DOI: 10.28934/ea.1711 First Online: December 22, 2025

REVIEW PAPER

Two Sides of a Digital Coin: Comparison of CBDC and Cryptocurrencies

Nenad Tomić[1] | **Predrag Stanković**[2*]

[1] University of Kragujevac, Faculty of Economics, Department for Finance, Financial Institutions and Insurance
[2] University of Kragujevac, Faculty of Economics, Department for Accounting, Audit and Business Finance

ABSTRACT
This paper aims to compare central bank digital currencies (CBDCs) and cryptocurrencies by examining their fundamental differences, with a focus on their implications for financial inclusion, political and corporate influence, and monetary policy effectiveness.
The analysis is based on a conceptual and comparative approach, drawing on an extensive literature review and theoretical insights to identify and contrast the key characteristics, advantages, and disadvantages of both CBDCs and cryptocurrencies. The findings highlight that cryptocurrencies offer greater resistance to political and corporate control and support decentralized financial systems, while CBDCs provide enhanced tools for monetary policy implementation and state oversight. Both models have the potential to improve financial inclusion, but their approaches differ: CBDCs rely on institutional infrastructure, whereas cryptocurrencies depend on technological accessibility and user digital literacy. The study also reveals that CBDC could pose risks to personal financial autonomy, while cryptocurrencies may undermine monetary stability in less developed economies. This paper contributes to the understanding of digital money by presenting a structured comparison of two competing models, offering insights into their complementary potentials and long-term implications for the global financial system. Unlike most existing studies, the analysis integrates the perspectives of financial inclusion, political and corporate influence, and monetary policy effectiveness within a single comparative framework. In addition, it emphasizes the relevance of these issues for emerging markets and developing economies, where the introduction of CBDCs or the widespread use of cryptocurrencies could generate distinctive challenges and opportunities. It also highlights how their interaction may shape future developments in financial infrastructure, regulation, and user trust.

Keywords: *digital money, central bank digital currencies, cryptocurrencies, monetary policy, financial inclusion*

JEL Classification: E42, E50, E52, E58

INTRODUCTION

Business entities are increasingly relying on digital technologies to support their operations. E-commerce transforms the way companies interact with their customers and facilitates the execution of transactions. Under the influence of technological innovations, the concept of money has undergone significant changes. Numerous studies indicate that the digital transformation of money is closely intertwined with the emergence of new technologies, which are reshaping the role of traditional financial institutions and facilitating innovation in payment systems (Zhao, Fan

* Corresponding author, e-mail: predrag.stankovic@ef.kg.ac.rs

& Yan, 2016). The digitalization of the economy contributes to a substantial reduction in cash circulation and fosters the implementation of digital technologies in the financial sector (Mischenko & Naumenkova, 2021). This has led to the emergence of new forms of currency that exist exclusively in digital form and are detached from traditional financial systems. One of the key features of digital money is the ability to conduct transactions quickly and efficiently. Compared to traditional bank-based payment systems, where transfers are slow and costly, digital money enables faster transactions with proportionally lower costs. This is particularly important in the context of cross-border payments, where time delays and high fees are common obstacles.

Cryptocurrencies and central bank digital currencies (CBDC) represent two distinct approaches to the development of digital money, each with its own characteristics, advantages, and challenges (Cunha, Melo & Sebastião, 2021). While cryptocurrencies operate on decentralized blockchain networks, offering users greater freedom and pseudonymity, central bank digital currencies are issued by state institutions with primary objectives such as monetary stability and regulatory oversight. In this regard, CBDCs represent centralized and controlled monetary systems (Bindseil, 2020). In the current regulatory vacuum, both national and international institutions face significant challenges in establishing appropriate frameworks for digital currencies (Arner, Auer & Frost, 2020). The fundamental difference in the nature of these forms of digital money also results in differences in their performance and the goals for which they were established. Consequently, their role within the financial system is not identical.

The aim of the paper is to identify the differences in their potential impact on the global financial system through the analysis of the characteristics, advantages, and disadvantages of these two concepts. Understanding these differences is not only relevant for investors and economists, but also for all economic actors aware of the evolving role and functions of money in the digital age.

The first part of the paper will present the fundamental characteristics of cryptocurrencies. The second part will focus on central bank digital currencies. The third part of the paper will provide a key elaboration of how their systemic differences influence their opposing roles and potential within the modern financial system.

CRYPTOCURRENCIES

Although early electronic money systems in the 1990s demonstrated the possibility of developing state-backed digital currencies, governments and central banks showed little to no practical interest in this concept at the time. In reality, it was not until the significant expansion of the cryptocurrency market in the second decade of the 21st century that central banks actively engaged in the development and testing of their own digital currencies. Therefore, cryptocurrencies are, in fact, historically older than the now widely accepted concept of central bank digital currencies.

Cryptocurrencies are generally considered a decentralized form of electronic money, based on distributed database management technology in the form of a ledger, known as blockchain (Narayanan et al., 2016). The basic unit of data entry in the blockchain is a transaction, which represents a change in the state of the system (Iansiti & Lakhani, 2017). In the context of cryptocurrencies, a transaction refers to the transfer of value between the payer and the payee. Transactions are not recorded individually in the ledger but are grouped into blocks that are subsequently embedded into the data chain. Blockchain is a cryptographic technology that, by combining the achievements of asymmetric cryptography, hash functions, Merkle trees, and timestamping with so-called consensus protocols, enables database management in an environment where there is no trust among participants (Scardovi, 2016). The public key of each participant serves as their "current account," i.e., an account to which the cryptocurrency balance is linked. The corresponding private key is used to sign transactions. Since the private key cannot be derived from the public key, while the digital signature created with the private key can be verified, transactions are easy to authenticate but impossible to forge. By applying hash functions

to individual transactions and transaction blocks, and by calculating the root of the Merkle tree, data integrity is maintained. Timestamping is used to chronologically sort transactions and the aforementioned blocks.

