

“Central Bank Digital Currency vs. Crypto currency: A Comparative Study on Regulation, Stability, and Financial Inclusion”

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ABSTRACT

With various advancements in information technology and an increase in the reach that the internet has acquired, the issue of digital currency inevitably had to be addressed by this paper, which sheds light on the difference between CBDCs and crypto currencies. CBDCs are digital money created, kept, and maintained by central banks, while crypto currencies like Bit coin are decentralized and operate independently of government interference. The study investigates the following: the way they are regulated, their implications on financial stability, and how their operation could be beneficial for those who are unbanked. CBDCs are mainly safer and more stable, given their backing by governments, while crypto currencies would be riskier but would highlight person-to-person innovative ways of sending and receiving money.

Keywords:

Cryptocurrency, Bitcoin, Digital money, Financial stability ,Regulation, Government-backed currency, Digital economy ,Blockchain technology, Innovation in payment systems.

INTRODUCTION

The early 1980s was when the idea of a crypto currency was first mentioned but rather late in the 1990s the cryptographic protocols and the software took some steps forward. Satoshi Nakamoto introduced the idea of a crypto currency in 2008. Bitcoin, the first crypto currency was born as a protocol in 2009 and Nakamoto made it public as open-source software in that year. After 2010, many other digital currencies have come, like Ethereum, Cardano, Tether, XRP, Dogecoin, Filecoin, Litecoin, Binance Coin, and Solana. The year 2017 witnessed the increase in Bitcoin price, while it was followed by a crash in 2018. The currency operates on the Blockchain technology, which is a public ledger recording all the transactions by the currency holder, thus making it transparent. However, CBDC is not a new concept; as early as 1993, the Bank of Finland had started the world's first electronic cash called "Avant smart card" which is a kind of digital currency. But that idea was abandoned in the early 2000s. The idea of CBDC started gaining traction during 2019. Currently in 2023, 95% of global GDP is represented by the assessment of the digitization of currency plans of 114 central banks. Among them are Digital Rupee, Digital Ruble, eNaira, sand dollar, and JAM-DEX currency, etc. The CBDC is like stablecoins, which are backed by another currency, or goods, or financial instruments, more so with a network called

blockchain because such peer-to-peer transactions can be supervised and along with this, it's easier to track legal tender transactions. In contrast, Bitcoin and Ethereum belong to the world of cryptocurrencies that operate on decentralized blockchains where anonymity, peer-to-peer exchange, and resistance to government control are the primary features. One of the main points of concern brought up in connection with CBDC is the risk of disintermediating banks along with the resulting credit shortage if the introduction of CBDC leads to moving funds from deposits to CBDC accounts at a rapid pace (Carapella and Flemming, 2020; Mancini-Griffoli et al., 2018). It is possible that a CBDC might have a positive effect on banks' deposit bases because it would potentially attract the unbanked to open bank accounts for access to a CBDC wallet. The introduction of CBDC might actually increase the banked population⁵ if (1) CBDC is seen as an easier payment method than deposits, (2) users of CBDC enjoy having their transactions kept secret, or (3) the return on deposit risk-adjusted compared (zero liquidity risk with possible CBDC remuneration) to deposits is lower. The move of the unbanked population into the banking structure would create new deposits which could balance out the movement of funds from the already banked that would flock to the CBDC. The resulting increase in deposits could lead to a corresponding growth in lending in the economy, provided that reserves are a constraint and the wholesale funding supply is not perfectly elastic.

Objectives

- To analyze the scenario of CBDCs and crypto currencies regulation in different nations.
- To observe the impact of each on the stability of the financial system (risks and advantages).
- To investigate their contribution to the delivery of financial services to the unbanked.
- To present the policy implications and difficulties of digital money's future.

