

CENTRAL BANK DIGITAL CURRENCIES AND FINANCIAL STABILITY: LITERATURE REVIEW AND NEW QUESTIONS

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The continuous development of money and payment instruments is a matter of concern for each central bank. As a response to the use of cryptocurrencies, more and more central banks intend to issue digital currencies - the so-called Central Bank Digital Currency (CBDC). Information Technology progress and new financial elements determine central banks' adaptation to these new challenges. All over the world, central banks have explored the opportunity of issuing CBDC at different stages; some banks are conducting research, others are in the testing phase, and only a select few have begun distributing digital currency to the public. Against this background, our review paper aims to analyze the existing literature about central bank digital currency and contextualize it with financial stability. On the one hand, we underline the main research directions on this topic. On the other hand, we use VOSviewer software to identify the most frequent and essential keywords and the nodes between keywords characterizing the link between CBDC and financial stability. We show that CBDC issuance has complex implications for the economic and financial system. Central banks must carefully consider the design features of digital money and the potential benefits and risks of CBDC.

Keywords: Digital currency, CBDC, Financial stability, Literature review, Bibliometric analysis

JEL Classification: E42, E52, G21, O31

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1. Introduction and definition of CBDC

Money can be seen as a representation of a contract between parties involved in a transaction. The three primary functions of money are serving as a medium of exchange, a store of value, and a unit of account. Throughout human history, money has been used in different forms, from barter to digital money, and its role has evolved as society changes. Initially, people survived without the use of money; barter was an accepted form of exchange; gradually, different items (arrowheads, shells, salt, cattle) were used to represent value and make payments. Further progress was made in using metallic money, and gold and silver (valuable metals) were minted for physical coins. Later, banks and governments replaced coins from precious metals with other forms of currency, coins from cheaper metals, and banknotes. Currently, people from all around the world are facing another essential step in the history of money; CBDCs can be seen as the next step in the evolution of money, offering the potential to introduce new functionalities and capabilities.

The central bank's role is to establish trust in its currency and to ensure and maintain price stability for a nation or a group of nations. Additionally, central banks are vital in upholding financial stability. The functions assumed by the central bank are to oversee and manage a country's monetary (monetary policy objectives) and financial system (objectives related to financial stability), ensuring that it remains stable, efficient, and responsive to the needs of the economy and its citizens. The continuous development of money and payments in society is a matter of concern for each central bank, as they increasingly intend to issue their own digital currencies, the so-called central bank digital currency (CBDC). The emergence of crypto-assets, blockchain technology, FinTech, information technology, market dominance by BigTech companies, and the exponential development of these new financial elements determine central banks' adaptation to these new challenges. Thus, more than 100 central banks around the world have explored this field of CBDC at various stages; some are conducting research, others are in the testing phase, and only a few are already distributing CBDC to the public, all recognizing that the launch of CBDC should not be excessively delayed. In this context, several questions arise: What are the potential benefits of CBDC? What are the potential risks of CBDC? What is the impact of CBDC issuance on financial stability or the non-issuance of these digital currencies? What does it mean to issue a digital currency?

Central Bank Digital Currency (CBDC) is a digital version of central bank money that can function as a means of payment, a store of value, and a unit of account. CBDC is issued and backed by the central bank, making it a liability of the central bank, just like physical cash. The Bank for International Settlements (BIS 2018) defines Central Bank Digital Currency (CBDC) as a digital payment instrument that is issued by a central bank and represents a direct claim on the bank. CBDC is denominated in the national unit of account and can be used as a means of payment, a store of value, and a unit of account. It represents a digital form of central bank currency, distinct from both commercial bank deposits and physical

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cash. CBDC constitutes a liability for the central bank, signifying a claim on the central bank by the CBDC holder.

CBDC aims to offer a digital substitute for physical currency and improve the efficiency, safety, and inclusiveness of payment systems. CBDC can also facilitate monetary policy implementation by providing the central bank with a more direct and effective tool to manage the money supply and interest rates. Due to the increased demand for digital payment methods in retail and the decreasing use of cash (Auer and Böhme, 2020), central banks globally are exploring the potential adoption of CBDCs as an alternative currency option. CBDC represents a digital version of fiat currency issued and endorsed by a nation's central bank, contrasting with decentralized cryptocurrencies like Bitcoin, which lack central authority backing.

CBDC could be used in two forms: 'wholesale CBDC' is explicitly crafted for utilization by financial institutions, such as banks, to facilitate interbank payments and settlements (Paneta F, 2022), and 'retail CBDC' refers to a digital currency issued for the general public (BIS: Executive summary, 2021).