Consensus protocols play a crucial role in embedding blocks into the blockchain (Bamakan, Motavali & Bondarti, 2020). This means that in the decision-making process, that is, the process of verifying the validity of transactions, any number of participants can be involved, even if they do not know or trust each other. To enable such a system, consensus protocols must ensure that it is impossible to validate unauthenticated transactions (i.e., those not signed by the payer, and therefore most likely falsified) and to prevent the spending of funds that the payer does not actually possess (the double-spending problem inherent to all electronic money systems). Each transaction on the blockchain functions as a micro-program, which, in addition to specifying the amount of cryptocurrency being spent, must digitally sign the transaction on behalf of the payer and provide a reference to a previous transaction that confirms the existence of the funds being spent. In other words, the payer must have previously acquired the funds they intend to spend. Other participants routinely verify the executed transaction by checking the validity of the digital signature and the existence of the funding source. If the transaction is not validly signed, it will be disregarded. Likewise, a transaction will not be considered if no source of funds exists or if the referenced source has already been fully or partially spent, thus preventing additional spending. If all conditions are met, transactions are grouped into blocks according to the rules of the specific consensus protocol. To prevent malicious participants from colluding and attempting to manipulate the system, all protocols are designed to be competitive, meaning that participants (commonly referred to as miners or validators) must invest certain resources that will be forfeited if they fail to comply with the established rules. Protocols reward the participant who is the first to assemble a valid block containing only verified transactions, thereby discouraging malicious behavior by eliminating the opportunity to profit from dishonest actions.

Essentially, cryptocurrencies are self-sustaining systems because they shift maintenance costs to miners, who invest their own resources with the goal of earning rewards by participating in consensus mechanisms. This contributes to system stability and security. Bitcoin, as the first cryptocurrency created in January 2009, remains the most significant and well-known cryptocurrency. According to data from the website coinmarketcap.com, its value exceeded $110,000 per 1 BTC in March 2025, making it primarily an investment asset rather than electronic money held by users for online payments. This leads to the fundamental problem of most cryptocurrencies: they generally do not meet the criteria to function as money because their high price volatility prevents their use as a reliable store of value. Consequently, the majority of users holding Bitcoin and other leading cryptocurrencies do not use them as a medium of exchange but rather hold them primarily for investment purposes (Steinmetz et al., 2021). Cryptocurrencies remain predominantly speculative investment instruments, with their use in payments being sporadic and often associated with misuse, such as payments in illegal activities, rather than legitimate e-commerce transactions. Despite these limitations, cryptocurrencies are increasingly being explored as a means to enhance transaction security and improve the efficiency of financial flows, particularly in sectors that require a high degree of decentralization (Catalini & Gans, 2020). Nevertheless, certain characteristics of cryptocurrencies make them a promising option for the future of electronic money, which will be further elaborated in the third part of this paper.

Beyond Bitcoin, which remains the dominant cryptocurrency, several other digital currencies have gained significant importance in the last decade. Ethereum, launched in 2015, introduced the concept of smart contracts and decentralized applications, thus expanding the use of blockchain beyond simple peer-to-peer payments (Buterin, 2015; Antonopoulos & Wood, 2018). Litecoin, created in 2011, sought to improve on Bitcoin by enabling faster block generation times and lower transaction fees, while Ripple (XRP) targeted the inefficiencies of cross-border payments by offering low-cost and near-instantaneous settlement (Glaser et al., 2014). In addition, the emergence of stablecoins such as Tether (USDT) illustrates an attempt to mitigate one of the key

weaknesses of cryptocurrencies – high volatility – by pegging their value to fiat currencies (Lyons & Viswanath-Natraj, 2020; Bullmann, Klemm & Pinna, 2019).

Price volatility is one of the defining features of cryptocurrencies and a major reason why their role as money remains contested. Numerous studies demonstrate that Bitcoin and other cryptocurrencies behave more like speculative assets than stable mediums of exchange (Baur, Hong & Lee, 2018; Yermack, 2015). Bitcoin rose from below USD 500 in 2013 to nearly USD 69,000 in 2021, before undergoing sharp corrections, while Ethereum increased from less than USD 1 in 2016 to over USD 4,800 in 2021, reflecting extreme levels of price fluctuation (Corbet et al., 2019). Such patterns challenge their reliability as a store of value and increase portfolio risks compared to traditional assets (Katsiampa, 2017; Klein, Pham Thu & Walther, 2018). Nevertheless, the high volatility also attracts investors seeking speculative opportunities, contributing to increased trading volumes and liquidity in global financial markets (Urquhart, 2016).

In terms of innovation, Ethereum's architecture, based on programmable smart contracts, has been particularly important for the rise of decentralized finance (DeFi), enabling the creation of new financial instruments and decentralized exchanges that operate without intermediaries (Schär, 2021). These innovations illustrate that, while Bitcoin established the foundation of digital money, subsequent cryptocurrencies have significantly expanded the scope and functionality of blockchain-based finance.