Scope

The paper identifies and performs an analysis of cryptocurrencies versus CBDCs (Central Bank Digital Currency), stressing most the aspects of financial inclusion, stability and regulation. It then explains the methods of creation and management of CBDCs by the central banks and governments and contrasts them with the operation of cryptocurrency on the public, decentralized networks. The document further discusses the perils of each system, such as the risks of volatility in cryptocurrencies and banking problems that might arise due to CBDC adoption. This comparative study is premised on earlier investigations, documents, and case studies from world bodies like the IMF and BIS along with real cryptocurrency experiences since the majority of CBDC projects are still at the testing phase. .

REVIEW OF THE LITERATURE

Vijeta (2017) explains that crypto currencies are the digital forms of money and they have become people's choice for financial transactions thus creating a new standard. The crypto currency is user friendly and does not require an intermediary for the transaction. However, this system is high-tech and is prone to the problems that come with the technology of block chain; it also needs the proper understanding of crypto currency which might render the innocent people susceptible to the criminals. Pretson (2023) mentioned that the Central Bank Digital currency is the same as cash issued by the central bank. The digital rupee came into being. This research was conducted to assess people's interest in the cryptocurrency and the CBDC at both national and regional levels in India. The CBDC's operating framework allows for tracing, being non-intrusive and aligning with the central bank's objectives while at the same time the potential risks to be considered. CBDC Overview The last several years have seen researchers and international organizations focusing their attention on CBDC's. The BIS and other surveys reveal that a majority of central banks are actively researching CBDC's, with many of them already transitioning from the concept phase to proof-of-concept and pilot projects. The literature points out that one of the reasons for this interest is to make payment systems safer and faster, while at the same time, preserving monetary sovereignty and facilitating the settlement of cross-border transactions. Moreover, the reviews underline the fact that...

CBDCs are meant to function in accord with current economic and legal systems, thus, governments can still manage the flow of money, the imposition of taxes, and the measures against money laundering (AML) through CBDC. Ozili (2023) points out that CBDCs help in the regular monitoring of the financial system while cryptos, on the contrary, because of their decentralized characteristics, are spreading to different countries as a problem for the regulators. The Bank for International Settlements (BIS, 2023) claims that CBDCs might result in better monetary policy to the extent of their usage and on the other hand, crypto currencies lead difficulties for the authorities in terms of compliance.

Financial Stability

According to the International Monetary Fund (IMF, 2024), central bank digital currencies (CBDCs) can make payments safer and faster, but “disintermediation” of banks could occur as a result of consumers choosing to store their funds in CBDC wallets instead of making bank deposits, which is the downside of this whole scenario. To prevent this from happening, central banks are imposing limits on the amounts that can be held, as well as tiered remuneration. However, cryptocurrencies are subject to drastic fluctuations, which not only compromise their use as value storage but also raise concerns regarding the stability of the entire system (BIS, 2023).

Financial Inclusion

CBDCs have the ability to come up with digital wallets that are very cheap and this might ease the access to financial services for those who do not have bank accounts. The example of the Bahamian Sand Dollar (Wenker, 2022) shows that inclusion through these moneys is possible but at the same time, there are worries about privacy and trust. Cryptocurrencies may facilitate access to financial services in places where banks are not strong or where remittance costs are high; still, the use of them is hampered by lack of knowledge about the digital world, no internet access, and their unstable nature (Song, Zhao, & Zhou, 2024).

Case Studies and Comparative Work

new empirical research is coming out, and the results are not uniform. The BIS (2023) points out that although CBDCs bring regulatory assurance, crypto currencies flourish in areas where users look for options to fiat systems. Both the IMF (2024) and Ozili (2023) acknowledge the possibility of co-existence of the two instruments but with very different consequences: CBDCs will be the backbone of the mainstream finance, while crypto currencies will still be a parallel, high-risk system.

Research Gaps

There seems to be a consensus among researchers that the estimation of the long-term macroeconomic impacts of CBDCs, especially in the cross-border scenarios, should be supported by more empirical studies. At the same time, the fast-growing adoption of DeFi and stable coins urges the regulators to come up with novel frameworks for the entire crypto currencies (BIS, 2023; IMF).

