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Cryptocurrencies and their Implications for Central Bank Policies in Developing Economies

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Abstract: *The study explores the effect of cryptocurrencies (Bitcoin market capitalization (BMCAP), total cryptocurrency market capitalization (TMCAP), and investment in cryptocurrencies (ICRYTO)) on exchange rate fluctuations in developing economies. The population of interest is developing economies, with a specific focus on Nigeria. Annual data spanning from 2014 to 2023, was used to capture the evolution of cryptocurrencies and their potential effects on exchange rate fluctuation sought from Statista, CoinMarketCap, CryptoCompare, financial databases and central bank of Nigeria Statistical Bulletin. The Causal-comparative research design was used to examine variations in cryptocurrency and their influence on exchange rate movements in developing economies. Quantitative approach, using econometric modeling techniques was used to examine the effects of cryptocurrency-related variables on exchange rates.From the results, BMCAP show positive but not significant effect, TMCAP has positive and significant effect while ICRYTO show negative and menial effect. The study concludes that TMCAP is the only statistically significant variable influencing exchange rate in the model. The others (BMCAP & ICRYTO) have minimal direct influence on the exchange rate in this model. The study recommends that policymakers and analysts should monitor changes in total cryptocurrency market capitalization when studying exchange rate dynamics.*

Keywords: Cryptocurrency, Bitcoin, Market Capitalization, Investment

Introduction

Cryptocurrency is a type of digital or virtual currency that uses cryptography for security. Unlike traditional currencies issued by governments (e.g., naira, dollar, euro), cryptocurrencies operate on decentralized systems, typically based on blockchain technology. Types of Cryptocurrency are Bitcoin (BTC), Ethereum (ETH), Tether (USDT), Binance Coin (BNB) and Ripple (XRP). Bitcoin (BTC) is the first and most widely recognized cryptocurrency, introduced in 2009, Ethereum (ETH) is Known for its smart contract functionality, Tether (USDT) is a stablecoin pegged to the value of a fiat currency like the US dollar, Binance Coin (BNB) is used on the Binance platform for trading and fees and Ripple (XRP) is designed for cross-border payments and transactions. Although cryptocurrencies are advantageous in aspect of lower transaction fees compared to traditional banking, increased financial inclusion for unbanked populations, and transparency and security through blockchain (Zohar and Masulis, 2023), it poses challenges such as price volatility, regulatory concerns and government restrictions and potential misuse for illegal activities. Cryptocurrencies, particularly Bitcoin, have significantly transformed the global financial landscape, introducing new dynamics that challenge traditional monetary systems.

In developing economies, where central banks strive to maintain monetary stability amidst challenges such as inflation and exchange rate volatility, the rise of digital currencies presents both opportunities and threat. The impact of cryptocurrencies on financial markets, and particularly on exchange rates, has become a critical area of empirical research. Chuen et al. (2017) highlighted that integration of digital currencies like Bitcoin into financial markets can lead to significant volatility, especially in economies with less resilient monetary policies. This volatility, often exacerbated by speculative investment in cryptocurrencies, can translate into increased exchange rate fluctuations, creating challenges for central banks to stabilize their national currencies. Narayan and Sharma (2019) found that Bitcoin's growing market capitalization can create downward pressure on local currencies as investors shift capital towards more speculative assets, destabilizing exchange rate movements. Katsiampa (2019) concluded that as cryptocurrency investments become more widespread, their market capitalization correlates with exchange rate volatility, especially in countries with unstable monetary systems.

Moreover, the International Monetary Fund (2023) proposed that central banks could mitigate the destabilizing effects of cryptocurrencies through the development of Central Bank Digital Currencies (CBDCs). These digital currencies, issued and controlled by central banks, could offer a stable and risk-free alternative to private cryptocurrencies, thus helping to stabilize exchange rates while fostering financial inclusion and improving the efficiency of monetary policy. The rise of cryptocurrencies, particularly Bitcoin, has posed new challenges for central banks in developing economies, where exchange rate stability is a critical concern for economic growth and financial stability. The increasing market capitalization of cryptocurrencies and the growing trend of investment in digital currencies have created complex dynamics that may influence exchange rate movements. As cryptocurrencies become more integrated into global financial markets, their potential impact on exchange rates, especially in economies with unstable or volatile currencies, has raised significant questions about the adequacy of existing monetary policy frameworks.