Table 1. Overview of selected cryptocurrencies and their price development (2013–2025)

Cryptocurrency	Launch year	Approx. price 2013	Peak price (USD)	Price 2025
Bitcoin (BTC)	2009	< 500	~69,000 (2021)	~110,000
Ethereum (ETH)	2015	< 1	~4,800 (2021)	~3,500
Ripple (XRP)	2012	< 0.01	~3.84 (2018)	~0.55
Litecoin (LTC	2011	~4	~410 (2021)	~70
Tether (USDT)	2014	~1	~1	~1

Source: CoinMarketCap (2025). Data search. Accessed 27/09/2025 from: https://coinmarketcap.com/

While cryptocurrencies represent a decentralized approach to money creation and governance, central banks have responded by exploring CBDCs as a way to combine digital innovation with monetary control.

CENTRAL BANK DIGITAL CURRENCIES (CBDCS)

With the growth of the cryptocurrency market, the question of adopting this concept by states to reform payment systems has become inevitable. CBDCs are emerging as a response to the need to preserve monetary sovereignty and enhance the efficiency of payment systems in the era of the digital economy (Auer & Böhme, 2020). State-backed digital money emerges not only as a practical necessity due to the digitalization of business operations but also as an opportunity for governments to prevent private cryptocurrency systems from gaining widespread consumer adoption. It should be made clear from the outset that the creation of true blockchain-based cryptocurrencies by states is not only impossible but also undesirable (Stockel, 2025). As previously noted, blockchain is designed for scenarios where a certain number of participants – whether known or unknown in advance – lack mutual trust when making decisions. Participants in reaching consensus have equal voting power. In practice, this would mean that a state would lose its ability to control monetary policy within such a system. It is evident that it would be highly disadvantageous for a state to implement a monetary system that it would subsequently be unable to control. Distributed ledger systems may enhance resilience against cyberattacks; however, blockchain architectures based on proof-of-work mechanisms involve very high energy consumption, which makes them unsuitable for sustainable implementation by central banks and raises broader concerns about efficiency and environmental impact (Sedlmeir et al., 2020).

On the other hand, a digital money system in which the state retains a leading role and makes all decisions would not constitute a true blockchain system. Fortunately, for decades, there has been the possibility of implementing electronic money systems based on blind signatures (Chaum, 1983). CBDC should be viewed in this context – as a form of electronic money developed as early as the 1990s, except that the issuer would now be the central bank instead of private entities (Kiff et al., 2020). In addition to blind signature systems, modern CBDC architectures are increasingly incorporating privacy-enhancing elements through zero-knowledge proofs and tokenisation (Chaum, Grothoff & Moser, 2021).

The literature identifies several motivations or rationales for the introduction of CBDCs. These include the need to support unconventional monetary policy (Bordo & Levin, 2017), the preservation of financial stability, increasing competition in the retail payments sector, and the prevention of criminal activities (Engert & Fung, 2017), as well as enhancing financial inclusion and responding to the emergence of private cryptocurrencies such as Bitcoin (Ozili, 2022). In academic circles and broader societal contexts, there has long been discussion of the so-called Fourth Industrial Revolution and the ways it will transform business operations. One of the main obstacles to the full integration of the Internet of Things and the creation of the so-called Internet of Value is inadequate payment infrastructure (Floros, 2019). CBDC could provide a foundation for faster and cheaper payments, effectively restoring the concept of micropayments to its full significance within payment systems. These motivations are significant, which explains the high percentage of central banks currently engaged in developing operational solutions or conducting testing (Boar & Wehrli, 2021). However, these are highly sensitive projects that will require international coordination among central banks, not only for feasibility but primarily for the acceptability of the project. This refers not only to acceptance by end-users but also by the banking sector, which may be more or less affected depending on the design of the CBDC system. User response will undoubtedly be conditioned by the system's design.

Recent studies emphasise that central banks should adopt a proactive yet cautious approach when considering CBDCs. The International Monetary Fund (IMF) proposes a dynamic decision-making framework that guides central banks through staged exploration, from research and piloting to potential implementation, ensuring that infrastructure, legal frameworks, and institutional capacity are prepared in advance (IMF, 2023). This approach highlights that the feasibility and desirability of CBDCs differ significantly across jurisdictions. Similarly, the Bank for International Settlements (BIS) reports show that more than 90% of central banks are now engaged in CBDC research or pilot projects, with an increasing focus on hybrid systems that combine central bank issuance with private sector distribution (BIS, 2024). Hybrid models are considered particularly promising because they allow central banks to maintain control over monetary liabilities while enabling innovation and efficiency through regulated intermediaries (Auer, Cornelli, & Frost, 2020).

The first scenario involves introducing CBDCs as a complement to the existing payment system. In addition to cash and deposit money, there would be state-issued electronic money. In such circumstances, the burden of adopting CBDC would fall on deposit money, as consumers inclined to use cash could continue to do so. Consequently, commercial banks would be adversely affected because a reduction in demand for deposit money would decrease their lending capacity (Caccia, Tapking & Vlassopoulos, 2024). Moreover, their presence in payment transactions would diminish, leading to a decline in transaction fee revenues. On the other hand, the push towards a fully cashless payment system would significantly impact consumers, as well as banks. The state would gain the ability to monitor consumers permanently and possess a tool for the immediate freezing of all available funds of individuals or enterprises. While this presents significant opportunities in combating terrorism and organized crime, concerns arise that some of these powers could be misused to exert pressure on disloyal individuals (Kaur, 2024).

