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Digital Currency and Financial Markets in Nigeria: Impact and Policy Implications

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ABSTRACT

The rise of privately issued digital currencies, which primarily serve as alternative investment assets poses a challenge to the traditional financial instruments traded in the financial market. This study examines the dynamic relationship between the major privately issued digital currency (Bitcoin) and two financial market securities in Nigeria. The paper employed Vector Autoregressive (VAR) model and presents three relevant findings. First, the impulse response function indicates the absence of a significant response of the Nigerian financial market to shocks emanating from the Bitcoin market, implying lower connectedness between the two markets. Secondly, the outcome of the variance decomposition reveals a lower contribution of Bitcoin to changes in stock prices and treasury bills, however, stock prices and treasury bills contributed higher impact to each other compared to the contribution of Bitcoin. Thirdly, a weak bi-directional causality between the Bitcoin and treasury bills was observed and a uni-directional causality running from treasury bills and stocks, implying the existence of portfolio rebalancing from the fixed income to the equities market. Despite the weak connection between digital currency and the financial market, the paper recommends that the Central Bank of Nigeria and the Securities and Exchange Commission should maintain monitoring the development of crypto exchanges and continue reviewing the existing policy restricting cryptocurrency transactions through banks to avoid its unsavoury effects.

KEYWORDS

Digital Currency; Financial Market; VAR

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1. Introduction

Privately issued digital currencies, especially cryptocurrencies of varying forms such as Bitcoin, Ethereum, Ripple, Binance Coins, among others have been gaining global acceptability (Jimoh, & Oluwasegun, 2020; Hasan et al, 2022; Salisu et al, 2023). These coins are conceived to be an alternative investment asset (Corbet et al, 2019; Campiglio, 2016; Salisu et al., 2023; Chari, 2023), their values are measured by their prices (Kumar, 2021; Kyriazis, 2021; Anamika et al., 2023), and these prices are volatile (Guizani & Nafti, 2019; Basher & Sadorsky, 2022), and their supply limited (Chuen et al., 2017; Hayes, 2020). These coins are considered investment instruments as opposed to currency that is generally acceptable for the exchange of goods and services and used as a unit of account (Kyriazis, 2020; Corbet et al, 2019; Salisu et al, 2023).

The traditional financial market on the other hand, which is a system that enables the facilitation of transactions and investment of securities such as stocks, bonds, and foreign currencies has been empirically proven to be interconnected with the emerging privately issued digital currencies, popularly known as cryptocurrencies, such as Bitcoin and Ethereum (Kumah et al, 2021; Agyei et al, 2022; Ha, 2023; Frikha et al, 2023). Therefore, owing to the rising adoption of privately issued digital currency, especially Bitcoin, by individual and institutional investors, it is becoming increasingly difficult to detach these cryptocurrencies from the financial market as this instrument becomes an integral part of the financial system with increasing investments. The trends in the volume of transactions and market capitalisation are presented in Appendix 1 & 2.

Available studies on digital currency and its relationship with the financial market can be broadly grouped into two categories in terms of findings. The first strand of studies maintains that investment in the financial market, specifically, in equities and bonds would remain unaffected by digital currencies (Dabrowski & Janikowski, 2018; Gilbert & Loi, 2018; Gkillas & Longin, 2019). The second strand of studies pointed out that digital currency has an inimical effect on the financial market with a tendency for spillover effects (see, Matkovskyy & Jalan, 2019; Handika et al, 2019; Zhang et al, 2021; Kumah et al, 2021; Agyei et al, 2022; Iyer, 2022; Frikha et al, 2023; Ha, 2023). Similarly, some studies have also discovered that cryptocurrencies function as a separate risk source from traditional assets (Liu & Serletis, 2019; and Li & Huang, 2020).

The current regulations in Nigeria do not consider transactions in this form of digital currency (all forms of privately issued digital currency) as a legal undertaking, following the restriction of cryptocurrency trading through commercial banks by the Central Bank of Nigeria (CBN) in February 2021, as they are perceived to pose financial stability threat. However, before this restriction, Nigeria was the leading destination of cryptocurrency (Bitcoin) trading in Africa (Nault, 2021; Ozili, 2022; and Mohammed, 2023). Appendix 3 demonstrates the rising transaction of Bitcoin on online exchanges in Nigeria, prior to the CBN restriction.

The restriction of cryptocurrency trading by the regulatory authority in Nigeria led Nigerian crypto investors to adopt peer-to-peer trading (Onyekwere et al, 2023). A survey revealed that 65.0 per cent of Nigerian crypto investors make fiat deposits to crypto exchanges for crypto trading via peer-to-peer trading with other investors[1]. This action implies portfolio diversification from investing in the Nigerian financial market instruments such as the Nigerian equities, bonds, or treasury bills to cryptocurrency.

