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New age of money transfer: CBDCs

Abstract: This paper provides a comprehensive analysis of Central Bank Digital Currencies (CBDCs), examining their potential to transform the global financial landscape. It explores the three primary models of CBDC issuance: direct, indirect, and hybrid, detailing their operational complexities, privacy concerns, financial inclusion potential and regulatory challenges. The study also delves into cross-border CBDC initiatives, assessing various models for enhancing payment system interoperability and cooperation among central banks. Additionally, the paper addresses critical issues such as cybersecurity risks and privacy implications associated with CBDCs, emphasizing the need for robust regulatory frameworks and technological safeguards. Overall, the findings highlight the promising yet complex role of CBDCs in improving transactional efficiency, expanding financial access, and reinforcing monetary security in an increasingly digital economy.
Keywords: Central Bank Digital Currency (CBDC); Cross-Border Payments; Financial Inclusion; Privacy Concerns; Cybersecurity Risks.

Összefoglalás: A jelen tanulmány átfogó elemzést nyújt a központi banki digitális valutákról (CBDC), megvizsgálva a globális pénzügyi környezet átalakítására képes potenciáljukat. Feltárja a CBDC kibocsátásának három elsődleges modelljét: a közvetlen, a közvetett és a hibrid változatot, részletezve működési bonyolultságukat, adatvédelmi aggályaikat, a pénzügyi integráció lehetőségét és a szabályozási kihívásokat. A tanulmány a határokon átnyúló CBDC-kezdeményezésekkel is foglalkozik, felmérve a fizetési rendszerek interoperabilitásának és a központi bankok közötti együttműködés javításának különböző modelljeit. Ezenkívül a dokumentum olyan kritikus kérdésekkel foglalkozik, mint a kiberbiztonsági kockázatok és a CBDC-kkel kapcsolatos adatvédelmi vonatkozások, hangsúlyozva a szilárd szabályozási keretek és technológiai biztosítékok szükségességét.

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Összességében az eredmények rávilágítanak a CBDC-k ígéretes, mégis összetett szerepére a tranzakciós hatékonyság javításában, a pénzügyi hozzáférés bővítésében és a monetáris biztonság megerősítésében az egyre inkább digitálissá váló gazdaságban.
Kulcsszavak: Központi banki digitális valuta (CBDC); határon átnyúló fizetések; pénzügyi befogadás; adatvédelmi aggályok; kiberbiztonsági kockázatok.

Introduction

In the ongoing evolution of the global finance system, the emergence of the Central Bank's Digital Currencies can be viewed as a significant point, which will define the new dynamics of monetary exchange and finance interaction [1]. With such common practices in the banking system taking a new form in the digital innovation context, the role of the CBDCs in the global finance architecture may become one of the central themes, causing far-reaching consequences for cross-border transactions and contradict the traditional practice of corresponding banking [2].

The discussion on central bank digital currencies is essentially based on the potential role that they can play in the current global financial ecosystem [3]. It should be noted, that CBDCs differ from cryptocurrencies in that they are regulated and issued by the central bank [4]. This implies a new role of the central bank as a direct issuer of digital cash and requires a detailed discussion on the impact and potential for CBDCs to become a substitute for correspondent banking, the system already in place in which a bank performs transactions on behalf of another bank.

A closer look at CBDCs will show that their introduction poses a range of opportunities and challenges. On the one hand, there is the strong possibility of greater inclusivity and creating abilities and scales that allow transferring money to any country in a matter of seconds. Improved efficiency can be seen as another potential advantage which, however, depends on whether the transactions are made in real-time, or their execution is deferred. With the conveniences of usage, however, comes the disadvantage of risks and potential challenges.

[1] Yamaoka, H. (2022): *Digital Currencies and the Future.*

[2] Foster, K. (2021): Digital Currencies and CBDC Impacts on Least Developed Countries (LDCs). *The Dialogue on Global Digital Finance Governance Paper Series.*

[3] Engen, O. (2019): *Central Bank Digital Currency.*

[4] He, D. (2021): Digitalization of cross-border payments. *China Economic Journal,* 14., (1.), pp. 26–38.

Literature Review and Theoretical Framework of Central Bank Digital Currencies (CBDCs)

An understanding of the theoretical framework of CBDCs is crucial for making any assumptions about its potential impact on the financial system and society. As such, the most important points of consideration as stipulated in the theoretical framework are outlined below:

Monetary Policy Implications: One of the most significant purposes of CBDCs is the utility provided to the central banks. By creating and controlling CBDCs, the central banks could control interest rates, affect inflation, and stabilize the economy through transmission effects [5]. The theoretical framework of CBDCs underlines its ability to improve the effectiveness of the monetary policy transmission mechanism and enhance macroeconomic outcomes.

