a risk that spillover effects from volatility in the prices of cryptocurrency assets may influence the performance of other financial markets, particularly the stock market (Joseph et al. 2024).

Cryptocurrency has become an increasingly popular investment option worldwide due to its decentralized

structure, enhanced security features, and potential for substantial returns (Obeng, 2023). As of July 2024, the total cryptocurrency market capitalization was $2.2 trillion, inn comparison to $17.2 billion of December 2016 (Coincodex, 2024). The African financial market is not let out of the emerging trend of increasing adoption of cryptocurrency as a means of payment and investment option. In Nigeria, the cryptocurrency market is viewed as an avenue for rapid wealth accumulation and a hedge against economic instability. This position is driven by economic challenges, a tech-savvy youth population, and the benefits of decentralized finance (Fakunmoju et al. 2022).

The Nigerian cryptocurrency market witnessed substantial growth between 2020 and 2024. In 2020, Nigeria ranked third globally in cryptocurrency transactions, trailing only the United States and Russia, with an estimated transaction volume of $400 million (Ogunode et al. 2022). Nigeria's volume of crypto transactions grew 9% year-over-year to $56.7 billion between July 2022 and June 2023, and to an approximate transaction volume of $59 billion between July 2023 and June 2024 (Abdurrahaman et al. 2024). Along with the growth of cryptocurrency, the Nigerian stock market experienced mixed performance over the years, characterized by periods of growth, alongside declines attributed to inflationary pressures, currency volatility, and global economic uncertainties. As of January 2019, the Nigerian Stock Exchange (NSE) All Share Index (ASI) stood at 30,557.20 points, a decline from its ten-year peak of 45,092.83 points in January 2018. By July 2024, the ASI rose to 97,774.22 points, marking a significant increase from approximately 26,355.35 points in January 2020 (ng.investing, 2024).

The growing integration of cryptocurrencies into mainstream financial systems implies that price movements in digital assets can have economic implications on the stock market. One is the risk of spillovers from the highly volatile cryptocurrency market into the stock market (Uzonwanne, 2021). Also, volatility in the prices of cryptocurrencies can create uncertainty in investor sentiment that can influence their decision-making (Jmoh & Oluwasegun, 2020). Rapid and unpredictable price swings in cryptocurrencies can increase investor risk perception, leading to portfolio adjustments. These adjustments may involve reallocating assets between cryptocurrencies and traditional stocks or adopting other risk-averse strategies which can have unintended consequences on stock valuations (Sami & Abdallah, 2021).

The extreme price volatility of cryptocurrencies has been linked to increases uncertainties in the Nigerian financial markets. Sodiq & Oluwasegun (2020) demonstrate that fluctuations in cryptocurrency prices, particularly Bitcoin and Ethereum, significantly influence Nigeria's stock market prices, introducing instability and unpredictability. Additionally, the volatility spillover effects between cryptocurrencies and the foreign exchange market in Nigeria was analysed by Ibikunle & Akutson (2022) to reveal a growing interconnection between the two markets that contributes to financial market uncertainties that can disrupt market dynamics, and pose challenges for financial market stability. Abdullahi and John (2023) assert that the absence of government regulation of the cryptocurrency market in Nigeria could lead to decreased investment in the Nigerian stock market and poor stock market performance.

In response, the Nigerian government banned cryptocurrency transactions in 2021 to mitigate associated risks, including volatility and links to illicit activities. Also, the Securities and Exchange Commission (SEC) issued Digital Assets Rules in 2022 to regulate virtual assets, and while the government adopted a National Blockchain Policy in 2023 to foster digital innovation while addressing risks. Despite these policies, uncertainties persist regarding the response of stock market performance to cryptocurrency price volatility in Nigeria, thereby raising concerns about investor confidence in stock market stability due to potential spillovers from the cryptocurrency market.

Studies relating to stock market performance and volatility in cryptocurrency asset prices while limited, have yielded mixed results. Abdullahi and John (2023), and Ibikunle and Akutson (2022) demonstrated a moderate spillover effect from price volatility of cryptocurrency to stock market performance. Conversely, Joseph et al. (2024) conclude that the volatility of cryptocurrency prices does not significantly impact stock market performance. Obeng (2023) suggested positive effect of cryptocurrency price volatility in stock market performance. Kiarie (2024) found negative impact of cryptocurrency price volatility on the financial market. Jimoh and Oluwasegun (2020) found a one-way causality from cryptocurrency price volatility to stock market performance, Ahmed et al. (2023). argued in favour of bi-directional relationship. However, the response of the stock market to volatility in priced of cryptocurrencies have been inadvertently ignored. This study, therefore, re-

examined the effect of cryptocurrencies price volatility on stock market performance as well as the stock market response to volatility in the prices of major cryptocurrencies in Nigeria.

Beyond the introduction, the remainder of this paper is structured as follows: section two provides a comprehensive literature review; section three outlines the methodology employed in the study; section four presents the empirical results; and section five concludes the paper and offers policy recommendations based on the finding.

Literature Review

Conceptual Review

The stock market is a component of the modern financial system and presents a platform where companies raise capital by issuing equity shares (Ahmed et al. 2023). These shares, representing fractional ownership, are traded among investors, with prices determined by the market forces of supply and demand (Sami & Abdallah, (2021). The performance of the stock market performance is evaluated using several metrics, including stock price movements, market indices (e.g., S&P 500, NSE All Share Index), and the stock returns, which measures investor gains or losses based on the all-Share Index (Malkiel, 2003).