However, there is limited empirical evidence on how variables such as Bitcoin's market capitalization, the total cryptocurrency market capitalization, and the level of investment in cryptocurrencies specifically influence exchange rates in developing economies.This knowledge gap has led to a lack of clarity on how cryptocurrencies impact exchange rate dynamics, making it difficult for policymakers to formulate appropriate strategies to maintain exchange rate stability. This research aims to explore the impact of cryptocurrencies specifically Bitcoin's market capitalization, total cryptocurrency market capitalization, and investment in cryptocurrencieson exchange rates in developing economies.

Conceptual Review

Cryptocurrencies

Cryptocurrencies are decentralized digital assets that utilize cryptography for secure transactions. Unlike traditional currencies, cryptocurrencies operate independently of central banks or governments and are generally based on blockchain technology, which ensures transparency and security. Bitcoin, the first and most widely recognized cryptocurrency, is considered a store of value and medium of exchange by many, though its volatile nature presents challenges for policymakers.Zohar and Masulis (2023) emphasized that the increasing adoption of digital currencies like Bitcoin could potentially disrupt traditional monetary systems, particularly in developing economies where financial systems are more susceptible to volatility.

Bitcoin Market Capitalization

Bitcoin market capitalization refers to the total value of all Bitcoins in circulation, calculated by multiplying the current price of Bitcoin by the total supply. This metric serves as a measure of Bitcoin's market size and reflects investor sentiment, as well as its influence on global financial markets.Baur et al. (2021) explored the relationship between Bitcoin market capitalization and exchange rate volatility in emerging economies. They found that fluctuations in Bitcoin's market capitalization are significantly correlated with exchange rate movements, as large-scale investments or divestments in Bitcoin can create ripple effects throughout the financial system, particularly in countries with high foreign exchange exposure.

Total Cryptocurrency Market Capitalization

Total cryptocurrency market capitalization refers to the combined market value of all cryptocurrencies, not just Bitcoin. As the cryptocurrency market grows, the overall capitalization reflects the increasing diversification of digital assets and investor interest in alternative currencies beyond Bitcoin.Chen and Jiang (2022) investigated how total cryptocurrency market capitalization affects exchange rates in developing economies. They concluded that large movements in total market capitalization could lead to increased exchange rate volatility, particularly in nations where cryptocurrencies are perceived as a safe haven or speculative asset.

Cryptocurrency Investment

Cryptocurrency investment refers to the allocation of financial resources into cryptocurrencies as an asset class. It includes both retail and institutional investments, with participants often seeking high returns amid the volatility inherent in the cryptocurrency market. In developing economies, cryptocurrency investment can be viewed as an alternative to traditional financial instruments, particularly in environments with limited access to banking services. Pellegrini and Rossi (2023) examined the role of cryptocurrency investment in emerging markets and its impact on exchange rate movements. Their study found that significant increases in cryptocurrency investment tend to lead to capital flight from local markets, contributing to exchange rate depreciation. This capital outflow often results from investor speculation on the potential of digital assets, which in turn impacts currency stability.

Exchange Rate

Exchange rates refer to the value of one currency in terms of another and are a critical aspect of international trade and investment. In developing economies, exchange rates can be volatile, affected by factors such as inflation, foreign investment, and speculative activity in financial markets.Akinboade and Ogbu (2023) explored the influence of cryptocurrency-related activities on exchange rates in African economies. Their study found that significant fluctuations in cryptocurrency markets, especially Bitcoin, lead to heightened exchange rate volatility. This is particularly problematic in countries where the local currency is already susceptible to external shocks and speculative investments.

Theoretical Review

Theory of Disintermediation

Disintermediation gained prominence in the 20th century. it was explained in works of Mishkin (2019). Disintermediation refers to the removal of intermediaries (banks, brokers) in financial transactions, allowing individuals to transact directly. Cryptocurrencies facilitate this through decentralized blockchain technology, bypassing the need for central banks and traditional financial systems. This can affect the effectiveness of monetary policies, which often rely on banks as channels for policy implementation.

Gresham's Law

Gresham's Law was first articulated by Sir Thomas Gresham, a 16th-century English financier. The concept was later formalized and attributed to him by economist Henry Dunning Macleod in the 19th century.Gresham's Law states that "bad money drives out good money" when both are legal tender. In practical terms, people hoard "good money" (valuable or appreciating assets like gold or, in this case, cryptocurrencies) while spending "bad money" (currency that depreciates in value, like the Naira in a high-inflation economy). Cryptocurrencies' growing adoption as a store of value in Nigeria may diminish the effectiveness of fiat currency in circulation.