Limitation

CBDCs are still at a nascent stage and only a handful of countries are doing pilot projects, hence there is very limited long-term data to go by. The markets of cryptocurrencies are very volatile, and their pricing is quite difficult to predict, thus making it very hard to arrive at permanent conclusions. The frameworks of laws and regulations concerning CBDCs and cryptos are still in a process of evolution. The present reality might not be the same in a short period of time.

Comparative Analysis of CBDCs and Crypto currencies

Dimension	Central Bank Digital Currencies (CBDCs)	Crypto currencies
Regulation	Issued and fully regulated by central banks; subject to monetary policy, AML, and KYC compliance.	Decentralized; regulation varies across countries; prone to legal uncertainty and cross-border challenges.
Financial Stability	Backed by government and central bank reserves; low volatility; can strengthen monetary sovereignty.	Highly volatile; influenced by speculation and market sentiment; poses systemic risks.
Financial Inclusion	Can provide low-cost digital wallets; examples like eNaira and Sand Dollar show potential to reach unbanked populations.	May increase access in regions with weak banking, but adoption is limited by digital literacy, internet access, and volatility.
Transparency	Transactions traceable by central banks; supports AML/CFT compliance.	Pseudonymous; transactions visible on blockchain but users often anonymous, raising concerns over misuse.
Risks	Risk of bank disintermediation if deposits move to CBDCs; requires careful design of limits and remuneration.	Security risks (hacks, scams), price volatility, lack of consumer protection.

RESEARCH METHODOLOGY

Universe:

- All countries experimenting with CBDCs and global crypto currency markets.

Sampling Frame:

- CBDC projects are actively being worked on by countries and central banks.
- The big ones among cryptocurrencies that are already having marked influence in terms of market capitalization and global usage (e.g., Bitcoin, Ethereum, Tether).

Sampling Unit:

- Central bank statements and incidental project statistics concerning CBDCs.
- Illustrative evaluations of particular CBDCs (for instance, Digital Rupee • Parallel information about cryptos (Bitcoin, Ethereum, Stablecoins).

Data Collection

- International institutions' secondary data (IMF, BIS, World Bank).
- Central bank and government publications.
- Peer-reviewed journals, research papers, and doctoral dissertations.
- Reports on cryptocurrency markets and financial news data sources.

Tools of Analysis

- Regulation: A thorough investigation of the laws and policies that govern CBDCs and cryptocurrencies in different jurisdictions.
- Stability Indicators: Assessment of volatility as well as systemic risk with a look at the consequences for monetary policy
- Inclusion Indicators: Digital wallet access, monetization rates, and illustrative examples from the unbanked sector are the indicators
- Comparative Analysis Framework: Regulatory, stability, and inclusiveness aspects of the comparison between CBDCs and cryptocurrencies.

DATA ANALYSIS

No.	Name	Symbol	Market Capitalisation	Unit Price	Circulating Supply	Volume (24h)
1	Bitcoin	BTC	\$141,230,856,668	\$8,313.26	16,988,625	\$7,096,370,000
2	Ethereum	ETH	\$56,442,400,865	\$570.51	98,933,063	\$2,469,830,000
3	Ripple	XRP	\$32,984,545,806	\$0.84	39,122,794,968	\$1,688,280,000
4	Bitcoin Cash	BCH	\$16,639,053,113	\$973.98	17,083,550	\$740,993,000
5	Litecoin	LTC	\$8,186,324,143	\$145.76	56,164,963	\$439,487,000

Descriptive Statistics:

Market Capitalisation		Unit Price		Circulating Supply		Volume (24h)	
Mean	51096636119	Mean	2000.87	Mean	7862393034	Mean	2.49E+09
Standard Error	23988979377	Standard Error	1587.265785	Standard Error	7815115123	Standard Error	1.21E+09
Median	32984545806	Median	570.51	Median	56164963	Median	1.69E+09
Mode	#N/A	Mode	#N/A	Mode	#N/A	Mode	#N/A