Volatility quantifies the degree of price fluctuations of an asset or market over time, reflecting the magnitude and frequency of price swings (Zhou et al. 2022). It indicates the dispersion of price changes around the average. High volatility signifies substantial and rapid price movements, while low volatility suggests relative price stability. Numerous factors contribute to volatility, including economic data releases, company-specific news, investor sentiment, and geopolitical events (Kalu & Ibe, 2022; Campos-Martins & Hendry, 2024)

Cryptocurrency is a digital currency designed to work as a medium of exchange using cryptography to secure transactions (Kiarie, 2024). Unlike traditional currencies issued by central banks, cryptocurrencies operate on decentralized networks, typically based on blockchain technology, a distributed ledger that records all transactions (Ajayi et al. 2022). The performance of the cryptocurrency market is often assessed by tracking price fluctuations, market capitalization (total value of all circulating coins), and trading volume. High volatility is a characteristic feature of cryptocurrency markets, where asset prices experience significant price swings within short periods of time.

Stylised Facts

Figure 1 presents the monthly stock market returns in Nigeria between January 2016 and December 2023. Nigerian stock market returns (NGX) between January 2016 and December 2023 demonstrated substantial temporal volatility. Commencing with a moderate return of 3.5% in January 2016, the NGX experienced a rapid ascent to 30.41% by May 2016, maintaining elevated levels throughout 2017 and reaching a peak of 35.95% in January 2018 before subsequent declines. The period spanning 2019-2020 was characterized by pronounced oscillations, culminating in a return of 34.92% in December 2020, potentially reflecting market adjustments to the initial impact of the COVID-19 pandemic. Relative stability, punctuated by moderate declines towards year-end, was observed in 2021, indicative of market adaptation to the evolving post-pandemic economic challenges. The years 2022 to 2024 witnessed significant intra-year fluctuations, attributable to prevailing economic uncertainties in Nigeria,

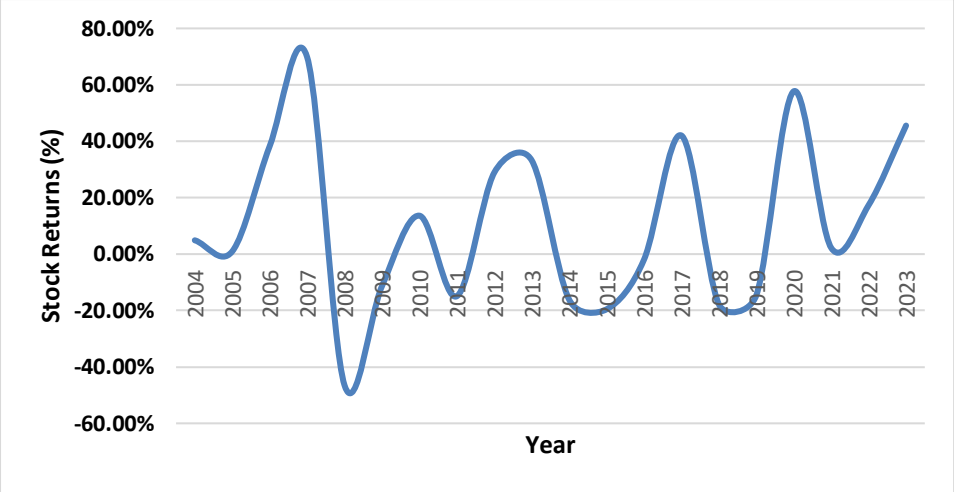

Figure 1. Monthly Stock Market Returns in Nigeria (2016-2023). Source: Investing.com (2024)

Figure 2 shows the monthly trend of the price of Bitcoin, Ethereum, Ripple, and Build n Build between January 2016 and July 2024. During the period, the price of Bitcoin rose from $369.8 (Jan 2016) to a peak of $58,763.7 (Mar 2021) before settling at $64,619.25 (July 2024). Ethereum followed a similar trajectory, increasing from $8.87 (Jan 2016) to $4,628.9 (Nov 2021) and ending at $2,281.9 (Dec 2023). Ripple experienced an initial surge from $0.0062 (Jan 2016) to $1.98 (Dec 2017), then stabilized at $0.6154 (Dec 2023). BNB, after remaining stable at $11.31 until Feb 2017, saw significant growth, peaking at $623.33 (Apr 2021) and then stabilizing around $312 (Dec 2023). The volatile price action of the cryptocurrencies reflects the highly speculative nature of cryptocurrency markets, driven by investor sentiment and rapid shifts in demand, characteristic of asset bubbles.

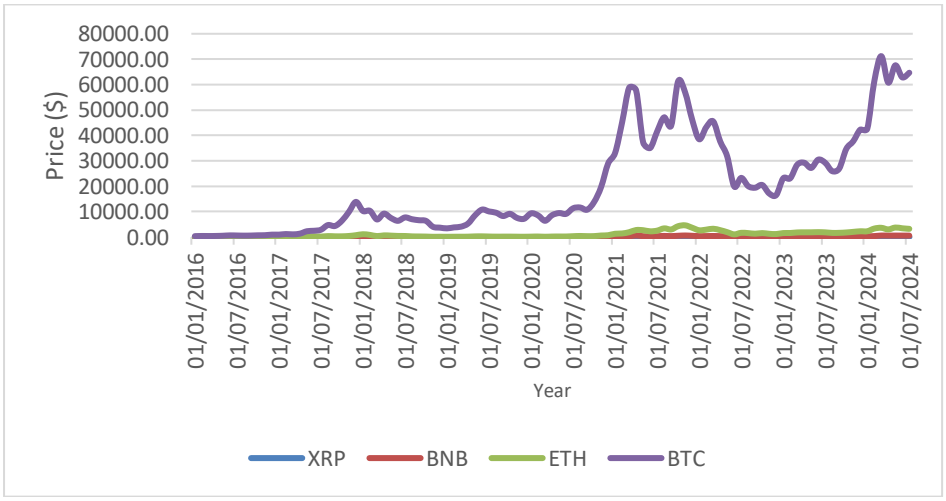

Figure 2. Monthly Cryptocurrency Prices (2016-2024). Source: Investing.com (2024)

Theoretical Framework

Financial Contagion Theory elucidates how shocks originating in one market can swiftly propagate to other financial markets due to the interconnectedness of the global financial system (Niyitegeka & Zhou, 2023). The theory identifies various mechanisms driving the transmission of shocks from one financial market into another. These mechanisms include direct exposure via cross-border investments, indirect exposure through shifts in investor sentiment, and herding behaviour that prompts widespread asset sell-offs (Kakran et al. 2023). A central postulation of the theory is that contagion extends beyond fundamental economic linkages, allowing shocks in one market to disrupt others even in the absence of direct economic connections.