CBDCs could be stored on cards or mobile applications (a value-based solution), or in dedicated current accounts held at centralized institutions such as central bank departments (an account-

based solution) (Bofinger, 2018). These two approaches do not necessarily require a direct replacement of cash and deposit money, as deposit money could continue to function alongside one or both models. In addition to conceptual discussions, practical experiences with CBDCs are already emerging worldwide. The Bahamas launched the Sand Dollar in 2020, aiming to strengthen financial inclusion across remote islands (Central Bank of The Bahamas, 2020). China's e-CNY pilot has been rolled out across multiple provinces, demonstrating large-scale merchant adoption and integration with existing digital ecosystems (Mu, 2021). Nigeria introduced the eNaira in 2021, though adoption has been slower, underlining the importance of trust and adequate user incentives (David-West & Umukoro, 2023). The Eastern Caribbean Central Bank launched DCash as a regional CBDC pilot, providing lessons on cross-border interoperability and governance (ECCB, 2021). Sweden's Riksbank has advanced the e-krona project through technical pilots, though the final policy decision remains open (Riksbank, 2023). These diverse experiences highlight that CBDC design and outcomes vary greatly depending on national objectives, infrastructure readiness, and institutional trust. The question remains whether and how the central bank's role in conducting monetary policy would change.

In a scenario where cash is replaced by CBDC stored directly on devices, no significant changes would occur. Consumers would always be able to withdraw funds onto an application or card, thus keeping them out of the central bank's reach. Demand for transactional deposits could decline due to the possibility of making payments with CBDC via apps. However, a fundamental change would take place with the implementation of CBDC based on some form of current account. Central banks could influence the overall money supply through interest rates, opening new possibilities for monetary policy. In the event of a drop in aggregate demand and the onset of a recession, central banks could implement negative interest rate policies. Without cash and the autonomous holding of CBDC, consumption would become the only way for holders to protect their assets from long-term losses (Tomić, Todorović & Čakajac, 2020). When designing CBDC, central banks must strike a balance between functionality, anonymity, and control, resulting in diverse CBDC models across the globe (Petare et al., 2024).

Given these distinct conceptual foundations, a direct comparison between CBDCs and cryptocurrencies can provide insights into their respective advantages, limitations, and potential complementarities.

COMPARISON OF CRYPTOCURRENCIES AND CBDCS

Both categories analyzed in this paper are highly heterogeneous. "Cryptocurrencies" encompass diverse types, from Bitcoin as a decentralized store of value, to stablecoins designed to reduce volatility, to smart contract platforms such as Ethereum that enable decentralized applications, as well as privacy-oriented coins like Monero and Zcash (Catalini & Gans, 2020; Eichengreen, 2019). Similarly, CBDCs are not a monolithic concept but vary according to design choices: retail versus wholesale, account-based versus token-based, and hybrid or synthetic models that combine public and private sector roles (BIS, 2024; IMF, 2023). Recognizing this heterogeneity is essential for avoiding over-generalization, and the comparison in this paper should therefore be interpreted as a synthesis of main trends rather than a strict equivalence across all subcategories.

The comparative framework applied in this paper does not assume full equivalence between all types of cryptocurrencies and CBDC models. Instead, it synthesizes their most salient characteristics across three analytical dimensions, acknowledging that significant internal variation exists within each group.

Financial Inclusion

Financial inclusion refers to enabling access to financial services for individuals or enterprises (Pesqué-Cela et al., 2021). Although at first glance this may seem a matter of limited interest, it

should be noted that financial services tend to be exclusive, especially for individuals (Birkenmaier & Fu, 2018). A large proportion of the population, particularly in developing countries, lacks access even to basic financial services. The network of bank branches does not cover much of the densely populated rural areas, leaving a significant share of the population without access to electronic payments or ATMs. Such users are limited to cash use exclusively, and thus cannot benefit from other, more sophisticated financial services.

Both concepts emphasize their contribution to financial inclusion (Blandin et al., 2020; Tan, 2024). Empirical research suggests that digital currencies can significantly promote financial inclusion in regions with underdeveloped banking infrastructure, enabling vulnerable and marginalized groups to access basic financial services more easily (Tay, Tai & Tan, 2022). As access to the internet and basic computing technologies has become widespread even in developing countries, information technologies can be leveraged to partially overcome this issue. Through electronic payments, users can gain access to a range of other services, such as private pension and life insurance or brokerage services. However, the two concepts do not offer the same degree of financial inclusion. CBDCs must rely on some form of institutional support. Central banks, either independently or with the assistance of the existing banking network, should facilitate the transition from widespread cash use to the distribution of digital money. Cryptocurrencies do not require the involvement of any institution, as their use only requires internet access and appropriate software. Nevertheless, if the user is not engaged in mining, initial possession of cryptocurrency is very likely dependent on a deposit made through the traditional payment system. It can be concluded that neither concept holds a clear advantage in terms of accessibility. Differences across the other two aspects of comparison are more pronounced.