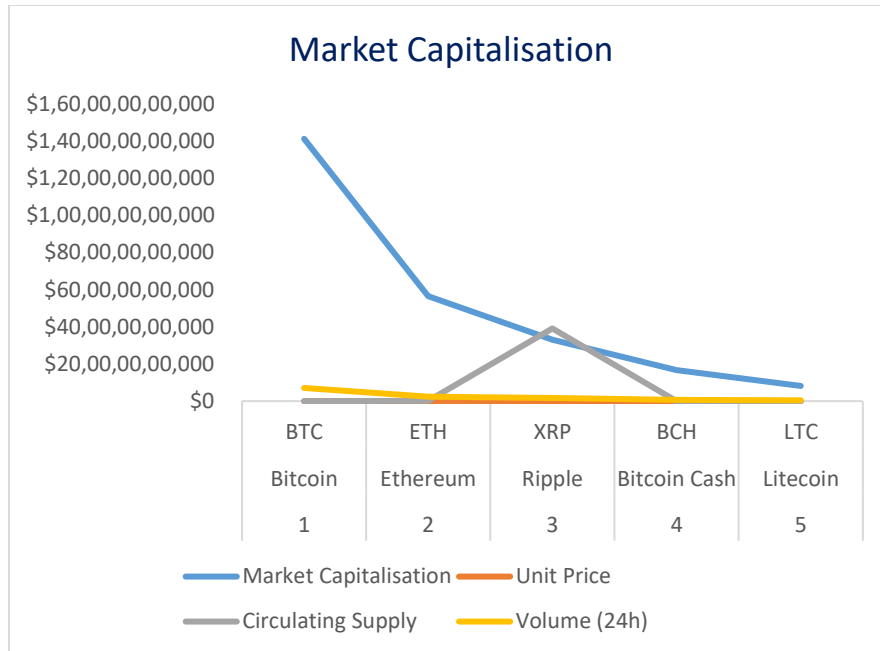
Standard Deviation	53640988597	Standard Deviation	3549.234193	Standard Deviation	17475128667	Standard Deviation	2.7E+09
Sample Variance	2.87736E+21	Sample Variance	12597063.36	Sample Variance	3.0538E+20	Sample Variance	7.28E+18
Kurtosis	2.706199306	Kurtosis	4.767881291	Kurtosis	4.999925036	Kurtosis	3.285871
Skewness	1.637451297	Skewness	2.172628088	Skewness	2.236047041	Skewness	1.771103
Range	1.33045E+11	Range	8312.42	Range	39105806343	Range	6.66E+09
Minimum	8186324143	Minimum	0.84	Minimum	16988625	Minimum	4.39E+08
Maximum	1.41231E+11	Maximum	8313.26	Maximum	39122794968	Maximum	7.1E+09
Sum	2.55483E+11	Sum	10004.35	Sum	39311965169	Sum	1.24E+10
Count	5	Count	5	Count	5	Count	5

The five cryptocurrencies displayed through descriptive statistics revealed significant differences among them. The market capitalisation indicated a very high mean of around \$51 billion, but the median of approximately \$33 billion suggested that dominant players like Bitcoin are the ones mainly skewing the distribution. In fact, the market sizes' disparity is further illustrated by the wide range from \$8 billion to \$141 billion. The unit prices portrayed a similar situation; for instance, the average was about \$2,000 while the median was only \$570, thus again indicating the power of outliers like Bitcoin. Among the different cases, circulating supply showed the greatest difference with a span from merely 16 million coins to nearly 39 billion coins indicating the huge difference between precious metals like gold and copper or the like between scarce assets such as Bitcoin and Ripple, the abundant asset. Then, trading volumes also had a huge difference in amounts with an average \$2.49 billion but heavy skewness towards Bitcoin which holds the highest daily liquidity. All in all, the descriptive analysis of the cryptocurrency market indicated sharp inequalities, as a few large and scarce coins not only dominated the value of the market but also the trading activity.