A global and domestic outlook indicates that the pace of global adoption remains high even with falls in the prices of crypto assets, as the global cryptocurrency market is predicted to grow with a compound annual growth rate of 56.4 per cent from 2019 to 2025, while on the domestic front, the crypto penetration rate in Nigeria is predicted to increase by an average of 2.4 per cent annually between 2024 to 2027[2]. Trading value in Bitcoin in Nigeria was tallied at around $400 million, in the first two quarters of 2022 according to P2P exchange Paxful.

[1] Kucoin, Into the Cryptoverse Report, Nigeria Edition 2022.
[2] Triple A at https://triple-a.io/crypto-ownership-data/.

The trend in cryptocurrency adoption is of concern to policymakers and investors as it portends financial stability concerns along two main pathways. First, the potential for asset switching as a significant adoption of privately issued digital currencies could partially absorb a chunk of investment that could ordinarily be invested in the Nigerian financial market. Another concern is the tendency for currency substitution as cryptocurrencies could potentially replace legal tender as a medium of payment and store of value. Since controlling the supply and demand for money for payments and investments is critical for monetary policy, the significant substitution of legal tender currency for cryptocurrency and the switching of traditional financial assets to cryptocurrencies would limit the efficacy of monetary policy formulation and implementation. Moreover, investments, especially within financial markets, are a veritable means for resource mobilisation and allocation for economic activities. Therefore, it has become pertinent to examine the relationship between financial markets and privately issued digital currencies and the impact of this relationship on investors and macroeconomic policy.

Given the above trend in the adoption of cryptocurrencies and the financial stability considerations, this paper attempts to investigate if the Nigerian financial market is susceptible to movements in trading activities of privately issued digital currency (Bitcoin) and to examine the magnitude and direction of any interconnectedness between these variables. The literature on cryptocurrencies and financial market dynamics in Nigeria is sparse with most focusing on regulatory considerations (Alvarez, 2018; Alekseenko & Gidigbi., 2021; Opebiyi, 2022) while Jimoh & Oluwasegun (2020) considered the effect of cryptocurrency returns volatility on stock prices. This paper contributes to the discourse by analysing specifically the dynamic relationship between cryptocurrency and the financial market in Nigeria to inform policy and investment decision-making. Moreover, we undertake a review of jurisdictional experiences of cryptocurrency regulation to provide context on the regulatory treatment of cryptocurrencies in relation to monetary and financial systems.

Following the introduction section, the next sections are organised in the following sequence: the second section contains the literature review, while the third section is the jurisdictional experiences; the fourth section, explains the methodology, the fifth section deals with the findings and discussion, whereas the sixth sections provide conclusion and recommendation.

2. Conceptual Clarification

Generally, digital currencies are virtual representations of value accepted for exchange by transacting parties. The literature differentiates between privately issued digital currencies and government-issued digital currencies. For example, the European Banking Authority (EBA) conceptualised privately issued digital currency as a "digital representation of value that is neither issued by a central bank or public authority nor necessarily attached to a fiat (conventional) currency but is accepted by natural or legal persons as a means of exchange and can be transferred, stored, or traded electronically" (EBA, 2014, p. 7).

In this study, we adapt the conceptualisation of the privately issued digital currency by the European Central Bank (ECB), which defines privately issued digital currencies as a "type of unregulated, digital money, which is issued and usually controlled by its developers, and used and accepted among the members of a specific virtual community" (ECB, 2012, p. 14). Following the above conceptualisation, in this paper, we use the term digital currency to refer to privately issued digital currency commonly known as cryptocurrencies such as Bitcoin, Ethereum, and Binance coin.

Another important concept in this study is the concept of financial market. While the concept of financial market is not new to literature, our conceptualisation of financial market centres around an investment destination for trading stocks and treasury bills. These instruments were selected as they play vital role in resource allocation and liquidity mobilisation.

2.1. Theoretical Linkages

The theoretical linkages of how cryptocurrency affects the Nigerian financial market can be explained by the flight-to-safety theory, which states that risk-averse investors tend to allocate a large portion of their portfolios in safer instruments such as stocks and bonds as opposed to highly volatile and risky asset such as cryptocurrency. We consider this theory relevant to explain the possibility of higher appetite for traditional financial market instruments to cryptocurrencies or vice-versa.

2.1.1. Flight to Safety Theory

On the backdrop of the attractiveness of privately issued digital currency as a new investment vehicle for portfolio investments owing to their role in international portfolio diversification. Especially in episodes of increasing crypto valuations and market prices. Bitcoin in specifics yields high risk-adjusted returns on average and has evolving connections with equities particularly in highly developed markets, making them desirable alternative for both domestic and foreign investors (Agyei, 2023). Risk-averse investors would always prefer riskless portfolios; however, other investors are driven by high returns and are less sensitive to inherent risk in assets. This tendency would result in diversification and risk. In connection with the above background, the flight to safety theory with its variant such as flight to quality, flight to liquidity, and the Pricing of Risk by Vayanos (2004) is apt in discussing a dynamic relationship of a multi-asset market. The key assumption in the theory is that investors and fund managers are subject to withdrawals when fund performance falls below a threshold. This generates a preference for near liquid assets that is time varying and increases with volatility. Risk-averse investment managers fear redemptions during high volatility periods and therefore an increase in volatility may lead to a flight-to-liquidity. At the same time, their risk aversion also increases, leading to a flight-to-safety, meaning that they require higher risk premiums, which in turn drives down the prices of risky assets to a flight-to-quality. The driving force in the theory is that uncertainty may lead agents to shed risky assets in favour of un-contingent and safe claims when aggregate liquidity is low thereby provoking a flight- to-quality or safety.