However, the launch of CBDC is not straightforward and, for the moment, represents an experiment associated with digital innovation. In this context, new literature has emerged investigating the role of CBDC, as well as its determinants and implications. In this line, a series of papers provides a theoretical background of CBDC issuance, analyzing the cost and benefits (Agur et al., 2022; Bindseil, 2021) or the crowding-out effect of CBDC on intermediation (Fernández-Villaverde et al., 2023; Li, 2023) and payment choices (Borgonovo, 2021), using different modeling specifications as payment portfolio models (Bian et al., 2021), monetary policy models (Davoodalhosseini, 2022; Kim and Kwon, 2019), or dynamic stochastic equilibrium models (Brunnermeier and Niepelt, 2019; Chiu and Keister, 2022). Another aspect of the literature empirically investigates the determinants of CBDC adoption (Alfar et al., 2023; Alonso et al., 2021) or the implications on financial and price stability (Chen and Siklos, 2022; Elsayed and Nasir, 2022), economic growth (Daud and Ahmad, 2023) or financial uncertainty (Dunbar, 2023). Finally, a last set of studies, closely related to ours, perform a deep literature review and designs the future avenues of research (Auer et al., 2022; Bhaskar et al., 2022; Chapman et al., 2023; Hoang et al., 2023; Kuehnlenz et al., 2023; Panetta et al., 2023).

Building on previous works we contribute to the literature in several ways. First, we perform a literature review investigating the context of the central bank's digital currency appearance, the role, and the implications of CBDC adoption and contextualize it with financial stability. Second, we develop a bibliometric analysis using VOSviewer software to identify the most frequent and essential keywords related to CBDC. The VOSviewer visualization offers a detailed overview of the research landscape on CBDCs, emphasizing the interconnected themes and issues. Each cluster highlights a significant area of focus, including financial

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system stability, technological foundations, regulatory challenges, economic impacts, and financial inclusion. This comprehensive mapping not only helps to identify key research areas and their interconnections but also serves as a valuable guide for future studies in the rapidly developing field of digital currencies, showcasing the practical implications of this research.

2. Literature review: context, role and implications

The rise of digital payments among consumers has triggered significant and rapid changes in the financial and banking industries. However, the use of CBDCs as a response to these challenges is not straightforward. Central banks in advanced economies have published reports highlighting a variety of motivations for issuing retail CBDCs, as well as counterarguments. We have classified the pros and cons of CBDC's use in Table 1.

Table 1. Motivations for issuing - Pros and cons of CBDCs

Motivation	Pros	Cons
Ensuring Adequate Central Bank Money	- Maintains the public's access to risk-free central bank money.	- Requires significant infrastructure investment.
Preserving Central Bank Seigniorage	- Continues revenue from issuing currency as cash use declines.	- Potential public resistance to digital-only currency.
Enhancing Monetary Policy Transmission	- Allows for more precise control over money supply and interest rates.	- Could disrupt existing financial institutions and intermediaries.
Supporting Financial Stability	- Offers a safe, liquid digital asset that can reduce risks like bank runs	- This could lead to the destabilization of traditional banking systems and reliance on central bank liquidity.
Promoting Financial Inclusion	- Provides access to financial services for unbanked populations.	- Risk of digital exclusion for those lacking technology access or skills.
Improving Payment System Efficiency	- Reduces transaction costs and increases the speed of payments.	- Cybersecurity risks and operational complexities.
Encouraging Competition and Innovation	- Fosters competition, promotes innovation and provides more payment choices.	- This may lead to fragmentation of payment systems if they are not universally accepted.
Combating Illicit Activities	- Provides a traceable, secure alternative to cash, helping combat financial crimes.	- Raises concerns about privacy and surveillance of financial transactions.
Maintaining Monetary Sovereignty	- Ensures central bank control over national currency and monetary policy.	- Potential conflict with private sector digital currencies and international reserve currencies.
Responding to Technological Advancements	- Keeps monetary systems up-to-date and secure in the face of technological changes.	- Requires ongoing adaptation to fast-evolving technologies and standards.

Source: Author's own interpretation

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We detailed some of the motivations underlining the source and some ideas from the paper mentioned:

Ensuring adequate central bank money and Preserving Central Bank Seigniorage. Revenue Seigniorage is the profit made by the central bank through the issuance of currency. CBDCs can help central banks maintain this revenue stream by reducing the use of physical currency, which is costly to produce and distribute. (Engert and Fung, 2017)

Enhancing Monetary Policy Transmission. CBDCs can help central banks implement monetary policy more effectively by providing a direct channel for injecting liquidity into the economy. CBDCs can also enable better monitoring of money flows (Engert and Fung, 2017). Researchers have indicated that, if properly managed, a sovereign digital currency can enhance the monetary policy toolkit of a central bank (Barrdear and Kumhof, 2021).

According to some authors (Keister and Monnet, 2022), a well-designed CBDC **may enhance rather than weaken financial stability**. The study suggests that CBDCs may help mitigate bank runs by providing an alternative means of payment and a safe asset for households and firms to hold (Kumhof and Noone, 2021). Furthermore, CBDCs have the potential to enhance the resilience of the financial system by providing a secure and efficient means of settlement for interbank transactions (Agur et al., 2022).