Empirical Review

Yaya et al. (2024) investigated the connectedness of African stock markets. They focused on analysing data for Egypt, Kenya, Morocco, Nigeria, South Africa, and Tunisia covering the period 2008 to 2023. The Quantile Connectedness Approach was used to analyse the data. Findings revealed that the South African stocks dominated the network during the bearish market phase by transmitting shocks, whereas in the bullish market phase, Nigerian stocks were the primary shock transmitters, while Egyptian and Tunisian stock markets consistently received shocks in both phases.

Joseph et al. (2024) examined the spillover effects, interconnectedness and volatility correlation between cryptocurrency and traditional financial markets in the five largest African countries. Data used spanned 2017 to 2021. GARCH models were used to analyse the data. The findings indicate a significant, low spillover effect from cryptocurrency to the African traditional financial market, with moderate and growing effects in South Africa, Nigeria, and Kenya. Although the findings showed no evidence of a spillover effect from African financial markets to the cryptocurrency market, positive correlation were found to exist between cryptocurrency volatility and the African financial market.

Abdullahi & John (2023) assessed the effect of cryptocurrency volatility affects the performance of listed companies in Nigeria. Monthly data for the period January 2017 and December 2021 were analysed through a GARCH (1,1) model. Analysis of the mean equation indicates that cryptocurrency trading activity in Nigeria exhibits greater responsiveness to positive market sentiment and favourable news compared to negative news. The variance equation demonstrates that both current cryptocurrency volatility and company performance are influenced by prior shocks and past volatility.

Jia, et al (2023) analysed the relationship between the gold market, Bitcoin, and stock market returns in China. The study utilizes monthly data from 2014 to 2019. The Quantile-On-Quantile and the Method of Moments Quantile Regression (MMQR) methods are employed for comprehensive empirical analysis. The findings showed significant effects of Chinese stock market returns on Bitcoin, and gold price effects on Bitcoin also exist. Additionally, findings suggested that gold prices negatively affect stock market returns and *vice versa.*

Fakunmoju, et al. (2022) investigated the effects of cryptocurrency trading and monetary corrupt practices on the performance of the Nigerian economy. Primary data were collected through a sample survey administered to 98 top and middle levels staff in the CBN. The Tobit regression was employed to analyse the data. method of analysis. The results indicate that cryptocurrency and monetary corrupt practices have a negative but significant effect on Nigerian economic performance. The study through the Vector Autoregressive (VAR) model

Ajayi et al. (2022) analysed the impact of cryptocurrency shocks on exchange rate in Nigeria. Monthly cryptocurrency returns for the period August 2017 to June 2021 were obtained and analysed through the Vector Autoregressive (VAR) model. Empirical results showed that exchange rate adjusts slightly to chocks in cryptocurrency, with Ripple and Bitcoin causing the most significant shocks. Variance Decomposition indicated that Ripple impacted the highest on exchange rate variations in both the short and long run.

Uzonwanne (2021) verified the presence of returns and volatility spillovers across five major stock markets (FTSE 100, S&P 500, CAC 40, DAX 30, and Nikkei 225) and the bitcoin market. A multivariate Vector Autoregressive Moving Average (VARMA) model coupled with an Asymmetric Generalized Autoregressive Conditional Heteroskedasticity (AGARCH) model was employed to analyse daily data from March 2013 to March 2018, examining return and volatility spillovers between the market pairs. The analysis found significant return spillovers and volatility spillovers were observed across these market pairs.

Sami and Abdallah (2021) examined the influence of cryptocurrency market on the performance of stock markets in the Middle East and North Africa region. Daily data for the period 2014 to 2018 were analysed through the Generalized Method of Moments. The findings demonstrated evidence of significant relationship between the cryptocurrency market and the stock market performance in the MENA region. Specifically, a negative relationship was found to exist between cryptocurrency returns and stock market performance in Gulf countries that adhere strictly to Islamic Sharia rules. Whereas, a positive influence of cryptocurrency returns on stock market

performance was revealed in non-Gulf MENA countries that are flexible in applying Sharia laws.

Susilo et al. (2020) examined the effectiveness of hedging strategies in cryptocurrency markets. Daily data on Bitcoin, Ethereum, Monero, Ripple, and Litecoin for the period 8, 2015, to July 2, 2019 as well as equity indices in Indonesia, Malaysia, Vietnam, Thailand, and the Philippines, alongside iShares MSCI World ETF were analysed through the asymmetric generalized dynamic conditional correlation (AG-DCC) GARCH model. The findings indicated that the hedging effectiveness of cryptocurrencies were insignificant positive. This suggests that cryptocurrencies do not effectively protect against market risks in the countries studied.

Data Requirement and Source

The data required for this study are monthly data from January 2016 to July 2024. The dependent variable is stock market returns derived from Nigeria Stock Exchange All Share Index (ASI). The dependent variables are Bitcoin, Ethereum and Ripple. Exchange rate, and interest rate were added as control variables in the model. Data on All Share Index were sourced from Investing.com (www.ng.investing.com). The prices of Bitcoin, Ethereum and Ripple were obtained from Coincodex (https://coincodex.com/crypto), while data on exchange rate and inflation rates were sourced from the Central Bank of Nigeria statistics database. Monthly returns for Bitcoin (BTC), Ethereum (ETH), Ripple (XRP), and Binance Coin (BNB), as well as stock market returns, were calculated using the natural logarithm of the difference between each asset's monthly closing price and the preceding month's closing price.