Regarding the level of education, awareness, and digital literacy, it is evident that CBDCs enable a higher degree of inclusion. Apart from technological barriers, a major obstacle to full inclusion is the low level of financial literacy among populations that are already excluded from the system (Demirgüç-Kunt et al., 2022). Regarding the level of education, awareness, and digital literacy, it is evident that CBDCs enable a higher degree of inclusion. Apart from technological barriers, a major obstacle to full inclusion is the low level of financial literacy among populations that are already excluded from the system (Demirgüç-Kunt et al., 2022). In addition, most countries will need to amend existing legislation to grant CBDCs legal tender status and to establish clear regulatory and supervisory frameworks. Appropriate oversight and accountability mechanisms are essential to ensure trust, protect consumers, and prevent misuse of the system, particularly in jurisdictions where institutional capacity is limited (IMF, 2023; BIS, 2024). Thanks to their institutional foundation, CBDCs can establish a clearer and simpler usage system focused on the end user. In contrast, cryptocurrencies appear to be systems that set standards but are not primarily aimed at universal inclusion. In practice, the required level of digital knowledge may vary from case to case, but it can be concluded that the secure use of cryptocurrencies for payments generally demands a higher level of digital literacy. This raises the question of how their usage could contribute to greater inclusion, given that those excluded from traditional financial flows are precisely the individuals lacking advanced digital skills. It goes without saying that the mining process further complicates the situation, as it is an expensive and demanding operation. It remains unclear which individuals can afford mining equipment and participate continuously in this process while lacking access to financial services.

In terms of regulation and legal prerequisites, cryptocurrencies hold an advantage. Within crypto communities, users are relatively equal, so no one's background or legal status affects their access to funds. The situation with CBDCs is somewhat different, considering that even in developed countries, socially marginalized individuals often face difficulties opening current accounts at banks. Individuals with criminal records frequently do not meet the criteria for certain types of financial services, which may discourage them from holding bank accounts altogether. Furthermore, the transition to CBDCs would accelerate the process of freezing and confiscating

funds when requested by the state. Thus, while CBDCs enable greater inclusion, they also increase the likelihood of consumer exclusion.

Reduction of Political Influence

One of the characteristics that electronic money must possess, according to Matonis (1995), is the reduction of state influence on monetary value. Building on Hayek's (1976) view that all state-issued money is political money and that every government more or less abuses the monetary system to fulfill its own objectives, Matonis concludes that state influence would undermine trust in private electronic money systems. In other words, for electronic money to succeed, it must operate according to purely economic principles, not political ones. It is clear that CBDCs do not meet this criterion, as they represent a digital extension of traditional state-issued money. All the negative consequences of using monetary policy for political purposes remain present in the case of CBDCs.

While the ideas of Hayek (1976) on the denationalization of money and Matonis's (1995) early criteria for electronic money provide a valuable historical framework, they were developed before the emergence of programmable digital currencies and distributed ledger technology. Contemporary digital currencies – whether in the form of CBDCs or cryptocurrencies – operate under algorithmic governance and programmability, which fundamentally transcends these earlier frameworks (BIS, 2021; Adrian & Mancini-Griffoli, 2019). Therefore, in this paper, the earlier theories are used as a conceptual background, while the main comparative analysis relies on more recent approaches that account for the technological and institutional innovations of blockchain-based systems.

It is important to distinguish between historical forms of money, such as commodity money and early electronic payment systems, and contemporary programmable digital currencies. Commodity money and pre-blockchain systems lacked programmability and algorithmic governance, while both CBDCs and cryptocurrencies are characterized by code-based rules, automated verification, and in many cases smart contract functionality (Böhme et al., 2020; Auer Auer, Cornelli, & Frost, 2020). For this reason, in the present analysis, commodity and early electronic money are referenced only as background, while the main focus remains on the comparison between CBDCs and cryptocurrencies as the two relevant forms of digital money.

Cryptocurrencies, as private money, are free from political influence, precisely in the manner Hayek proposed. Additionally, they possess another significant characteristic – they are not subject to corporate influence either. In early electronic money systems, the reduction of political influence was offset by the rise of corporate control by the issuing company. In practice, corporate influence, despite being a private interest, could be just as detrimental as political interference. Moreover, in decentralized systems, the risk of abuse of power is significantly reduced due to algorithmic transparency and the impossibility of centralized revocation of funds (De Filippi & Wright, 2018). A review of some unsuccessful early electronic money systems shows that all failed due to poor business decisions by the issuers (Guttmann, 2003). Cryptocurrencies are governed by a community of miners regardless of who initiated the project and developed the algorithm. Fully controlled private cryptocurrencies are undesirable and poorly regarded within the crypto community. It can be concluded that cryptocurrencies, at least nominally, strive toward the pure economic model proposed by Hayek. However, in practice, this characteristic is not always desirable, as without mechanisms to mitigate demand shocks, nearly all cryptocurrencies are exposed to high volatility.

Impact on Monetary Stability

Regarding the impact on monetary policy capabilities, CBDCs and cryptocurrencies exhibit significant differences. Earlier, the influence of CBDC implementation modalities on monetary policy was discussed. In contrast, cryptocurrencies as private initiatives potentially reduce

policymakers' maneuvering space (He, 2018). The extent of this impact depends on the stability of the national currency and the purposes for which the population uses cryptocurrencies. Developed countries with stable currencies are unlikely to be affected by this issue, even with widespread cryptocurrency adoption. In these countries, the population mainly uses cryptocurrencies for speculative investment purposes. In the long term, cryptocurrencies may emerge as consortium projects by large internet-dependent corporations. This could alter the demand function for cryptocurrencies, not due to distrust in the national currency, but as a means to enable faster and simpler payments within specific internet services. Such cryptocurrency usage would complement the traditional payment system rather than replace it.