3. Impact of digital currencies on Financial Market: Insight from Jurisdictions

Countries learn from the experiences of other countries. In this section, we have drawn lessons from the experiences of some selected countries on the impact of privately issued digital currency on financial market. The insight was summarised and presented in Table 1. For a comprehensive review of the jurisdictional experience for more sample countries see, Jeris et al (2022).

4. Methodology

In addition to country experiences and insight obtained from the literature review on the form of interaction and relationship between the privately issued digital currency and traditional financial market, this section utilised data on some variables of interest to examine the relationship for Nigeria.

4.1. Data Sources and Description

The paper employed monthly data spanning from 2018M1 to 2023M6 for the analysis. The dataset includes the all-share index (ASI) measured as the composite index of all the traded stocks on the Nigerian Exchange Limited (NGX) market, 91-day treasury bills rate (NTB) measured in rate, and Bitcoin prices (BTC) measured in millions of naira. The idea is to examine the causal relationship between the private digital currency (Bitcoin) and some financial market instruments. The choice of Bitcoin as a proxy for private digital currency was determined by three

Table 1. Jurisdictional Experience on privately issued digital currency and Lessons.

S/N	Country	Legality of Cryptocurrency	Impact: Positive/Negative	Lessons for Nigeria
1	China	Illegal. All exchanges, mining, and trading activities are banned.	The impact of cryptocurrency on China's financial market is relatively strong, but the impact of China's financial market on cryptocurrency is very weak. Specifically, negative spill overs are stronger than positive spill overs.	Securities and Exchange Commission (SEC) and Central Bank of Nigeria (CBN) to intensify monitoring of crypto exchanges and continue reviewing the policy on cryptocurrency transactions.
2	Singapore	Legal. Exchanges and issuers are licensed, and crypto assets are recognized by law.	Mixed impact, with some evidence showing co-movement between Bitcoin and the Singaporean stocks and others pointing to a weak correlation.	Cryptocurrencies, particularly Bitcoin can serve as an alternative investment. Weak correlation implies weak contagion tendency, as such authorities can consider regulating it.
3	Brazil	Legal. Cryptocurrencies recognised as a payment method.	During crises, cryptocurrencies were discovered to be a haven for investors in Brazil	Cryptocurrency transactions can serve as a risk diversifier, and as such regulatory authority may consider strict regulations.

factors. First Bitcoin is the most traded privately digital currency in terms of volume and market capitalisation. Secondly, the price of Bitcoin is internationally determined like oil price, making it suitable for analysis irrespective of the country's location. Thirdly, Bitcoin data was readily available for the sample period used in the paper. The other variables were chosen as Holovatiuk (2020) submitted that the five (5) most common key asset classes in the financial market are stocks, fixed income, commodities, foreign exchange, and real estate. Thus, we use 2 of these key variables (stocks and fixed income instrument) because of data availability on these variables and their suitability to the context of the study. The dataset was obtained from the Central Bank of Nigeria statistical database and the Nigerian Exchange Limited (NGX) Statistics database. Bitcoin data was obtained from Coinmarketcap website.

4.2. Technique of Analysis

The paper employs a Vector Autoregressive (VAR) in first difference, which is used in examining the dynamic relationship among the study variables. The choice of VAR in first difference was informed by the non-stationarity of the variables (that is, all being I (1) series) from the unit root test and were not cointegrated based on the Johansen Cointegration test. The paper considered preliminary tests including summary statistics, unit root, and pairwise correlation matrix to adequately explain the salient features of the data.

4.2.1. Model Specification

The VAR in first difference has proven to be useful for describing the dynamic behaviour of economic and financial time series. In the VAR framework, all the variables are treated as endogenous variables being explained by its lagged values and the past values of the other endogenous variables (Granger, 1969; Sims, 1982). The VAR in difference is given by:

$$\Delta BTC = \beta_1 + \sum_{t=1}^{k} \beta_2 \, \Delta BTC_{t-1} + \sum_{t=1}^{k} \beta_3 \, \Delta ASI_{t-1} + \sum_{t=1}^{k} \beta_4 \, \Delta NTB_{t-1} + \mu_t \quad eqn \tag{1}$$

$$\Delta ASI = \beta_1 + \sum_{t=1}^{k} \beta_2 \Delta ASI_{t-1} + \sum_{t=1}^{k} \beta_3 \Delta BTC_{t-1} + \sum_{t=1}^{k} \beta_4 \Delta NTB_{t-1} + \mu_t \quad eqn \tag{2}$$

$$\Delta NTB = \beta_1 + \sum_{t=1}^{k} \beta_2 \Delta NTB_{t-1} + \sum_{t=1}^{k} \beta_3 \Delta BTC_{t-1} + \sum_{t=1}^{k} \beta_4 \Delta ASI_{t-1} + \mu_t \quad eqn \tag{3}$$