Empirical Model

To analyse the effect of cryptocurrency price volatility on stock market performance in Nigeria, the baseline equation to be estimated is expressed in its functional form as follows:

$$STKR_t = f(BTC_t, ETH_t, XRP_t, EXR_t, INT_t) \quad (1)$$

Where, $STKR_t$ denote monthly stock returns, BTC, ETH and EXP represents volatility in the prices of Bitcoin, Ethereum and Ripple respectively. EXR signifies monthly exchange rate, INT is monthly interest rate, and *t* is time. In econometric terms Equation (1) is formulated as

$$STKR_t = \beta_0 + \beta_1 BTC_t + \beta_2 ETH_t + \beta_3 XRP_t + \beta_4 EXR_t + \beta_5 INT_t + \varepsilon_t \quad (2)$$

Where: β_0= Constant, $\beta_1 \ldots \beta_5$ = Coefficient of the independent variables and ε_t = is the error term. Equation (2) is reformulated in logarithmic notation to assume the following structure

$$lnSTKR_t = \beta_0 + \beta_1 lnBTC_t + \beta_2 lnETH_t + \beta_3 lnXRP_t + \beta_4 lnEXR_t + \beta_5 lnINT_t + \varepsilon_t \quad (3)$$

Apriori Expectation: $\beta_1 > 0;\ \beta_2 > 0;\ \beta_3 > 0, \beta_4 < 0;$ and $\beta_5 < 0$.

Estimation Technique

The estimation technique employed in the study is the Autoregressive Distributed Lag (ARDL) model developed by Pesaran et al. (2001). The model is capable of estimating time series integrated at different orders, specifically I(0) and I(1), while mitigate endogeneity issues, thus improving the accuracy of parameter estimates. Equation 3, is presented in the ARDL framework as follows;

$$\Delta lnSTKR_t = \alpha_0 + \sum_{i=1}^{p} \rho_1 \Delta lnSTKR_{t-1} + \sum_{i=1}^{p} \rho_2 \Delta lnBTC_{t-1} + \sum_{i=1}^{p} \rho_3 \Delta lnETH_{t-1} + \sum_{i=1}^{p} \rho_4 \Delta lnXRP_{t-1} + \sum_{i=1}^{p} \rho_5 \Delta lnEXR_{t-1} + \sum_{i=1}^{p} \rho_6 \Delta lnINT_{t-1} + \beta_1 \Delta lnSTR_{t-1} + \beta_2 lnBTC_{t-1} + \beta_3 lnETH_{t-1} + \beta_4 \Delta linXRP_{t-1} + \beta_5 lnEXR_{t-1} + \beta_6 lnINT_{t-1} + \varepsilon_t \quad (4)$$

where Δ represents the first difference of in the log of the variables *STKR*, *BTC*, *ETH*, *XRP, EXR*, and *INT*. Meanwhile, $t-1$ denotes the optimal lags selected by Schwarz's Bayesian Information Criterion (SBIC), and ρ and β are the estimated coefficients for short run and long run, respectively.

To analyse the dynamic response of stock market returns to cryptocurrency volatility, this study employs the Dynamic ARDL model developed by Jordan and Philips (2018). This approach offers several advantages over the standard ARDL model. Specifically, it allows for dynamic simulations of alternative ARDL specifications, to provide providing detailed understanding of inter-variable relationships across time. Moreover, the Dynamic ARDL framework facilitates counterfactual analysis, thereby enabling the assessment of the isolated impact of a specific independent variable on the dependent variable while controlling for other factors. These simulations enhance the interpretability and practical relevance of the results by illustrating the magnitude and significance of estimated effects under counterfactual scenarios. The specific Dynamic ARDL model estimated in this study is presented in Equation (6).

$$\Delta y_t = \alpha + \sum_{i=1}^{p} \theta_i \, \Delta(y)_{t-1} + \sum_{j=0}^{q} \beta_j \Delta(x)_{t-j} + \lambda(y)_{t-1} + \gamma(x)_{t-1} + \delta S_t + \varepsilon_t \qquad (6)$$

In Equation (6), Δy_t represents the first difference of the dependent variable at time *t*, and α is the intercept term. The θ_i coefficients capture the short-run effects of the lagged differences of the dependent variable, while *p* denotes the number of lags. The β_j coefficients reflect the short-run effects of the lagged differences of the independent variable(s), with *q* representing the number of lags. The λ coefficient measures the long-run adjustment of the dependent variable, and γ captures the long-run relationship with the independent variable(s). $(y)_{t-1}$ and $(x)_{t-1}$ are the lagged levels of the dependent and independent variables, respectively, and ε_t is the error term. S_t denotes the counterfactual shock in the independent variable, while δ quantifies the impact of the counterfactual shock (S_t) on the dependent variable, y_t.

To extract the volatilities in the series, a Generalized Autoregressive Conditional Heteroskedasticity (GARCH) model was employed as suggested by Bollerslev (1986). The GARCH (1:1) approach incorporates lagged conditional variances as autoregressive components, defined as follows:

$$Z_t = \alpha + \gamma' X_t + \mu_t \qquad (7)$$

where $\mu_t \mid \Omega_t \sim \text{iid}\, N(0, \sigma_t^2)$, and here

$$\sigma_t^2 = \partial_0 + \sum_{i=1}^{p} \rho_i \sigma_{t-i}^2 + \sum_{j=1}^{q} \partial_j \mu_{t-j}^2 \qquad (8)$$

where the value of the variance scaling parameter (σ_t^2) is susceptible not just to the values of previous shocks provided as lagged squared residuals but also to the values of itself provided as lagged σ_t^2 terms in the past, as shown by Eq. (8). It is worth noting that the GARCH (p, q) model may be simplified to the $\text{ARCH}(q)$ structure by setting all of the coefficients I value to zero (i.e., $\rho_i = 0$). The model is be expressed in the simplest version as $\text{GARCH}(1,1)$ below by following the GARCH (p, q) specifications:

$$\sigma_t^2 = \partial_0 + \rho_1 \sigma_{t-1}^2 + \partial_1 \mu_{t-1}^2$$

Based on the fact that the $\text{GARCH}(1,1)$ model is relatively simple and performs well in general due to only three unknown parameters (∂_0, ∂_1, and ρ_1).