Empirical Review

Baur et al. (2021) explore how Bitcoin market capitalization impacts exchange rate volatility in emerging economies, finding a significant correlation between Bitcoin price fluctuations and currency movements in emerging markets.Katsiampa(2019) investigate how the total market capitalization of cryptocurrencies influences exchange rate volatility in emerging markets. He found significant effects of cryptocurrency market movements on the exchange rates of these countries.Narayan and Sharma (2019) examine the relationship between Bitcoin's market capitalization and exchange rates in emerging economies, using panel data to show that Bitcoin price changes have a statistically significant effect on exchange rate fluctuations.Chen and Jiang's (2022)research provide evidence that total cryptocurrency market capitalization significantly influences exchange rate volatility, especially in countries with a high level of cryptocurrency adoption.Pellegrini and Rossi(2023)investigate how cryptocurrency investment contributes to exchange rate instability in emerging economies They find that increased investment in cryptocurrencies leads to greater volatility in exchange rates. Baur and Dimpfl(2020)explore the relationship between Bitcoin volatility and exchange rate fluctuations in emerging markets, showing that Bitcoin's volatility has a measurable impact on exchange rates, especially in countries with high cryptocurrency adoption.Poon and Chan (2021) analyze the relationship between cryptocurrency adoption and exchange rate behavior, finding that developing economies with high levels of cryptocurrency adoption experience greater exchange rate fluctuations.Narayan and Liu (2022) provide empirical evidence of the relationship between cryptocurrencies and exchange rates in developing economies, showing that cryptocurrency market fluctuations are directly linked to exchange rate volatility. González and Rodríguez (2020)explore the impact of cryptocurrency-related capital flows on exchange rate stability in emerging economies, concluding that these capital flows contribute to higher volatility in exchange rates.Carvalho and Silva. (2021)examines how cryptocurrency adoption affects exchange rate regimes in Latin American economies, finding that higher adoption leads to more erratic exchange rate behavior due to speculative investments in digital currencies.Kremmydas and Papadopoulos (2023)investigate the implications of cryptocurrencies on exchange rate regimes and financial stability, focusing on emerging markets. They conclude that cryptocurrencies have the potential to destabilize exchange rate systems in these countries.Wang and Zhang (2023) examine how fluctuations in cryptocurrency market capitalization affect exchange rate stability in developing economies, highlighting that significant shift in market capitalization led to higher volatility in exchange rates.Kim and Kang (2020)examine the effect of Bitcoin prices on exchange rate volatility in emerging markets, finding that Bitcoin's price volatility is linked to increased volatility in local exchange rates.Chen and Tsou (2021)provide evidence that cryptocurrency market fluctuations have significant spillover effects on the exchange rates of Southeast Asian economies. Ahmed and Baig (2022)investigate how cryptocurrency adoption affects exchange rate determination in developing countries. They concluded that rising cryptocurrency adoption can lead to increased exchange rate volatility. Bouri and Gupta (2022) explore how cryptocurrency market fluctuations influence exchange rate behavior in African countries, showing that cryptocurrencies exacerbate exchange rate volatility. Narayan and Sharma (2022)analyze the relationship between cryptocurrency prices and exchange rate dynamics in emerging economies, showing that cryptocurrency price shocks significantly affect exchange rates. Fang and Li (2021)explore how changes in cryptocurrency market capitalization influence exchange rate volatility in Latin American countries, concluding that a rise in market capitalization increases exchange rate fluctuations.Katsiampa and Perera (2021)investigates the relationship between Bitcoin, Ethereum, and exchange rate risk in emerging markets, finding that cryptocurrency market performance can act as a predictor for exchange rate fluctuations.Zhou and Zhang (2022)examine the impact of cryptocurrency price fluctuations on exchange rate movements in developing economies, highlighting that cryptocurrencies can amplify exchange rate risks in these regions. Feng and Wu (2022)explore how cryptocurrency markets impact foreign exchange rates in Asian and African developing economies. They find a substantial influence of cryptocurrency price movements on currency stability.Li and Liu. (2022)provides a cross-country analysis of the interplay between cryptocurrency prices and exchange rate volatility. They show that exchange rate volatility increases with the rise of cryptocurrency markets in developing economies. Al-Khazali and Al-Mazrouei (2023) examine how cryptocurrency investments affect exchange

rate movements in Gulf Cooperation Council (GCC) countries, suggesting that cryptocurrency investments have a moderating effect on exchange rate fluctuations. Kumar and Singh (2022)explore how cryptocurrency price changes influence exchange rates in BRICS countries, revealing that these countries are increasingly affected by cryptocurrency market shifts.Zhou and Zhang (2021)investigate the link between cryptocurrency market volatility and exchange rate risk in small emerging economies, highlighting that fluctuations in cryptocurrency markets exacerbate exchange rate instability in these economies. Youssef and Hassan (2021)provide empirical evidence on the relationship between cryptocurrency market growth and exchange rate fluctuations in African and Middle Eastern countries, concluding that cryptocurrency growth amplifies exchange rate risks.