In equation 1-3, Δ is the difference operator, μ_t is the innovations and is assumed to be white noise with zero mean. K is the number of lags, and 2 optimal lag length has been decided by the Akaike information criterion (AIC) and final prediction error (FPE) reported in Table 2. As reported in Table 5, we find that all the variables are integrated of the same order one, i.e. I (1), implying the suitability of the technique. The above model is used for the purpose of testing for testing the dynamic relationship between the privately issued digital currency and the two selected financial market indices.

Table 2. Determination of appropriate lag length (k).

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-155.9186	NA	0.115687	6.356745	6.471466	6.400431
1	6.976882	299.7277*	0.000246	0.200925	0.659810*	0.375671*
2	16.72260	16.76264	0.000239*	0.171096*	0.974146	0.476902
3	24.64612	12.67763	0.000253	0.214155	1.361369	0.651021
4	30.16932	8.174338	0.000296	0.353227	1.844605	0.921152

Notes: The appropriate lags selected is 2 based on AIC. Source: Author's computations.

4.2.1.1. *A-priori* Economic Expectation

Guided by the flight-to-safety theory and the institutional knowledge on the contemporaneous relationship among the variables, all things being equal Bitcoin is expected to have a weak causal relationship with the financial market variables in Nigeria as the penetration and use of Bitcoin is still evolving. However, we expect the Uni-directional/bi-directional causality among the other variables, ASI and NTBs.

5. Results and Discussion

5.1. Pre-estimation test

The preliminary checks entail the basic descriptive statistics to understand the underlying data-generating process and nature. In addition to the preliminary checks, the second procedure involves the estimation of pair-wise correlation and unit root test.

5.1.1. Descriptive Analysis

Deduced from the standard deviation in Table 3, it was shown that Bitcoin appears to be the most volatile among the variables, followed by stock index (ASI). This justifies the inherent price fluctuations that characterise these variables, leading to difficulty in forecasting their future behaviour with precision. The volatile nature of Bitcoin also lends voice to the previous submissions of Kumar (2021), Kyriazis (2021), and Anamika et al. (2023). Further deduced from the results of summary statistics in Table 2 is that NTB was the only variable that is not normally distributed series as its probability value is less than 0.05. The mean values show the averages of the dataset over the study period.

Table 3. Summary Statistics.

Statistics	ASI	BTC	NTB
Mean	38,252.14	23,976.65	4.14
Median	39,132.37	19,917.25	2.50
Std. Dev.	10,368.79	16,489.81	3.37
Jarque-Bera	3.29	4.94	10.16
Probability	0.19	0.08	0.01*
Observations	54	54	54

*Notes: * & ** denotes rejection of null hypothesis at 1% level of significance.*

5.1.2. Correlation Analysis

Correlation analysis involves the determination of the level of association between two or more variables. In this case, we deployed a pairwise correlation matrix to examine the level of relationship between the study variables. The aim for this analysis is to discover the degree (magnitude) and direction of relationship between the financial market and digital currency to aid policy direction.

The result in Table 4, shows that fair and positive correlation exists between the stock index (ASI) and the Bitcoin prices. This suggests that Bitcoin price does not erode stocks performance measured by the ASI, as an increase in the former does not lower the latter. However, the result pointed fair and negative correlation between the fixed income instrument (NTB) and the Bitcoin. This finding is indicative of cross-investment rebalancing. This outcome was in tandem with the case of China as highlighted in Table 1, indicating negative spill overs in the Chinese market. Interestingly, a negative relationship was spotted between the stock index and the NTB, implying the existence of assets switching or portfolio rebalancing as increase in stocks performance tends to lure more investors to the stock market, leading to a shift of investment from the fixed income to the equities market, and vice-versa. This form of relationship was also consistent with the flight-to-safety theory.

Table 4. Pairwise Correlation Matrix.

Variables	ASI	BTC	NTB
ASI	1.00		

BTC	0.55	1.00	
	(0.00) *	-----	
NTB	-0.28	-0.51	1.00
	(0.04)**	(0.00)*	-----

*Notes: * & ** denotes statistically significant at 1% & 5% level of significance..*

5.1.3. Unit Root test

The stationarity test using Augmented Dickey-Fuller (ADF) and Phillips and Perron (PP) test in Table 5 reveals that all the variables were not stationary at level, however, the after differencing the variables, they become stationary. Therefore, the summary of the stationarity of the variables is that all the variables are stationary at first difference. In line with this, the VAR in difference becomes the most appropriate as it was suitable for non-stationary series that are not cointegrated (Granger, 1969).