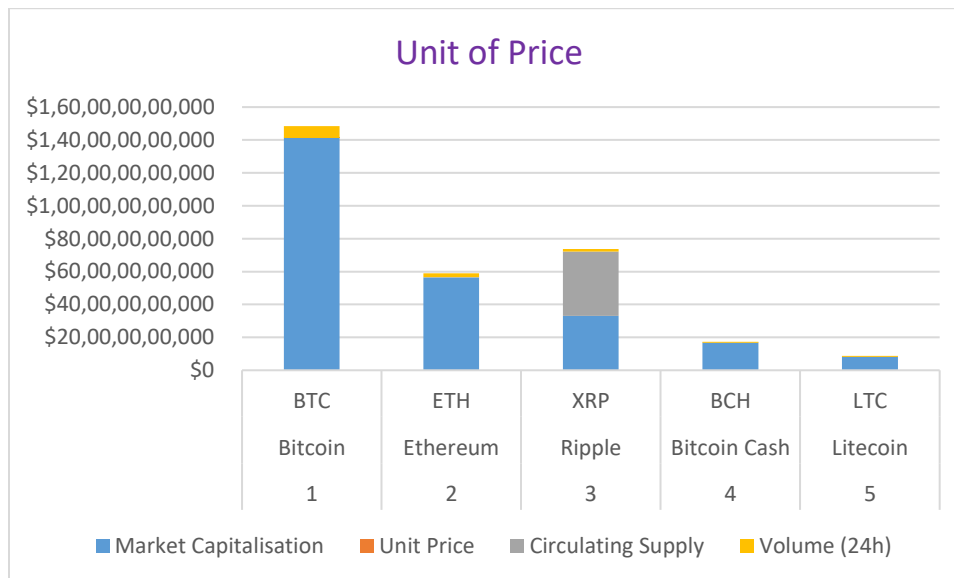
Co-relation Analysis:

	<i>Market Capitalisation</i>	<i>Unit Price</i>	<i>Circulating Supply</i>	<i>Volume (24h)</i>
Market Capitalisation	1			
Unit Price	0.935644004	1		
Circulating Supply	-0.189232695	0.316021315	1	
Volume (24h)	0.998066422	0.947806189	-0.166027833	1

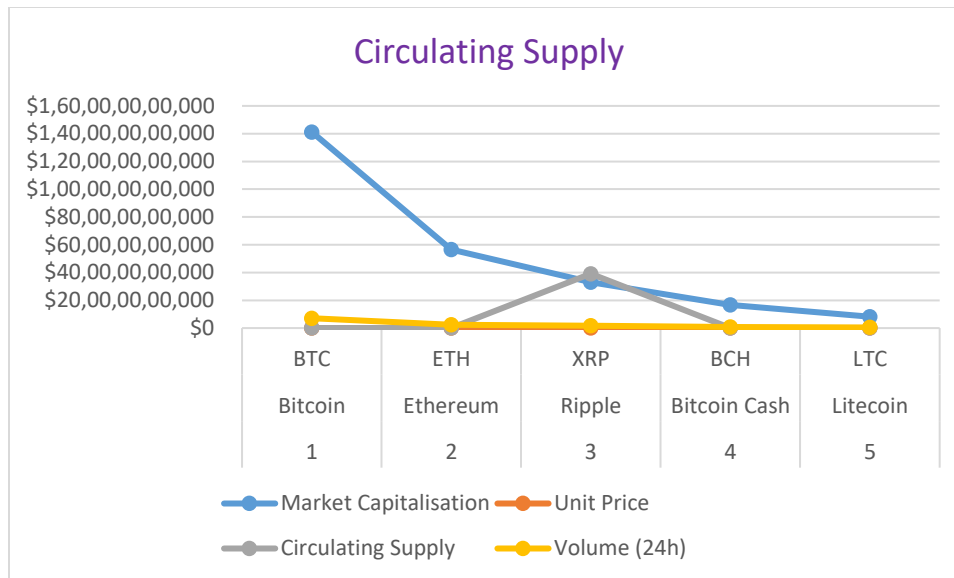
The correlation analysis yielded additional information about the relationships stemming from the variables. Market capitalization is rather highly and positively correlated with both unit price (0.93) and trading volume (0.99), which indicates that not only do more valuable cryptocurrencies have a great total value but they also get the most trades. A likewise strong correlation between unit price and trading volume (0.95) implies that investors are more likely to buy and sell coins when the prices are higher. On the other hand, circulating supply displays a weak negative correlation with market cap (-0.19) and unit price (-0.31) that indicates a supply that is not a driver of value nor the opposite. Rather in the case of Bitcoin the limited supply is often the driving factor of the scarce prices. The weak negative correlation between supply and trading volume (-0.16) also indicates that the market liquidity is not related to the number of circulating coins but is rather a function of market interest and price. All these findings point towards the predominance of price and size over supply levels is determining