Research Method

The study explores the effect of cryptocurrencies (Bitcoin market capitalization, totalcryptocurrency market capitalization, and investment in cryptocurrencies) on exchange rate fluctuations in developing economies. The population of interest includes developing economies, with a specific focus on Nigeria. Annual data spanning from 2014 to 2023, was used to capture the evolution of cryptocurrencies and their potential effects on exchange rate fluctuations sought from Statista, CoinMarketCap, Crypto Compare, financial databases and central bank of Nigeria Statistical Bulletin. The Causal-comparative research design was used to examine variations in cryptocurrency and their influence on exchange rate movements in developing economies. Quantitative approach, using econometric modeling techniques was used to examine the effects of cryptocurrency-related variables on exchange rates. The model of Ahmed and Baig (2022) was adopted and modified for the study. The model for the study is stated in its functional form as:

E-RATE = f(BMCAP, TMCAP, ICRYTO) equation (1)
E-RATE = a_0+ a_1BMCAP+ a_2TMCAP+ a_3ICRYTO+ u equation (2)
E-RATE = Exchange rate measured by effective exchange rate
BMCAP= Bitcoin market capitalization measured by bitcoin market capitalization (USD)
TMCAP= Total cryptocurrency market capitalization measured by total market capitalization (USD)
ICRYTO=Investment in cryptocurrencies measured by consumers who invest in cryptocurrency (%)
a_0= Intercept
a_0- a_3= coefficients
u = Error term

Results and Discussion

Table 1 Descriptive Statistics

	E_RATE	BMCAP	TMCAP	ICRYTO
Mean	77.78120	121.0080	98.58000	10.21000
Median	75.98374	11.00000	9.050000	8.650000
Maximum	97.16395	1.070000	3.280000	20.40000
Minimum	63.01528	4.500000	5.500000	3.700000
Std. Dev.	10.17564	233.2193	193.0742	5.739619
Skewness	0.688894	2.190398	2.142334	0.622887
Kurtosis	2.705018	6.460537	6.276826	2.211393
Jarque-Bera	0.827214	12.98612	12.12332	0.905772
Probability	0.661261	0.001514	0.002331	0.635791
Sum	777.8120	1210.080	985.8000	102.1000
Sum Sq. Dev.	931.8928	489521.1	335498.9	296.4890
Observations	10	10	10	10

Source: Researchers' Compilation, 2024.

Table 1 shows that E-RATE has a mean 0f 77.78%, high and low value of 97.16% and 63.01%. BMCAP has a mean of 121.01, high and low value of $1.07 trillion and$4.5 billion.TMCAP has a mean 0f 98.58, high and low value of $3.28trillion and 5.5billion.ICRYTO has a mean 0f 10.21%, high and low value of 20.40% and 3.70%. The values for skewness show that all the variables are positively skewed. For the Kurtosis, apart from E-RATE and ICRYTO that are within the threshold of "3", BMCAP and TMCAP are above the threshold. The Jarque Bera Probability shows that data for E-RATE and ICRYTO conforms with normal distribution but values for BMCAP and TMCAP are not.

Table 2: Correlation Analysis

	E_RATE	BMCAP	TMCAP	ICRYTO

E_RATE	1.000000			
BMCAP	0.167741	1.000000		
TMCAP	0.797991	0.152689	1.000000	
ICRYTO	0.079370	0.551222	0.101990	1.000000

Source: Researchers' Compilation, 2024.

The correlation coefficient in Table 2 shows that BMCAP has positive and moderate correlation with exchange rate. TMCAP has strong positive correlation with E-RATE. Only ICRYTO has weak positive connection to E-RATE in Nigeria.

Table 3: Multicollinearity Test

Variance Inflation Factors
Date: 12/28/24 Time: 17:52
Sample: 2014 2023
Included observations: 10

Variable	Coefficient Variance	Uncentered VIF	Centered VIF
C	28.13542	5.032074	NA
BMCAP	0.000166	1.891704	1.456134
TMCAP	0.000171	1.321061	1.024349
ICRYTO	0.271016	6.490031	1.437135

Source: Researchers' Compilation, 2024.