Following the non-stationarity of the study variables at their level form, we conduct a Johansen cointegration test to test whether a linear combination of the variables would produce a stationary outcome (Johansen, 1988). As shown in Table 6, the null hypothesis of no cointegrating relationship cannot be rejected and we therefore, we conclude that there is no evidence of long cointegrating relationship between Bitcoin and financial market variables in Nigeria. Thus, we could not estimate the Vector Error Correction Model (VECM), but rather estimate a VAR model in difference to examine the dynamic relationship between the variables.

Table 5. Unit Root test result.

	Panel A: Bitcoin					
	Level			Difference		
	Constant	Constant & Trend	None	Constant	Constant & Trend	None
ADF	-1.613	-1.529	-0.408	-5.780***	-5.752***	-5.803***
PP	-1.685	-1.688	-0.470	-5.659***	-5.612***	-5.678***
	Panel B: ASI					
	Level			Difference		
	Constant	Constant & Trend	None	Constant	Constant & Trend	None
ADF	0.398	-2.752	1.729	-5.348***	-5.534***	-5.165***
PP	0.262	-2.167	1.598	-5.205***	-5.356***	-5.078***
	Panel C: NTB					
	Level			Difference		
	Constant	Constant & Trend	None	Constant	Constant & Trend	None
ADF	-2.418	-2.055	-1.979	-4.874***	-5.029***	-4.872***
PP	-2.117	-1.506	-2.026	-4.593***	-5.158***	-4.650***

*Notes: (*) Significant at the 10%; (**) Significant at the 5%; & (***) Significant at the 1%. *MacKinnon (1996) one-sided p-values.*

Table 6. Johansen Cointegration Test.

Panel A: Unrestricted Cointegration Rank Test (Trace)				
Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.*
None	0.231	20.706	29.797	0.376
At most 1	0.117	7.035	15.495	0.574
At most 2	0.011	0.566	3.841	0.452
Panel: Unrestricted Cointegration Rank Test (Maximum Eigenvalue)				
Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen Statistic	0.05 Critical Value	Prob.*
None	0.231	13.671	21.132	0.393
At most 1	0.117	6.469	14.265	0.554
At most 2	0.011	0.566	3.841	0.452

*Notes: * denotes rejection of the hypothesis at the 0.05 level.*

5.2. Dynamic relationship between Bitcoin and selected financial market variables

The impulse response result indicates that Bitcoin responded positively and significance to its own shocks in the short run, particularly for two months within the ten-month forecast horizon. This implies that in the short term, self-generated shocks explain the dynamics in Bitcoin price behaviour. Similarly, the selected financial market variables (stocks and NTB) exhibit a similar reaction to their own shocks. However, there was absence of significant response of the Nigerian financial market to shocks emanating from the Bitcoin market. Specifically, the result suggests that both stocks and NTB responded positively to shocks originating from Bitcoin, though, at a statistically insignificant level. This implies lower connectedness between the dynamics in the Bitcoin market and the Nigerian financial market. Therefore, the activities of the Bitcoin market would not have a significant consequence on the performance of the Nigerian local bourse. This outcome contradicts the findings of Jiang et al (2021) who demonstrate dependence between cryptocurrencies and stocks, and further highlight that the significance dependence is rarely negative, which indicates that cryptocurrencies fail to be a strong hedge or safe haven against stock markets. On the contrary, the finding was consistent with the stance of Dabrowski and Janikowski (2018), Gilbert and Loi (2018), and Gkillas and Longin (2019) who maintain the null effect of Bitcoin on financial markets.

The insignificant impact of activities in the Bitcoin market on selected financial markets variables in Nigeria was further buttressed by lower contributions of Bitcoin to the historical decompositions of stocks and NTBs. The