Transaction Efficiency and Cost Reduction: CBDCs have the theoretical capability to improve payment systems and decrease transaction costs. The speed with which digital technology works makes the CBDC transactions faster compared to the traditional methods [6]. The theoretical framework of CBDCs demonstrates that their use is advantageous in the capacity to increase the speed, trustworthiness, and cost-effectiveness of financial transactions.

Technological Infrastructure and Security: The integrity and security of CBDCs are ensured by advanced technological instruments. For instance, blockchain technology and cryptographic processes are used to protect the development of CBDCs in the digital form. The theoretical perspective emphasizes that proper encryption techniques and cybersecurity mechanisms are integral in preventing an individual's or organization's CDBCC from being hacked, defrauded, or accessed without permission [7].

International Implications and Interoperability: The theoretical implications of CBDCs can also be observed in the context of international monetary systems and cross-border transactions. The consideration conducted in the theoretical framework demonstrates the fact that CBDCs are expected to be adopted in different countries and supported by many central banks, and it will contribute to the need for these institutions' coordination in the process of establishing the prevalent approach to the resolution of such issues as currency exchange, monetary sovereignty, and regulatory arrangements.

[5] Ms. Mitali Das (2023): *Implications of Central Bank Digital Currencies for Monetary Policy Transmission.*

[6] Michael Kumhof a, C. N. (2021): Central bank digital currencies — Design principles for financial stability. *Economic Analysis and Policy,* Volume 71.

[7] Varonin, A. (2021): *Central bank digital currencies: the historical view, technologies, and perspectives.*

Comparative Analysis of CBDC Models

Central Bank Digital Currencies can be implemented in several ways, with each way having its own set of characteristics and implications. A comparative analysis of different CBDC models can help understand the differences between them and the consequences these models have.

Direct Issuance Model

In the direct issuance model, central banks issue their CBDCs directly to end-users. Instead of relying on financial intermediaries such as commercial banks, members of the general public and firms get access to the medium of exchange directly. Namely, digital currency tokens are placed on accounts on the books of central banks, which they can then use for payments and other transactions. Such an implementation allows a monetary authority to control the money supply more directly and execute monetary policy more efficiently [8]. By avoiding commercial banks as intermediaries, the direct issuance model eliminates the counterpart risk. Moreover, in this model, financial authorities have direct access to the details of transactions between individual and corporate accounts on CBDCs, which raises privacy concerns.

Indirect Issuance Model

On the other hand, there is also an indirect issuance model, where central banks distribute CBDCs through commercial banks or other financial representatives. Both individuals and companies access CBDCs through their accounts opened with intermediaries, who hold CBDCs reserves with the central bank. Indirect issuance maintains an existing intermediately function of commercial banks preserving banking-related services and extending loans [9]. This model helps avoid operational and other costs associated with direct issuance. The high reliance on commercial banks can, however, adversely affect financial stability if the banks become weak links in the chain, which can happen due to the ever-present possibility of bank failures.

[8] Redaelli, S. (2022): *CBDC and Bank Run in an open economy context.*

[9] George, A. (2019): *Essays on innovation, central bank digital currency, and asset pricing.*

Hybrid Approach

The hybrid approach combines direct and indirect issuance and represents a flexible and agile model for CBDC implementation. Under this model, central banks may decide to issue CBDCs directly to some entities or citizens while providing indirect issuance of CBDCs through commercial banks to others. Together with diversification benefits, the hybrid approach allows the central banks to adjust the mechanisms of CBDC issuance to a particular use case and beneficiaries. Hybrid issuance also leads the concentration risk when only a single channel for CBDC distribution is used [10]. Nonetheless, the hybrid approach might bring management challenges in the form of the coordination of multiple channels for CBDC issuance. In particular, regulatory coherence of direct and indirect issuance might present a challenge. Moreover, identifying target audiences for direct and indirect channels of CBDC issuance might be difficult and require access to large-scale data and corresponding analytical capabilities.

[10] Kondova, S. M. G. (2023): The Potential Impact of Central Bank Digital Currencies (CBDCs) on Economic and Financial Sector Development. *International Congress on Information and Communication Technology.*

Table 1. Comparison of the key aspects of each CBDC model

Aspect	**Direct Issuance Model**	**Indirect Issuance Model**	**Hybrid Approach**
Issuance Mechanism	Central banks issue CBDCs directly to end-users	Central banks distribute CBDCs through banks	Combination of direct and indirect issuance
Control Over Money Supply	Central banks have direct control over issuance	Central banks delegate issuance to intermediaries	Mixed control through direct and indirect means
Financial Intermediation	Bypasses commercial banks	Utilizes existing banking infrastructure	Combination of direct and intermediary access
Counterparty Risk	Reduced due to direct issuance	Exists due to reliance on commercial banks	A mix of direct and indirect risks
Operational Complexity	This may be high due to managing individual accounts	Relatively lower due to leveraging banks	Moderate complexity due to dual issuance

[11] Marinos Themistocleous (2023): Towards cross-border CBDC interoperability: insights from a multifocal literature review. *Journal of Enterprise Information Management,* 36., (5.).