Results and Discussion

Descriptive Statistics

Table 1 displays the descriptive statistics for the data used in the study. Based on the results, the mean return for monthly stock returns (STR) in Nigeria is 1.550%, with a substantial variation observed as indicated by a maximum return of 16.680 and a minimum of -18.750. This suggests that while the average return is positive, STR exhibits significant volatility, pointing to periods of high gains and losses in the Nigerian stock market. For cryptocurrencies, Bitcoin (BTC) has the highest mean price of $18,484.780, followed by Ethereum (ETH), which is averagely valued at $1,054.397. Binance Coin (BNB) has a mean value of $143.928, while Ripple (XRP) recorded the lowest mean price of $0.423. The maximum prices of the four cryptocurrencies demonstrate wide disparities, with BTC reaching a peak of $67,576.000 and ETH at $4,628.900, while XRP and BNB peaked at significantly lower values of $1.980 and $623.330, respectively. The minimum prices further underscore the

downward volatility inherent in these markets, with BTC, ETH, XRP, and BNB recording lows of $369.800, $8.000, $0.006, and $5.120, respectively, over the period under review.

The exchange rate (EXR) shows a mean of $412.165 with moderate variability, ranging from a minimum of $197.000 to a maximum of $1,347.720. In contrast, the real lending interest rate (INT) presents a mean of 4.058%, fluctuating between a low of 0.919% and a high of 6.686%. The standard deviation of INT at 2.306 further highlights its variability over the period. The Jarque-Bera test results indicate that STR has a probability value of 0.526, suggesting a normal distribution, whereas BTC, ETH, XRP, BNB, EXR, and INT show significant deviations from normality, as evidenced by their respective probability values being below 0.05.

Table 1. Descriptive Statistics

Statistic	STR	BTC	ETH	XRP	BNB	EXR	INT
Mean	1.550	18,484.780	1,054.397	0.423	143.928	412.165	4.058
Maximum	16.680	67,576.000	4,628.900	1.980	623.330	1,347.720	6.686
Minimum	-18.750	369.800	8.000	0.006	5.120	197.000	0.919
Std. Dev.	6.546	18,033.170	1,165.355	0.343	178.788	212.737	2.306
Jarque-Bera	1.283	17.757	20.882	111.812	17.833	272.552	13.374
Prob.	0.526	0.000	0.000	0.000	0.000	0.000	0.001

Source: Researcher Computation, 2024.

Unit Root Test

Table 2 displays the results of the unit root tests conducted for all the variables, utilizing both the Phillip Perron (PP) and the Augmented Dickey Fuller (ADF) Unit Root Test. The findings indicate that the dependent variable, STKR, became stationary after the first difference. Similarly, BNB, exchange rate and interest rate were stationary after the first difference, in both the PP and ADF tests. On the other hand, all the other variables, including BTC, ETH, and XRP, remained stationary at their original levels. Although, none of the variables exhibited stationarity beyond the first difference. Given that the dependent variable achieved stationarity after the first difference, and none of the variables exhibited stationarity beyond order 1, the prerequisites for the application of ARDL are satisfied.

Table 2. Unit Root Test

	Phillip Perron			Augmented Dickey Fuller		
	Level	1st Difference	Order of Stationarity	Level	1st Difference	Order of Stationarity
STKR	-2.613	-32.483	I(1)	-2.583	-12.127	I(1)
	(0.232)	(0.000)		(0.391)	(0.000)	
BTC	-7.723	-23.045	I(0)	-7.676	-11.134	I(0)
	(0.000)	(0.000)		(0.000)	(0.000)	
ETH	-7.542	-23.859	I(0)	-7.406	-10.828	I(0)
	(0.000)	(0.000)		(0.000)	(0.000)	
XRP	-9.098	-79.231	I(0)	-9.097	-7.626	I(0)
	(0.000)	(0.000)		(0.000)	(0.000)	
BNB	-2.776	-15.039	I(1)	-2.036	-13.723	I(1)
	(0.210)	(0.000)		(0.573)	(0.000)	
EXR	-3.776	-8.041	I(1)	-3.596	-8.107	I(1)

	(0.023)	(0.000)		(0.036)	(0.000)	
INT	-2.451	-8.927	I(1)	-2.372	-8.927	I(1)
	(0.352)	(0.000)		(0.392)	(0.000)	

Source: Researcher's computation, 2024

Correlation Test

The correlation analysis reveals varying degrees of linear association between Nigerian stock market returns and cryptocurrency price volatility. BTC price volatility exhibits the strongest positive correlation with STKR (r = 0.323). ETH price volatility also shows a positive, albeit slightly weaker, correlation with STKR (r = 0.293). In contrast, the correlations between STKR and the price volatility of XRP (r = 0.064), BNB (r = 0.046) and INT (r = 0.032) are weak, suggesting minimal linear relationships.

Table 3. Correlation Matrix

	STKR	BTC	ETH	XRP	BNB	EXR	INT
STKR	1						
BTC	0.323	1					
ETH	0.293	0.560	1				
XRP	0.064	0.316	0.454	1			
BNB	0.046	0.374	0.274	0.272	1		
EXR	0.034	-0.132	0.005	-0.079	-0.543	1	
INT	0.032	-0.100	-0.099	-0.179	-0.665	0.730	1

Source: Researcher's computation, 2024

Cointegration Test

The Autoregressive Distributed Lag (ARDL) bounds test for cointegration, presented above, decisively rejects the null hypothesis of no long-run relationship between the variables under investigation. The calculated F-statistic of 9.345 substantially exceeds the critical value bounds at all conventional significance levels. Specifically, the F-statistic surpasses the upper bound critical values for I(1) variables at the 10% (3.09), 5% (3.49), and 1% (4.37) significance levels. This rejection across all significance thresholds provides compelling evidence of a statistically significant long-run equilibrium relationship between the stock market returns and cryptocurrency volatility.