Developing countries may face far greater challenges. Studies indicate that the widespread use of cryptocurrencies in countries with weak institutions can undermine the transmission mechanism of monetary policy and reduce the effectiveness of state oversight over capital flows (Davoodalhosseini, 2022). In these contexts, segments of the population turn to cryptocurrencies as alternatives to unstable national currencies that fail to fulfil one of the fundamental functions of money – a store of value. These economies struggle with long-standing high inflation problems. Zimbabwe, for example, was notorious for hyperinflation, which made economic planning and storing value difficult for its population. The cryptocurrency exchange Golix offered a solution by enabling most well-known cryptocurrencies to be purchased directly with the local currency. This created a local alternative for storing value. Since 2018, Golix has been targeted by the central bank, which banned its operations. Although the exchange continued functioning amid legal disputes, users increasingly faced difficulties withdrawing funds, and it is assumed that the founders embezzled part of the assets. While this experiment failed, it demonstrated a way to circumvent poor monetary policy decisions at the local level. Another example is El Salvador, which institutionally relinquished monetary policy by abolishing its national currency and adopting the US dollar and Bitcoin as legal tender (Ward, 2024). Such institutional changes require careful evaluation of their long-term effects on macroeconomic stability and central bank independence (Yermack, 2018). Despite this case, due to high volatility, existing cryptocurrencies are not a suitable solution for a reserve currency role. However, consortium cryptocurrencies developed by large corporations with relatively stable value could serve as financial havens for users in developing countries. Motivations for this include domestic currency volatility, underdeveloped banking networks, the desire for frequent cross-border payments without high fees and currency conversion costs, or evasion of regulatory authorities. The consequence will be the inability of central banks to influence economic developments through monetary policy measures, as these measures will target national currencies used by an insufficient proportion of citizens.

Table 2. Overview of selected cryptocurrencies and their price development (2013–2025)

Dimension	**CBDCs – Advantages**	**CBDCs – Disadvantages**	**Cryptocurrency – Advantages**	**Cryptocurrency – Disadvantages**
Monetary control	Enables effective policy transmission	Potential overreach by central banks	Decentralization ensures autonomy	Lack of monetary stability
Privacy	Regulated data use	Limited anonymity	Pseudonymity protects users	Vulnerable to misuse
Efficiency	Fast domestic payments	Implementation costs	Global reach	High energy use / slow scaling
Financial inclusion	Broad institutional access	Dependence on digital literacy	Peer-to-peer accessibility	Limited trust and volatility

Source: Authors

To provide a clearer and more structured understanding of the comparative position of CBDCs and cryptocurrencies, Table 2 summarizes the key advantages and disadvantages of both systems across several dimensions, including monetary control, privacy, efficiency, and financial inclusion. This comparative overview complements the analytical discussion presented earlier by highlighting their practical implications and trade-offs.

CONCLUSION

Cryptocurrencies and CBDCs represent two distinct trajectories in the evolution of money, each reflecting broader trends in finance where traditional institutions encounter disruptive innovation. Their development illustrates not only competing visions of money but also opportunities for complementarity.

On the one hand, CBDCs offer clear institutional advantages: they can strengthen monetary policy transmission, improve efficiency in payments, and potentially expand financial inclusion when combined with appropriate regulatory and technological frameworks. They also provide governments with new instruments for oversight and crisis management, which may be crucial in times of financial instability.

On the other hand, cryptocurrencies highlight the benefits of decentralization and reduced dependence on state or corporate control. Their blockchain foundations enable innovation, resilience, and new financial applications, though their high volatility and speculative use remain significant obstacles to their adoption as stable money. Importantly, most cryptocurrencies are not fully anonymous but rather pseudonymous, meaning that transactions are linked to public keys and can often be traced back through network analysis.

Rather than treating CBDCs and cryptocurrencies as mutually exclusive, a balanced view suggests that they may coexist and even complement each other. CBDCs could deliver stability and trust through regulatory backing, while cryptocurrencies could continue to drive technological experimentation and alternative models of finance. This coexistence, however, will depend on careful design choices, regulatory clarity, and the ability to safeguard both efficiency and personal financial autonomy.

Money is a complex institution built on trust and shaped by historical, technological, and social changes. The digitalization of money represents a critical turning point: whether through CBDCs or cryptocurrencies, its acceptance will depend on striking a balance between innovation and stability, as well as between oversight and individual freedom. The future of digital finance is therefore unlikely to be determined by a single model, but rather by the interaction of centralized and decentralized systems, each shaping global financial infrastructure in complementary and sometimes competing ways.

Despite these insights, this paper has certain limitations. It is primarily conceptual and comparative, relying on secondary sources rather than empirical data. Furthermore, while examples of national CBDC projects are referenced, the analysis does not provide an exhaustive country-by-country evaluation. In this sense, the paper should be seen as a contribution that synthesizes dispersed literature by integrating three perspectives—financial inclusion, political and corporate influence, and monetary policy—into a single comparative framework. This integrated approach highlights how both CBDCs and cryptocurrencies may differently affect emerging and developed economies, which has not been systematically addressed in prior studies.

Future research should address these limitations by providing more comprehensive empirical testing of the identified dimensions, comparative case studies of CBDC implementation across jurisdictions, and broader meta-analyses of cryptocurrency adoption patterns. Such work would strengthen the evidence base, clarify causal relationships, and support policymakers in making informed decisions about the design and regulation of digital currencies.

In light of the foregoing, it is clear that CBDCs and cryptocurrencies represent two sides of the same digital coin, and their development and mutual interaction will shape the future of the global

financial infrastructure. In the coming years, it can be expected that hybrid models combining elements of both systems will become more prominent, regulatory authorities will strengthen oversight and accountability mechanisms, and privacy and data protection will remain central issues in policy design. At the same time, growing international cooperation is likely to promote the establishment of global standards and interoperability frameworks, while ongoing technological experimentation with programmable money, smart contracts, and tokenization will continue to shape the trajectory of digital finance.