Aspect	**Direct Issuance Model**	**Indirect Issuance Model**	**Hybrid Approach**
Privacy Concerns	Central banks may have access to detailed transactions	Intermediaries may access transaction data	Privacy concerns depend on the implementation
Financial Inclusion	Potentially high due to direct access to CBDCs	Depends on the reach and accessibility of banks	Enhanced by targeting underserved populations
Regulatory Alignment	Direct oversight by central banks	Compliance with commercial bank regulations	Requires coordination between different systems
Flexibility	Limited by centralized issuance	Relatively higher due to intermediary channels	Offers flexibility in reaching diverse

Source: The table was created for the above-mentioned facts.

Exploring Cross-Border CBDC Initiatives

Central banks all over the world collaborate and research to develop Central Bank Digital Currencies to enhance cross-border payments. As a result, many initiatives try to turn the work into an experimentation program to investigate CBDC arrangements. Three distinct models delineate the varying degrees of payment system interoperability and collaboration:

Enhanced Compatibility among Domestic CBDC Systems: Several central banks work in this direction, which is seen among the members of the Committee on Payments and Market Infrastructures [11]. The point is that enhanced compatibility among domestic CBDC systems implies coordinating regulatory frameworks, data standards, and market practices to support cross-border payments. Thus, recent efforts of several financial institutions to focus on common data standards, which could be used as a basis for compatibility, indicate that their CBDC systems are aligned with international norms.

Interlinking CBDC Systems: Some projects have shown how domestic wholesale CBDC networks can be connected across countries.

This approach removes settlement risk as payment actions are synchronized and do not rely on any trusted intermediary or common platform. Other initiatives describe the advantages and complexities of using wholesale CBDCs to settle cross-border transactions and explain how central banks and private enterprises can effectively cooperate. Establishing a single multilateral CBDC system: Aber, and BIS Innovation Hub projects [12] and initiatives aim to build one platform through which numerous digital currencies can transact. Corridor networks are implemented to connect distinct domestic wholesale CBDC networks. This approach enables cross-border payments to take place without the need for complex legislation, correspondent banking networks, or currency arrangements.

[12] Athanassiou, P. L. (2020): *Wholesale central bank digital currencies: an overview of recent central bank initiatives and lessons learned.*

Advancing Cross-Border Payments through Central Bank Digital Currencies

Individual Jurisdiction CBDCs: For cross-border payments, several configurations of CBDCs can be discussed. One potential scenario is that CBDCs originating from their respective single jurisdictions are capable of being accessed globally (Gabriel Soderberg, 2022). As such, access to these digital currencies may be limited, and certain characteristics and features of these CBDCs, including their anonymity and regulation, may mirror the position selected by their issuing bodies.

Cooperative CBDC Arrangements: Alternatively, to improve CBDCs' cross-border operability, central banks consider the development of cooperative frameworks. Such configurations include the interaction of multiple central banks aimed at forming a uniform market and technological infrastructure (Banerjee, 2020). Thus, the overall goal of numerous initiatives is to enable transactions across multiple CBDCs regardless of geopolitical boundaries and regulations.

Perspectives of Central Banks: A thorough review of the central bank survey illustrates the persistent uncertainty surrounding this issue. Notably, there is a tendency among these institutions to consider the potential of CBDC in the context of non-residents in their respective countries. However, there are doubts related to the international application of domestic coins. This tendency can be associated with emerging concerns about the effectiveness of control on the international use of CBDC and appropriateness for compliance with monetary policy requirements.

Illustrative Case Studies

Examining ongoing CBDC initiatives provides valuable insights into potential cross-border implementations:

China's e-CNY Project: China's Digital Currency known as e-CNY, exemplifies a nuanced approach towards international usage [13]. Initially tailored for domestic retail transactions, e-CNY could extend its reach to foreign tourists and business travelers through collaborative agreements with foreign jurisdictions.

The Bahamas' Sand Dollar: The Bahamas' CBDC is focused mainly on domestic financial inclusion [14]. Nevertheless, non-residents may also access Sand Dollars, yet within the stipulated limits and through traditional banking channels.

The ECCB's D-Cash: The Eastern Caribbean Central Bank D-Cash project is intended for frictionless border transactions within the Eastern Caribbean Currency Union. The focus on financial inclusion and trade within the region highlights the true potential of CBDCs for cross-border economic integration [15].