Table 4. ARDL Bound Test

Test Stat.	Value	Signif.	I(0)	I(1)
F-Statistic	9.345	10%	2.2	3.09
		5%	2.56	3.49
		1%	3.29	4.37

Source: Researcher Computation, 2024.

Short-Run Results

The short-run regression results reveal several key relationships between stock market returns and various financial variables analysed are displayed in Table 5. From the results, a significant positive relationship exists between volatility in the price of Bitcoin and stock market returns. A one 1% increase in BTC results in an 0.836% rise in STKR. In contrast, the lagged value of price volatility in Ethereum significantly and negatively impacted on stock market returns. A 1% increase in (ETH(-1)) decreases stock market returns by 0.589%. Volatility in the price of Binance Coin also shows a positive and significant impact on stock market returns. From the result, a 1% increase in BNB is associated with a 0.946% increases stock market returns. On the other hand, the relationship between volatility in the price of Ripple and stock market returns is negative. The results shows that a 1% increase XRP dampens stock market returns by 0.267%, although, the result was non-significant. In terms of Ethereum price volatility, a significant positive relationship is observed. A 1% increase in D(ETH) increases stock market returns by 0.782 at the significant level of 1%. The result also indicates that exchange rate and interest rate are negatively related to stock returns. From the result, a 1% increase in exchange and interest rates, decreases stock market returns by 0.169 and 0.157 respectively. Although, the results were not significant, thereby suggesting their limited impact on stock market returns in the short run. Additionally, the error correction term (CointEq(-1)) is negative and significant, highlighting the presence of a long-term equilibrium relationship that adjusts stock market returns by 0.65% annually.

Table 5. ARDL Short-Run Results

Variable	Coefficient	t-Statistic	Prob.
C	1.090	0.763	0.448
STKR(-1)*	-1.112	-7.762	0.000
BTC**	0.836	2.382	0.020
ETH(-1)	-0.589	-2.714	0.009
XRP**	-0.267	-0.959	0.341
BNB**	0.946	2.914	0.005
EXR(-1)	-0.066	-0.120	0.905
INT**	-0.157	-1.159	0.250
D(STKR(-1))	0.170	1.625	0.109
D(ETH)	0.782	4.258	0.000
D(EXR)	-0.169	-0.278	0.782
D(EXR(-1))	-0.725	-1.126	0.264
D(EXR(-2))	-0.252	-0.675	0.502
CointEq(-1)*	-0.650	-2.671	0.010

Source: Researcher's computation, 2024

Long Run Effect

The long-term implications of cryptocurrency on stock market returns are unveiled in Table 6. From the results, volatility in the price of Bitcoin positively influence stock market performance. Fron the result, a 1% increase in BTC increases STKR by 0.568%, at the significant level of 0.05. Volatility in the prices of Ethereum is positively and significantly related to stock market performance. A 1% increase in ETH increases STKR by 0.113%, with the result being ($\rho < 0.05$). The result also shows a significant positive effect of Binance Coin price volatility on stock market performance ($\rho < 0.05$). A 1% increase in BNB is associated with a 0.305% increase in stock market returns. The result indicates that volatility in the price of BNB is an important determinant of stock market performance. The result implies that volatility in the prices of Bitcoin, Ethereum and Binance coin positively influences stock market performance in Nigeria. This suggests that while volatility in the price of Bitcoin, Ethereum and Ripple continues to have a positive influence on stock market performance in Nigeria over the long term, its impact is less pronounced when compared to the short-term effects.

This effect may be a result of spillovers from the cryptocurrency market into the stock market as investors advantage of short-term volatility in cryptocurrency prices to engage in speculative trading. Cryptocurrency price movements create opportunities for arbitrage and speculative gains, which can attract liquidity flows that temporarily influence stock market returns (Aloulou et al. 2024). Such spillover effects are particularly evident in financial markets, such as Nigeria, where investor sentiment and risk-on behaviour can dominate trading activity and price movements during periods of increased volatility (Abdullahi & John, 2023). Although, over the long term, the influence of cryptocurrency volatility on stock market performance has been noted to weaken as speculative pressures subside and fundamental factors of macroeconomic stability and corporate performance take precedence in the stock market dynamics (Doroslovački et al. 2024).

In contrast, the impact of volatility in the price of Ripple on stock market performance was negative. A 1% increase in XRP reduces STKR by 0.044%. With the result being insignificant, the implication is that volatility in the price of Ripple has limited role in influencing stock market performance in Nigeria. Exchange rate negatively and insignificantly influenced stock market performance. From the results, a 1% increase in EXR reduces STKR 0.059%, although, the result was not significant ($\rho > 0.05$). This suggests that fluctuations in the exchange rate do not have a meaningful long-term impact on stock market performance in Nigeria. Lastly, a significant negative relationship exits between interest rate and stock market performance. From the result, a 1% increase in INT decreases STKR by 0.836%. The result is also significant ($\rho < 0.05$) which suggests that higher interest rates decrease stock market performance in the long-run. The negative impact of interest rates on stock market returns reflects the broader economic effect of monetary tightening, where higher borrowing costs stifle investment and reduce the attractiveness of equities.