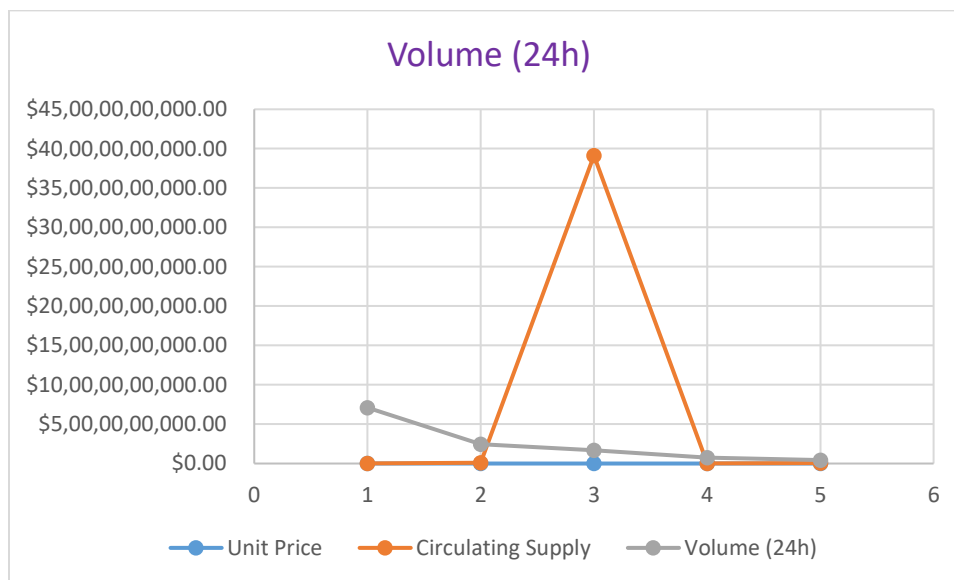
Bitcoin is the one with the largest market cap according to Market Capitalization thus its ruling the market, Ethereum is the main opponent, the large supply of Ripple raises its market cap although the price is still low, while Bitcoin Cash and Litecoin are just little players.



Bit coin stands out as the biggest market player with its leading market capitalization and trading volume. Ethereum is the next in line, and Ripple has a lot of supply but only a little value. The market shares of Bit coin Cash and Lite coin are very negligible compared to that of the above-mentioned cryptocurrencies.



Bitcoin is the cryptocurrency with the highest market capitalization showing a strong value even with a lower circulating supply. Ripple comes next with a large circulating supply but a lower market value. Ethereum stands at the midpoint, while Bitcoin Cash and Litecoin are still comparatively weaker.



Ripple's circulating supply compared to others is quite high, while Bitcoin's 24h trading volume is the highest. Ethereum has a moderate supply and volume, while Bitcoin Cash and Litecoin are far behind in all aspects.