REFERENCES

Adrian, T., & Mancini-Griffoli, T. (2021). The rise of digital money. *Annual Review of Financial Economics*, *13*(1), 57-77.

Antonopoulos, A. M., & Wood, G. (2018). *Mastering ethereum: building smart contracts and dapps*. O'reilly Media.

Arner, D. W., Auer, R., & Frost, J. (2020). Stablecoins: risks, potential and regulation. *BIS Working Paper, 905, 1-31.*

Auer, R., & Böhme, R. (2020). The technology of retail central bank digital currency. *BIS Quarterly Review, March*.

Auer, R., Cornelli, G., & Frost, J. (2020). Rise of the central bank digital currencies: drivers, approaches and technologies.

Bamakan, S.M.H., Motavali, A. & Bondarti, A.B. (2020) A survey of blockchain consensus algorithms performance evaluation criteria. *Expert Systems with Applications*, *154:113385*.

Bank for International Settlements (BIS). (2021). *CBDCs: Financial stability implications*. BIS Quarterly Review.

Bank for International Settlements (BIS). (2024). *Embracing diversity, advancing together – results of the 2023 BIS survey on central bank digital currencies and crypto*. BIS Papers No. 147.

Baur, D. G., Hong, K., & Lee, A. D. (2018). Bitcoin: Medium of exchange or speculative assets?. *Journal of International Financial Markets, Institutions and Money*, *54*, 177-189.

Bindseil, U. (2020). *Tiered CBDC and the financial system*. Frankfurt am Main: European Central Bank.

Birkenmaier, J., & Fu, Q. (2018). Household Financial Access and Use of Alternative Financial Services in the U.S.: Two Sides of the Same Coin?. *Social Indicators Research*, *139*, 1169-1185.

Blandin, A., Peters, G., Wu, Y., Eisermann, T., Dek, A., Taylor, S., & Njoki, D. (2020). *3rd Global Cryptoasset Benchmarking Study*. Cambridge: Cambridge Center for Alternative Studies.

Boar, C., & Wehrli, A. (2021). Ready, steady, go?-Results of the third BIS survey on central bank digital currency. *BIS Working Paper*, *114*, 1-21.

Bofinger, P. (2018) Digitalisation of money and the future of monetary policy. *Vox – CEPR Policy portal*.

Bordo, M. D., & Levin, A. T. (2017). Central bank digital currency and the future of monetary policy. *National Bureau of Economic Research Working Paper*, *w23711*, 1-30.

Bullmann, D., Klemm, J., & Pinna, A. (2019). *In search for stability in crypto-assets: are stablecoins the solution?* (No. 230). ECB Occasional Paper.

Buterin, V. (2014). A next-generation smart contract and decentralized application platform. *white paper*, *3*(37), 1-36.

Caccia, E., Tapking, J., & Vlassopoulos, T. (2024). *Central banks digital currecny and monetary policy implications*. Ocassional paper series, Frankfurt: European Central Bank.

Catalini, C., & Gans, J. S. (2020). Some simple economics of the blockchain. *Communications of the ACM*, *63*(7), 80-90.

Central Bank of The Bahamas. (2020). *Project Sand Dollar: A Bahamas payments system modernisation initiative*. Nassau: CBOB.

Chaum, D., Grothoff, C., & Moser, T. (2021). How to issue a central bank digital currency. *SNB Working Paper, 21(3), 1-38*.