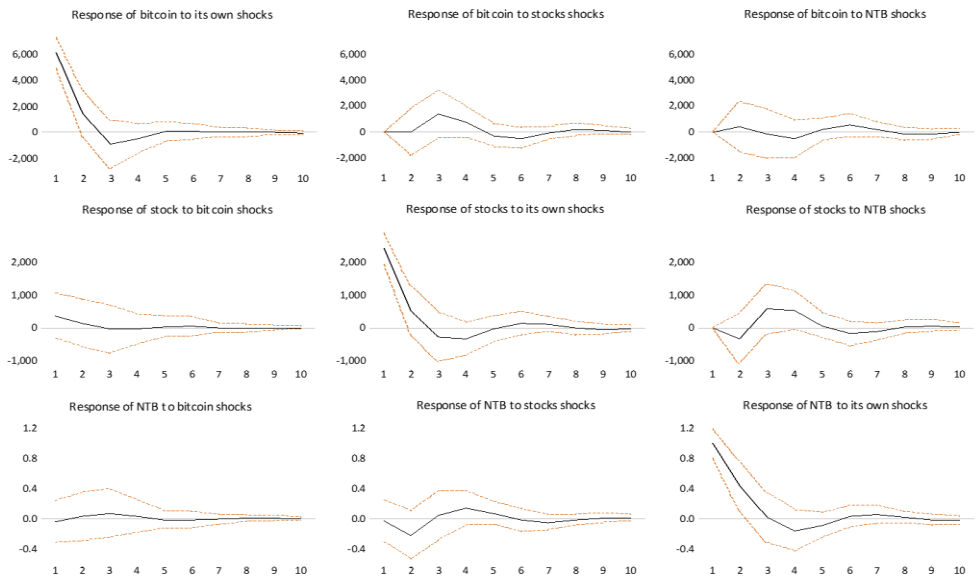

Figure 1. Response of financial market to shocks from Bitcoin.

result in Figure 2 and Table 7 shows that internal dynamics contribute higher to each of the variable dynamics than dynamics from other variables. However, some nuanced results were discovered in that stocks contribute about 6.4 per cent to the changes in Bitcoin, further contribute 5.9 per cent to changes in NTB. Similarly, NTB appears to contribute about 10.4 per cent to the variations in stocks and only 1.9 per cent to Bitcoin. The lower contribution of Bitcoin to changes in financial market indicates a weak connectedness between Bitcoin and selected financial market indices in Nigeria. This finding was consistent with some previous discoveries in the literature (see, Wu et al, 2014; Gilbert & Loi, 2018; Dabrowski & Janikowski, 2018; and Gkillas & Longin, 2019, among others).

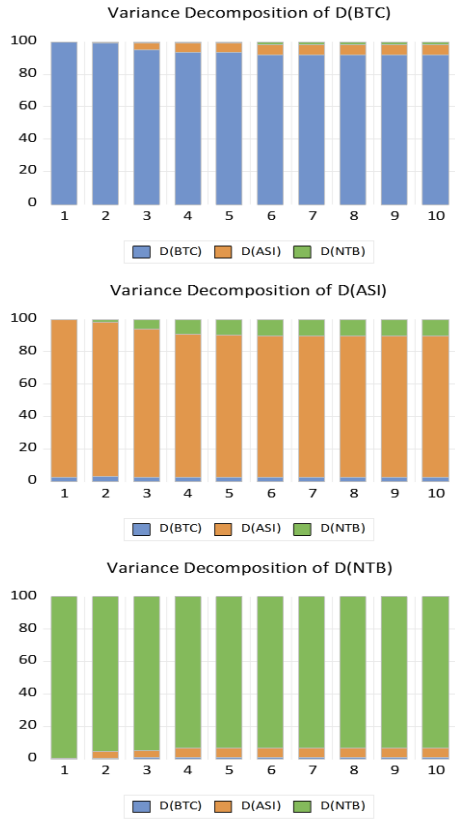

Figure 2. Contribution of Bitcoin to changes in financial market variables.

Table 7. Variance Decomposition Result.

Panel A: Variance Decomposition of Bitcoin				
Period	S.E.	Bitcoin	Stocks	NTB
1	6142.215	100.000	0.000	0.000
2	6325.237	99.608	0.004	0.389
3	6537.142	95.156	4.410	0.434
4	6620.947	93.267	5.668	1.066
5	6629.758	93.029	5.832	1.139
6	6669.231	91.949	6.304	1.747
7	6672.295	91.866	6.323	1.812
8	6677.125	91.734	6.380	1.886
9	6680.908	91.630	6.416	1.954
10	6680.924	91.630	6.416	1.954
Panel B: Variance Decomposition of stocks				
Period	S.E.	Bitcoin	Stocks	NTB
1	2465.005	2.245	97.755	0.000
2	2547.501	2.434	95.903	1.663
3	2627.847	2.310	91.348	6.342
4	2700.639	2.206	88.008	9.785
5	2701.743	2.223	87.942	9.835
6	2712.117	2.229	87.563	10.209
7	2716.482	2.222	87.405	10.373
8	2716.616	2.226	87.398	10.376
9	2717.844	2.225	87.353	10.422
10	2718.099	2.225	87.344	10.431
Panel C: Variance Decomposition of NTB				
Period	S.E.	Bitcoin	Stocks	NTB
1	1.009	0.165	0.081	99.754
2	1.123	0.207	3.823	95.970
3	1.127	0.606	3.936	95.458
4	1.147	0.657	5.383	93.960
5	1.153	0.658	5.760	93.582
6	1.154	0.678	5.787	93.535
7	1.156	0.677	5.922	93.401
8	1.156	0.679	5.938	93.384
9	1.157	0.680	5.948	93.372
10	1.157	0.680	5.961	93.359

Notes: The Cholesky ordering is Bitcoin, stock and NTB and all the series are in difference.