Advantages of CBDCs in Global Financial Transfers

Real-Time Transactions: CBDCs enable real-time transactions, facilitating instant settlement of payments across international borders [16]. Such transactions are made possible by the absence of intermediary banks and clearance processes, which reduce both the time and cost taken to complete a transaction. Instant settlement offers improved liquidity management and reduced counterparty risk, thereby boosting the efficiency of global financial transfers.

Broadened Financial Access: CBDCs can broaden financial access as they provide digital ways to transact for citizens and organizations using both banking and less-known banking infrastructure [17]. Providing peer-to-peer transactions and online payments, CBDCs enable the unbanked and underbanked to take part in economics. Broadened financial access facilitates economic inclusion by growing the economy and narrowing income inequality by providing equal access to financial services for everyone.

Enhanced Security Measures: CBDCs use advanced cryptographic methods and blockchain technology to enhance security measures in global financial transactions.

[13] Oriol Caudevilla, H. M. K. (2022): *The Digital Yuan and Cross-Border Payments: China's Rollout of Its Central Bank Digital Currency.* Hong Kong: University of Hong Kong, Faculty of Law.

[14] Sisodia, H. (2024): *Case Study on the Sand Dollar CBDC of the Bahamas: Lessons, Challenges, and Insights.* Exploring Central Bank Digital Currencies: Concepts, Frameworks, Models, and Challenges.

[15] Chen, X. (2023): Privacy Protection in the Context of CBDC: *Development Trends and China's Practice.* 16., (2.).

[16] Mehl, M. F. a. A. (2021): *Central bank digital currency and global currencies.*

[17] Sakharov, D. (2021): *Central Bank Digital Currencies: Key Aspects.*

These enhanced security measures prevent various cyber threats, including hacking attacks, data breaches, and identity theft, which protect the integrity of the financial system and create trust in digital transactions.

Challenges and Considerations for CBDC Implementation

Privacy Concerns: More specifically, the use of CBDCs raises serious privacy concerns due to the constant gathering and application of transactional data [18]. Because of the nature of CBDCs as a medium of exchange, continual surveillance of the population's financial activity by central banks or other official institutions can be considered a serious privacy violation. At the same time, transparency in tracking and preventing various illegal activities is a top regulatory priority. Therefore, the efficient implementation of central bank digital currencies implies a necessary balance between these concerns.

Cybersecurity Risks: There is a variety of cybersecurity risks concerning CBDCs, which include possibilities of hacking, data loss, and malicious assault of digital infrastructure. Implementation of these attacks could undermine the credibility of CBDC transactions while provoking financial losses, identity thefts, and even the collapse of the financial system [19]. Therefore, central banks and regulatory authorities need to enforce strong cybersecurity measures, including encryption, authentication protocols, and non-stop monitoring of digital networks. However, these actions could be insufficiently effective owing to the adaptive nature of cyber threats.

Summary

This comprehensive analysis of Central Bank Digital Currencies (CBDCs) juxtaposed against the correspondent banking system elucidates the transformative potential of digital currencies in reshaping the global financial landscape. Through the lens of the direct, indirect, and hybrid models of CBDC issuance, this paper has delineated the operational intricacies and implications of integrating CBDCs into the financial ecosystem, highlighting their capacity to enhance transactional efficiency, broaden financial inclusion, and fortify the security of monetary exchanges.

[18] Mohamed, H. (2020): *Implementing a Central Bank-Issued Digital Currency with Economic Implications Considerations.* 3., (1.).

[19] Delak, T. H. a. K. (2022): Security Considerations for a Central Bank Digital Currency. *Economic Research.*

The exploration of CBDCs reveals a paradigm shift towards digitalization in the financial sector, promising significant advancements in the speed and accessibility of transactions. CBDCs, as regulated and central bank-issued digital currencies, stand in stark contrast to decentralized cryptocurrencies, embodying a state-backed endeavor to meld the benefits of digital currency with the regulatory and stability assurances of traditional monetary policy. The theoretical and practical analyses underscore the potential of CBDCs to catalyze inclusive financial participation, providing unbanked and underbanked populations with unprecedented access to financial services.

In conclusion, CBDCs represent both an opportunity and a challenge for the global financial architecture. Their integration into the financial system promises to enhance transactional efficiency, expand financial access, and improve security. However, realizing these benefits while mitigating associated risks requires careful consideration of the operational, regulatory, and technological dimensions of CBDC implementation. As central banks and financial institutions navigate the complexities of digital currency integration, the evolution of CBDCs and their interplay with existing financial mechanisms will undoubtedly continue to be a focal point of scholarly and policy-oriented discourse.