CoinMarketCap (2025). *Data search*. Accessed 27/06/2025 from: https://coinmarketcap.com/
Corbet, S., Lucey, B., Urquhart, A., & Yarovaya, L. (2019). Cryptocurrencies as a financial asset: A systematic analysis. *International Review of Financial Analysis*, *62*, 182-199.
Cunha, P. R., Melo, P., & Sebastião, H. (2021). From bitcoin to central bank digital currencies: Making sense of the digital money revolution. *Future Internet*, *13*(7), 1-19.
David-West, O., & Umukoro, I. (2023). CBDC Field Research Insights: Nigeria's eNaira–Enabling Possibilities.
Davoodalhosseini, S. M. (2022). Central bank digital currency and monetary policy. *Journal of Economic Dynamics and Control*, *142*, 1-22.
De Filippi, P., & Wright, A. (2018). *Blockchain and the law: The rule of code*. Harvard University Press.
Demirgüç-Kunt, A., Klapper, L., Singer, D., & Ansar, S. (2022). *The Global Findex Database 2021: Financial inclusion, digital payments, and resilience in the age of COVID-19*. World Bank Publications.
Eastern Caribbean Central Bank (ECCB). (2021). *DCash pilot overview*. Basseterre: ECCB.
Eichengreen, B. (2019). From commodity to fiat and now to crypto: what does history tell us?. *Digital Currency*, 18.
Engert, W., & Fung, B. S. C. (2017). Central bank digital currency: Motivations and implications. *Bank of Canada Staff Discussion Paper*, *17*(16), 1-26.
Floros, E. J. (2019). Web 3.0 – The Internet of Value, in: Chishti, S., Craddock, T. & Courtneidge, R. (eds.): *The PayTech Book: The Payment Technology Handbook for Investors, Entrepreneurs and FinTech Visionaries*. Chichester, UK: John Wiley and Sons.
Glaser, F., Zimmermann, K., Haferkorn, M., Weber, M. C., & Siering, M. (2014). Bitcoin-asset or currency? revealing users' hidden intentions. *Revealing Users' Hidden Intentions (April 15, 2014). ECIS*.
Guttmann, R. (2003). *Cybercash – The coming era of electronic money*. New York, NY: Pallgrave Macmilan.
Hayek, F. A. (1976). *The denationalization of money*. London: Institute for Economic Affairs.
He, D. (2018). Monetary policy in digital age. *Finance & Development*, *55*(2), 14-16.
Iansiti, M., & Lakhani, K.R. (2017). The truth about blockchain, *Harvard Business Review*, *95*(1), 118-127.
International Monetary Fund (IMF). (2023). *How Should Central Banks Explore Central Bank Digital Currency? A Dynamic Decision-Making Framework*. IMF Fintech Note, September 2023.
Katsiampa, P. (2017). Volatility estimation for Bitcoin: A comparison of GARCH models. *Economics letters*, *158*, 3-6.
Kaur, G. (2024). Privacy implications of central bank digital currencies (CBDCs): a systematic review of literature. *EDPACS*, *69*(9), 87-123.
Kiff, M.J., Alwazir, J., Davidovic, S., Farias, A., Khan, M.A., Khiaonarong, M.T., Malaika, M., Monroe, M.H.K., Sugimoto, N., Tourpe, H. and Zhou, P. (2020). A survey of research on retail central bank digital currency. *IMF working paper*, *20*(104), 1-65.
Klein, T., Thu, H. P., & Walther, T. (2018). Bitcoin is not the New Gold–A comparison of volatility, correlation, and portfolio performance. *International Review of Financial Analysis*, *59*, 105-116.
Lyons, R. K., & Viswanath-Natraj, G. (2023). What keeps stablecoins stable?. *Journal of International Money and Finance*, *131*, 1-19.
Matonis, J. (1995). Digital cash and monetary freedom. *INET'95 Internet society annual conference*. Honolulu, Hawaii.
Mishchenko, V., & Naumenkova, S. (2021). The impact of digital currency on the transformation of monetary policy. *Three Seas Economic Journal*, *2*(4), 43-48.
Mu, C. (2021). Progress of research & development of E-CNY in China. *China Finance*, 4, 1–6.
Narayanan, A., Bonneau, J., Felten, E., Miller, A., & Goldfeder, S. (2016). *Bitcoin and cryptocurrency technologies: a comprehensive introduction*. New Yersey: Princeton University Press.

Ozili, P. K. (2022). Can central bank digital currency increase financial inclusion? Arguments for and against. In Sood, K., Balusamy, B., Grima, S. and Marano, P. (Ed.) *Big data analytics in the insurance market*. 241-249. United Kingdom: Emerald Publishing Limited.

Pesqué-Cela, V., Tian, L., Luo, D., Tobin, D. & Kling, G. (2021). Defining and measuring financial inclusion: A systematic review and confirmatory factor analysis. *Journal of International Development*, *33*(2), 316-341.

Petare, P. A., Josyula, H. P., Landge, S. R., Gatala, S. K. K., & Gunturu, S. R. (2024). Central bank digital currencies: Exploring the future of money and banking. *Migration Letters*, *21*(7), 640-651.

Scardovi, C. (2016). Restructuring and innovation in banking, London. UK: Springer.

Schär, F. (2021). Decentralized finance: On blockchain-and smart contract-based financial markets. *FRB of St. Louis Review*.

Sedlmeir, J., Buhl, H. U., Fridgen, G., & Keller, R. (2020). The energy consumption of blockchain technology: Beyond myth. *Business & Information Systems Engineering*, *62*(6), 599-608.

Steinmetz, F., Meduna., M.V., Ante, L., & Fiedler, I. (2021). Ownership, uses and perceptions of cryptocurrency: Results from a population survey. *Technological Forecasting and Social Change*, *173:121071*.

Stockel, M. (2025). Digital but not crypto: possible design pitfalls and rebound effects for green monetary policy using central bank digital currency. *Eurasian Economic Review*, *15*, 503-516.

Sveriges Riksbank. (2023). *E-krona pilot phase 2 report*. Stockholm: Sveriges Riksbank.

Tan, B.J. (2024). Central bank digital currency and financial inclusion. *Journal of Macroeconomics*, *81:103620*.

Tay, L. Y., Tai, H. T., & Tan, G. S. (2022). Digital financial inclusion: A gateway to sustainable development. *Heliyon*, *8*(6), 1-10.

Tomić, N., Todorović, V. & Čakajac, B. (2020). The potential effects of cryptocurrencies on monetary policy, *The European journal of applied economics*, *17*(1), 37-48.

Urquhart, A. (2016). The inefficiency of Bitcoin. *Economics Letters*, *148*, 80-82.

Ward, S.V. (2024). El Salvador Embraces Future With Bitcoin As Bukele Secures Historic Victory. Forbes, February 5.

Yermack, D. (2018). The potential of digital currency and blockchains. *NBER Reporter*, (1), 14-17.

Yermack, D. (2024). Is Bitcoin a real currency? An economic appraisal. In *Handbook of digital currency* (pp. 29-40). Academic Press.

Zhao, J. L., Fan, S., & Yan, J. (2016). Overview of business innovations and research opportunities in blockchain and introduction to the special issue. *Financial innovation*, *2*, 1-7.

Article history:	Received: 29.6.20 25.
	Revised: 23.10.2025.
	Accepted: 8.11.2025.