Testing for the causality among the variables via the block exogeneity test, the result in Table 8 shows that when the digital currency (Bitcoin) is considered as the dependent variable, it was only the NTB that was weakly significant at 10 per cent, which is considered as a borderline. This reaffirms the correlation result where weak negative correlation of 51.0 per cent was obtained. However, there was absence of causality between the stock index and Bitcoin. This implies that for now, Bitcoin does not have significant effect on the Nigerian stocks traded in the financial market. But the weak causality of 10 per cent between BTC and NTB is a pointer of a stronger relationship and as time progresses and adoption increases, this relationship might become highly significant at 5 per cent, or even 1 per cent level of significance.

Surprisingly, when stock index was considered as the dependent variable, there was no evidence of causality moving from the stock index to any of the study variables. This was surprising, given the close relationship between stock index and the NTB. However, when NTB is considered as the dependent variable, the variable was found to granger cause ASI at 1 per cent level of significance. This alluded to the asset switching phenomena and the flight-to-safety incidence and was consistent with the expectation. Similarly, NTB also granger cause BTC at weak level of

significance (10 per cent). This shows a bi-directional causality, though at a policy borderline level of significance.

Table 8. Causality between digital currency and some financial market instrument.

Panel A: Digital currency (Bitcoin) as dependent variable			
Excluded	Chi-sq	df	Prob.
LNASI	2.46	2	0.29
NTB	4.65	2	0.09***
All	5.88	4	0.21
Panel B: Stock index (ASI) as dependent variable			
Excluded	Chi-sq	df	Prob.
LNBTC	0.39	2	0.82
NTB	0.52	2	0.77
All	2.46	4	0.65
Panel C: Fixed income variable (NTB) as dependent variable			
Excluded	Chi-sq	df	Prob.
LNBTC	5.05	2	0.08***
LNASI	8.81	2	0.01*
All	10.04	4	0.04**

*Notes: *, ** & *** denotes statistically significant at 1% & 5% level of significance.*

5.3. Residual Diagnostics

The most relevant post-estimation test for Multivariate Models is the Serial Correlation test (using the LM test). The result of the LM and heteroskedasticity test indicates the absence of serial correlation and heteroskedasticity.

Table 9. Post-estimation Diagnostics.

Technique	F-Stat & JB/(Prob)	Null Hypothesis	Decision
LM Serial Correlation	0.751 (0.661)	No serial correlation	Accepted
Heteroscedasticity	62.801 (0.772)	Homoscedascity	Accepted

Source: Author's Computation.

6. Conclusion and Policy Options

Motivated by the continued development of blockchain technology and the rise of privately issued digital currencies, which primarily serve as alternative investment assets and pose a challenge to traditional financial instruments traded in the financial market. This study examines the impact of the major privately issued digital currency (Bitcoin) and two financial markets securities in Nigeria. Following a systematic literature review, the paper also provides a snapshot of countries experiences of some selected countries. Finally, the paper examines the dynamic relationship using VAR framework.

Conclusively, the paper discovered that in the jurisdictional experiences, cryptocurrency transactions are restricted in China, while in Singapore and Brazil, they are licenced and regulated. Furthermore, the jurisdictional experience pointed out that there is negative spill over of cryptocurrencies on the Chinese financial market. However, in Brazil it was found to be a veritable haven instrument, while the effect in Singapore was mixed. The impulse response function indicates the absence of significant response of the Nigerian financial market to shocks emanating from the Bitcoin market, implying lower connectedness between the two market. Similarly, the outcome of the variance decomposition reveals lower contribution of Bitcoin to changes in stocks and treasury bills), however, stocks and treasury bills contributed higher impact to each other compared to the contribution of Bitcoin. This further buttresses a weak connectedness between Bitcoin and selected financial market indices in Nigeria. The causality test shows a weak bi-directional causality between the privately issued digital currency (BTC) and fixed

income instrument (NTB). However, there was no evidence of causality between the stock index (ASI) and BTC. Finally, the paper revealed a one-way directional causality running from NTB to ASI, implying the existence assets switching or portfolio rebalancing from the fixed income to the equities market.

Following the above summary of findings, the paper recommends the need for CBN and SEC to intensify monitoring of crypto exchanges and continue reviewing the policy restricting cryptocurrency transactions through banks to avoid negative spill overs as in the case of China. In tandem with the causality result, it was evident that there is growing significant relationship between NTB and BTC, though at a very weak level of significance, therefore, the CBN should intensify monitoring of crypto exchanges and continue reviewing the cryptocurrency restriction, despite the weak causality to avoid its unsavoury effects. Additionally, we recommend that further studies, especially with country-specific data from major exchanges be conducted by other researchers to expand the body of knowledge on the crypto and financial markets dynamics in Nigeria.