The values for the centered VIF of the variables show that there is absence of multicollinearity among the variables. This is supported by the fact that the centered VIF are not above but withinthe threshold.

Table 4:Heteroskedasticity Test: Breusch-Pagan-Godfrey

F-statistic	0.129312	Prob. F(3,6)	0.9392
Obs*R-squared	0.607293	Prob. Chi-Square(3)	0.8948
Scaled explained SS	0.301881	Prob. Chi-Square(3)	0.9597

Source: Researchers' Compilation, 2024.

The Prob. Chi-Square (3) value of 0.8948 justify the absence of variance in the residuals.At such there is homoscedasticity in the model.

Table 5: Regression Result

Dependent Variable: E_RATE
Method: Least Squares
Date: 12/28/24 Time: 17:50
Sample: 2014 2023
Included observations: 10

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	74.01483	5.304283	13.95379	0.0000
BMCAP	0.002985	0.012896	0.231479	0.8246
TMCAP	0.041716	0.013066	3.192807	0.0188
ICRYTO	-0.069271	0.520592	-0.133061	0.8985

R-squared	0.640009	Mean dependent var	77.78120
Adjusted R-squared	0.460013	S.D. dependent var	10.17564
S.E. of regression	7.477444	Akaike info criterion	7.150834
Sum squared resid	335.4731	Schwarz criterion	7.271868
Log likelihood	-31.75417	Hannan-Quinn criter.	7.018060

F-statistic	3.555694	Durbin-Watson stat	2.501651
Prob(F-statistic)	0.057098		

Source: Researchers' Compilation, 2024.

From the regression result in Table 5, Bitcoin Market Capitalization (BMCAP) coefficient is 0.002985, which implies a positive but very small effect of Bitcoin market capitalization on the exchange rate in Nigeria. As 1-unit increase in BMCAP leads to an expected increase of 0.002985 in the exchange rate. However, this variable is not statistically significant (p-value = 0.8246), suggesting that Bitcoin market capitalization has little to no impact on the exchange rate in this model. The finding contradicts the significant value found by Baur et al. (2021), Narayan and Sharma (2019).

Total Cryptocurrency Market Capitalization (TMCAP) coefficient is 0.041716, indicating a positive relationship. A one unit increase in TMCAP is associated with an expected increase of 0.041716 in the exchange rate. This variable is statistically significant (p-value = 0.0188), suggesting that total cryptocurrency market capitalization significantly influences the exchange rate. This outcome agrees with the significant value found by Katsiampa (2019), Chen and Jiang's (2022).

Investment in Cryptocurrencies (ICRYTO) coefficient is -0.069271, indicating a negative relationship between consumers investment in cryptocurrencies and the exchange rate. Also, one unit increase in ICRYTO leads to an expected decrease of 0.069271 in the exchange rate. However, the variable is not statistically significant (p-value = 0.8985), implying it does not meaningfully impact the exchange rate in this model. This finding contradicts the positive value found by Pellegrini and Rossi (2023) and agrees to the adverse effect opined by. Kremmydas and Papadopoulos (2023).

R-squared (0.640009) indicates that approximately 64% of the variation in the exchange rate is explained by the independent variables. Adjusted R-squared (0.460013) after adjusting for the number of predictors, about 46% of the variation in the exchange rate is explained, which is lower but still suggests a moderate explanatory power.

Conclusion and Recommendation

The study explores cryptocurrencies and their implications for central bank policies in developing economies. Three cryptocurrency-related variables: Bitcoin market capitalization, total cryptocurrency market capitalization, and investment in cryptocurrencies was used. exchange rate was used as measure of monetary policy in Nigeria. The results indicate that total cryptocurrency market capitalization (TMCAP) is the only statistically significant predictor of the exchange rate, with a positive impact. However, Bitcoin market capitalization (BMCAP) and investment in cryptocurrencies (ICRYTO) do not exhibit significant effects. Meanwhile, the model explains approximately 64% of the variation in exchange rates, demonstrating moderate explanatory power. The study recommends that Policymakers should closely monitor developments in the total cryptocurrency market capitalization as it significantly affects exchange rates. Market participants, including investors and currency traders, should consider total cryptocurrency market capitalization as a potential factor when making decisions related to exchange rate movements.

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