DISCUSSION

The research points out quite notable differences when it comes to the market dynamics, regulation, and financial stability between crypto currencies and Central Bank Digital Currencies (CBDCs). Crypto currencies find themselves in a very concentrated and at the same time volatile environment where a few prevalent coins, Bitcoin and Ethereum, in particular, are the ones that determine the market value, as well as the trading activity, wholly. The results also show that scarcity and high unit prices are the primary factors influencing investors' decisions, but the circulating supply a little impact on liquidity or market position. The above-mentioned features pose a conundrum for authorities as they present both risks and difficulties for regulators, primarily because decentralized cryptos are outside the central banks' reach and thus are industry-wide speculation. On the other hand, CBDCs are a secure and regulated option that is distinct from the usual. These digital currencies have the full support of central banks, are subject to legal conditions, and permit governments to check transactions for illegal activities among others. While crypto currencies are still playing their cards right with innovative prospects like fast peer-to-peer transactions and global remittances, CBDCs are boosting financial inclusion with their ultra-cheap digital wallets that reach even the unbanked. The examples of the Bahamian Sand Dollar and India's Digital Rupee confirm that successful CBDCs can be implemented alongside the current fiat-currency condition with no volatility associated with the market of crypto currencies.

The comparative examination highlights that both tools have different ends. Cryptocurrencies are seen as high-risk, speculative assets that draw investors looking for new ways to store their money, while CBDCs are meant to strengthen monetary policy, provide stability in the financial sector, and facilitate the provision of banking services. The close relationship between the value of the market and the trading activities in cryptocurrencies underlines that the investors' interest and liquidity are focused on high-value assets, which is opposite to the more evenly distributed and regulated character of CBDC systems.

CONCLUSION OF ANALYSIS

The combined descriptive and correlation analyses together present a clear picture of the highly uneven and concentrated nature of the cryptocurrency market. A few major players, especially Bitcoin, dominate market capitalisation, unit price, and trading volume, which is responsible for skewing the overall averages. Wide ranges and high standard deviations across all variables confirm the volatility and disparities in the sector.

The correlation analysis backs up these findings and provides evidence that market capitalisation is very much related to both unit price and trading volume. This implies that cryptocurrencies of higher value not only have a more significant portion of the market but also get the most trading activity.

On the other hand, circulating supply has a weak negative relationship with value and liquidity, which means that scarcity is more closely associated with higher prices and stronger market presence than abundance. The study, therefore, concludes that the cryptocurrency markets are primarily driven by the value concentration, investor preference for expensive coins, and liquidity in the dominant coins, rather than by the total number of tokens in circulation. This brings out the speculative and unequal nature of the market, as a small group of assets sets the trends for the whole market, and investors as well as policymakers have to face both opportunities and risks.

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- ScienceDirect has published a paper titled “Central bank digital currency and cryptocurrency in emerging markets,” which will be available in 2024. ScienceDirect
- The year 2023 saw the International Review of Financial Analysis tackle the topic of central bank digital currencies with an article entitled "A Critical Review," which is accessible on ScienceDirect
- The question of whether central bank digital currency can lead to greater financial inclusion is currently being debated. ScienceDirect
- Peterson K. Ozili has examined the interrelationship of CBDC, Fintech, and cryptocurrency in the context of financial inclusion and financial stability. • Banks in different parts of the world show a similarity in that the central bank digital currencies have a positive effect on financial stability. The evidence comes from the global banking sector.
- The International Monetary Fund (IMF) has published a Working Paper in 2024 titled “Central Bank Digital Currencies and Financial Stability: Balance Sheet Analysis and Policy Choices.” — This paper provides a detailed balance-sheet analysis of CBDC issuance and the implications thereof for banking-sector stability and macroprudential responses. IMF
- The Bank for International Settlements (BIS) conducted a survey on central bank digital currencies and published the results in 2021. Among others, the survey reveals banking CBDC activity and discusses potential risks to banks' funding, lending, and resilience. It can be particularly useful for cross-country design comparisons and stability analysis. Bank for International Settlements+1
- • The Financial Stability Board (2024) has come out with the G20 Crypto-Asset Policy Implementation Roadmap (FSB report). — This report discusses the global regulatory priorities for crypto-assets and outlines the policy steps required to alleviate the concerns regarding financial stability and consumer protection. It is beneficial in the context of the “regulation” aspect of the crypto vs CBDC debate. Financial Stability BoardWorld Bank.
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