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Conflict of interest

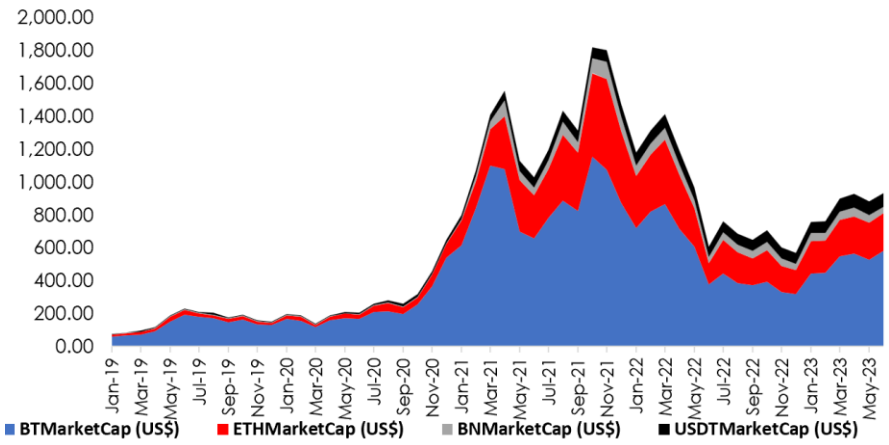
All the authors claim that the manuscript is completely original. The authors also declare no conflict of interest.

Author contributions

The authors contributed to the manuscript as follows: Conceptualization, literature review and country experiences: Bosha, E.O. Methodology, data analysis and writing of the original draft: Ibrahim, A.S. Conclusion, editing and review: Nwosu, C.P.

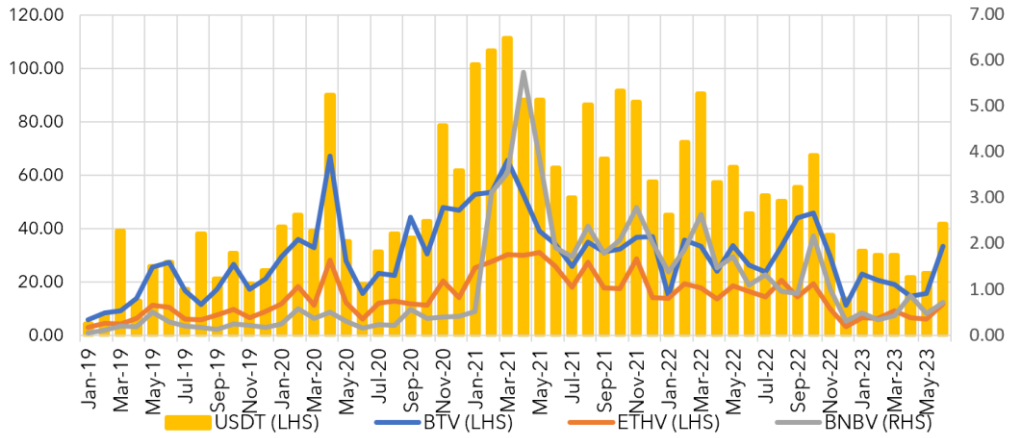
Appendix

A1. Rising Profile of Private Digital Currencies (Measured by Market Capitalisation).



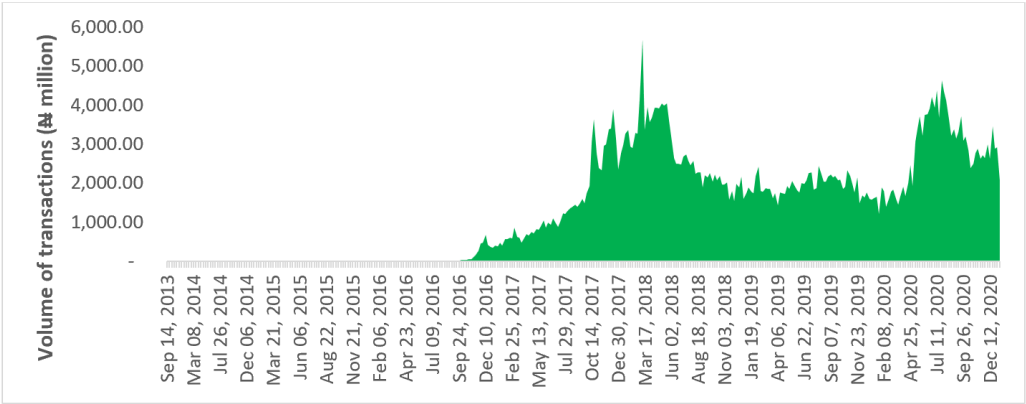
Notes: BT, ETH, BN & USDT refers to Bitcoin, Ethereum, Binance Coin & Tether, respectively. Source: Authors' Calibration using data obtained from coinmarketcap.com.

A2. Rising Volume of Private Digital Currencies (in US$ billion).



Notes: BTCV, ETHV, BNCV & USDT refers to volume of Bitcoin, Ethereum, Binance Coin & Tether, respectively. Source: Authors' Calibration using data obtained from coinmarketcap.com.

A3. Bitcoin trading volume on online exchanges in Nigeria from September 14, 2013, to January 9, 2021.



Source: Authors' Calibration using data obtained from coinmarketcap.com.

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