Table 6. ARDL Long-Run Results

Variable	Coefficient	t-Statistic	Prob.
BTC	0.568	2.012	0.049
ETH	0.113	2.193	0.031
XRP	-0.044	-0.745	0.459
BNB	0.305	2.565	0.013
EXR	-0.059	-0.12	0.905
INT	-0.836	-2.382	0.02
C	0.981	0.783	0.436

Source: Researcher's computation, 2024

Predicted Effect of Counterfactual Shocks to Cryptocurrency Assets on Stock Market Performance

The anticipated outcomes of a one standard deviation counterfactual shock to volatility in Bitcoin, Ethereum, Ripple and Build n Build on stock market returns in Nigeria visually presented in Figures 3A and B, 4A and B, 5A and B and 6A and B. The dark spots are the predicted mean values; the blue lines, from darkest to lightest are the 75%, 90% and 95% confidence intervals, respectively. The figures on the vertical axis shows the magnitude of impact while the figures on the horizontal axis displays the time horizon. In Figure 3A, positive shocks in Bitcoin (BTC) price volatility initially cause a sharp increase in STKR, stabilizing at a long-run value of approximately 6, indicating a sustained positive impact. Conversely, Figure 3B, depicts that negative shocks in BTC price volatility shocks trigger an immediate, albeit temporary, increase in STKR in the 5th period, followed by a gradual decline and stabilization at approximately -2 in the long run. Positive shocks in Ethereum (ETH) price volatility (Figure 4A) result in a steady increase in STKR returns, reaching a stable long-run value of approximately 1.28, demonstrating a consistent positive influence. On the other hand, negative shocks in volatility in the price of ETH causes a temporary positive increase in STKR in the 5th period (Figure 4B), followed by immediate decline in STRK to stabilize at 1.14 in the long run. In Figure 5A, positive shocks in Ripple (XRP) price volatility result to a gradual but sustained increase in STKR returns, stabilizing at a higher level (1.28) than the pre-shock baseline

(1.22). However, as shown in Figure 5B, negative shocks in the XRP price volatility cause a sharp persistent decline in STKR from an initial 1.22 to 1.14. Finally, Figure 6A shows that positive shocks in Binance Coin (BNB) price volatility trigger steep upward trend in STKR returns from the 5th period (2.3), stabilizing at a substantially higher level of 9, while in Figure 6B, negative shocks in BNB price volatility induce a steep downward trend in STKR from an initial base point of 1.9 to -3. The implicating of these findings is that volatility shocks in major cryptocurrencies have significant spillover effects on the Nigerian stock market. Positive volatility shocks in Bitcoin, Ethereum, and Binance Coin generally lead to sustained increases in stock market returns, while negative volatility shocks in these cryptocurrencies can cause temporary increases in stock market returns followed by a gradual decline. This shows the potential risks associated with cryptocurrency market instability.

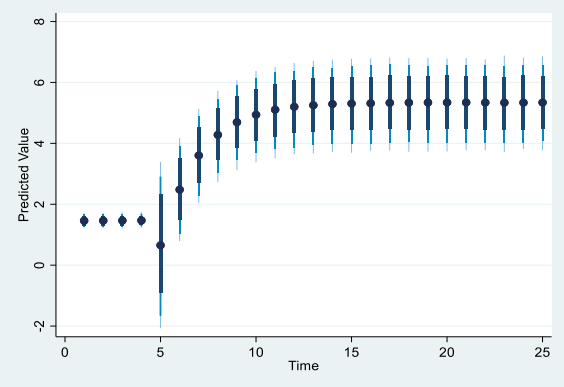

Figure 3A

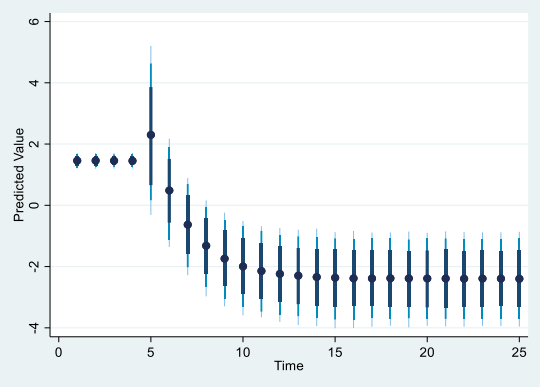

Figure 3B

Representation of the predicted impact of a ± 1 shock in Bitcoin (BTC) at t = 5 on Stock Market Returns.

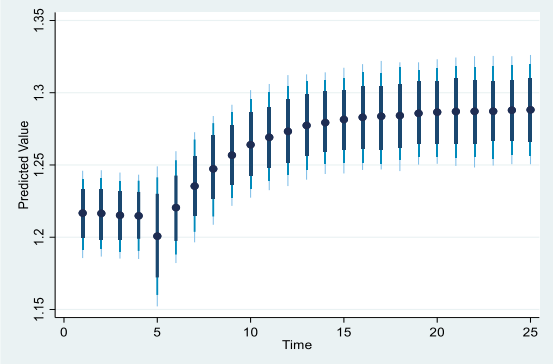

Figure 4A

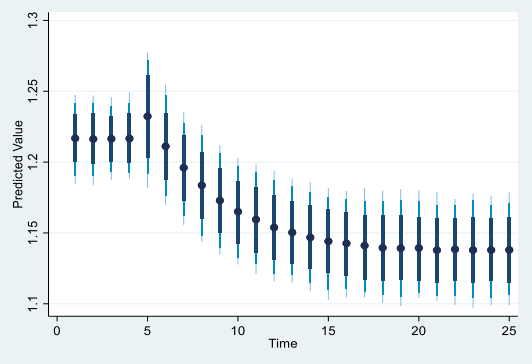

Figure 4B

Representation of the predicted impact of a ± 1 shock in Ethereum (ETH) at t = 5 on Stock Market Returns.

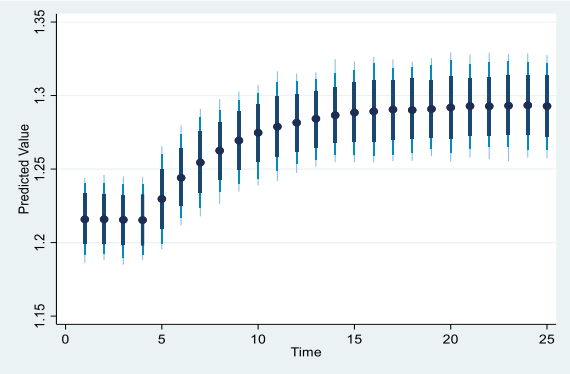

Figure 5A

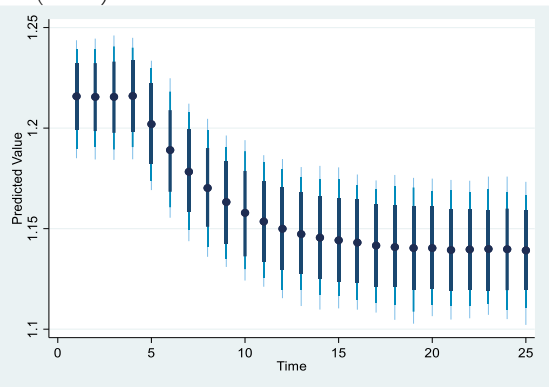

Figure 5B

Representation of the predicted impact of a ± 1 shock in Ripple (XRP) at t = 5 on Stock Market Returns.

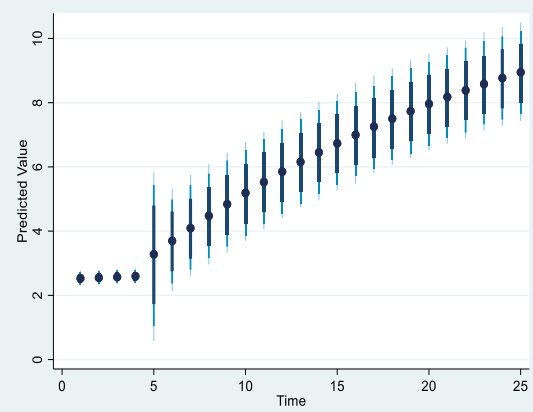

Figure 6A

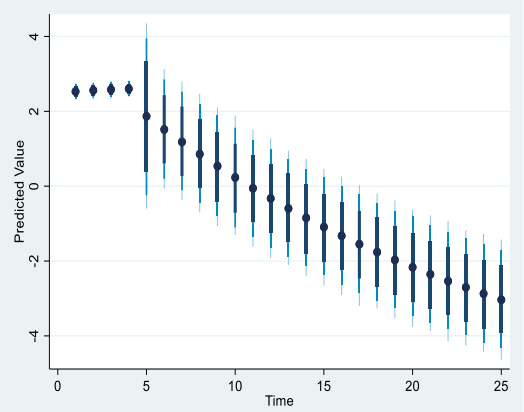

Figure 6B

Representation of the predicted impact of a ± 1 shock in Binance Coin (BNB) at t = 5 on Stock Market Returns.

Causality Test

Table 7 presents the Granger causality test result among stock returns and volatility in BTC, ETH, and BNB. The result reveals significant bidirectional relationships between STKR returns and the volatilities of Bitcoin, Ethereum, and Binance Coin. The statistically significant p-values ($p < 0.05$) for both directions of causality for these cryptocurrencies indicate a feedback loop: BTC volatility influences STKR returns, and STKR returns, in turn, influence BTC volatility; the same bidirectional relationship holds for ETH and BNB with STKR returns. This implies a dynamic interconnectedness where these cryptocurrency markets and the Nigerian stock market mutually influence each other. Conversely, no statistically significant Granger causality is found between XRP volatility and STKR returns ($p > 0.10$ for both directions), suggesting that, within the examined timeframe, neither market demonstrably predicts the other.

Table 7. Granger Causality Test Result

Null Hypothesis	F-Stat.	Prob.
BTC does not Granger Cause STKR	5.265	0.007
STKR does not Granger Cause BTC	7.950	0.001
ETH does not Granger Cause STKR	5.850	0.012
STKR does not Granger Cause ETH	4.271	0.031
XRP does not Granger Cause STKR	2.092	0.129
STKR does not Granger Cause XRP	0.998	0.373
BNB does not Granger Cause STKR	5.821	0.012
STKR does not Granger Cause BNB	5.974	0.004

Source: Researcher Computation, 2024.

Conclusions and Policy Recommendations

This study investigated the effects of volatility in the prices of cryptocurrencies on stock market performance in Nigeria between 2016 and 2024. The study analysed monthly data on Bitcoin, Ethereum, Ripple and Binance coin through the Autoregressive Distributed Lag and Dynamic ARDL estimation techniques to discern short-run and

long-term effects, as well as the response of stock market to volatility in cryptocurrency prices. The findings revealed long-run relationship between stock market performance and volatility in the prices of cryptocurrencies. Also, the effect of volatility in cryptocurrencies on stock market performance were positive except for Ripple. However, the effect of the impact of volatility in cryptocurrencies on stock market performance were lower in the long-run, as compared to their short-run effects. Additionally, there were evidence of spillover effects from volatility shocks in the cryptocurrency market to the stock market with the stock market responding positively to positive shocks in cryptocurrency volatility *vice versa*. While a bi-directional causality was observed between volatilities in Bitcoin, Ethereum, Binance coin and Stock market performance, no causality was found to exist between Ripple and stock market performance.

It is important that the Securities and Exchange Commission (SEC) and the Central Bank of Nigeria (CBN), develop comprehensive guidelines for cryptocurrency trading and integration with the financial market due to the interconnectedness between the cryptocurrency market and stock market performance in Nigeria. These regulations should address volatility risks in cryptocurrency investments and their spillover effects on the stock market to ensure that financial stability is preserved in the stock market while fostering innovation. Given the observed positive short-run effects and spillover dynamics, investors and portfolio managers should promote portfolio diversification strategies to capitalize on short-term gains from cryptocurrency-induced stock market rallies while cushioning against potential volatility-driven losses.

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