Promoting Financial Inclusion. CBDCs can potentially provide access to financial services for unbanked or underbanked individuals, which is a crucial step towards financial inclusion. (Alonso, Jorge-Vazquez, & Forradellas, 2020).

Improving payments efficiency and safety. CBDCs can potentially reduce transaction costs, increase the speed of payments, and facilitate cross-border payments, which could all contribute to greater payment system efficiency (BIS, 2022).

Encouraging Competition and Interoperability. CBDCs can act as a neutral technology platform, encouraging public-private partnerships and API company's software internally (API stands for Application Programming Interface and denotes the various methods by which one company can communicate with another). By facilitating competition and interoperability, CBDCs can promote innovation and provide more excellent choices to consumers. (Visa Economic Empowerment Institute, 2022)

Combating illicit money use. CBDC may also enhance the economy by diminishing the extent of the shadow economy (Alonso et al., 2021). Several researchers have suggested that, when effectively managed, a sovereign digital currency can broaden the monetary policy toolkit of a central bank (Barrdear and Kumhof, 2021).

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Enhancing competition for e-money payment providers. Electronic payment services in some countries are predominantly controlled by a few major private-sector providers. A retail CBDC could potentially enhance competition, reduce transaction costs, and expand options for both merchants and consumers (ECB – Bindseil, 2021).

Several **potential risks** have been identified in research studies that are associated with issuing Central Bank Digital Currencies (Table 2). We present a table that outlines the potential risks, along with their pros and cons.

Table 2. Potential risks to the CBDC's use

Risk	Pros	Cons
Financial Disintermediation	- Direct access to central bank money may reduce the reliance on commercial banks.	- Could lead to reduced bank deposits, impacting banks' ability to lend and manage liquidity.
Operational and Cybersecurity Risks	- Incentivizes investment in robust cybersecurity measures and infrastructure.	- High risk of cyber-attacks, fraud, and technical failures that could disrupt financial systems.
Privacy Concerns	- CBDCs can offer controlled levels of anonymity, balancing transparency and privacy.	- Increased government surveillance could lead to concerns about loss of privacy and civil liberties.
Monetary Policy Impacts	- Provides new tools for monetary policy implementation, such as negative interest rates.	- Unpredictable effects on monetary policy transmission and financial markets.
Impact on Commercial Banks	- Encourages innovation and competition in the banking sector.	- May destabilize traditional banking models, leading to bank runs or reduced profitability.
Cross-Border Risks	- Facilitates more efficient cross-border payments and reduces transaction costs.	- Potential for increased capital flight, currency substitution, and challenges to monetary sovereignty.
Economic Inequality	- Could promote financial inclusion by providing universal access to digital money.	- Risk of exacerbating inequality if access to digital infrastructure is uneven or exclusive.
Transition and Implementation Challenges	- Encourages modernization of the financial system with advanced technology.	- High implementation costs, need for extensive public education, and potential for transitional disruptions.
Legal and Regulatory Challenges	- Opportunities to update legal frameworks to better handle digital assets.	- Complexities in developing and enforcing regulations that ensure security, privacy, and compliance.

Source: Author's own interpretation

These risks are not exhaustive, and other risks may arise depending on the design and implementation of CBDC. We detailed some of the risks and underlined the source. Studies conducted in the field have pinpointed:

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Privacy Risks: CBDC could potentially compromise users' privacy if the central bank is able to track every transaction made using the digital currency (Borgonovo et al., 2021; Chiu and Keister, 2022).

Cybersecurity Risks: Given that a CBDC is a digital currency, it is susceptible to cyber-attacks. If the CBDC system is not secure, it could be subject to hacking, cyber theft, or other types of cyber threats. The findings reveal that central banks' sentiment towards CBDC improved after significant losses from cyberattacks on crypto assets, indicating they perceive CBDC as a public tool to safeguard consumers. In contrast, their sentiment deteriorated with the increase in cyberwarfare attacks, underscoring concerns about potential systemic threats to national financial systems (Tian et al., 2023).

Financial Stability Risks: The introduction of a CBDC could bear implications for financial stability. It could result in a shift of deposits from commercial banks to the central bank, which could affect the liquidity and stability of the banking system. There is a potential increase in the systemic risk if the CBDC is seen as a safer asset during times of financial stress, possibly triggering bank runs. Proper design features, such as interest-bearing CBDCs and limits on CBDC holdings, can help mitigate some of these risks (Infante et al. I, 2023).

Operational Risks: The implementation of a CBDC requires a complex infrastructure and operational framework. Any operational failures or malfunctions could cause significant disruptions to the financial system. The risks we mentioned can include Operating Risks (failures in processes and controls, inadequate processes, and lack of training), Technology Risks (technological failures, maintenance issues, and interoperability challenges), Third-Party Risks (dependence on external vendors for technology and operations introduces significant risks) Business Continuity Risks (natural disasters, supply chain disruptions, and high dependence on private sector infrastructure can impact CBDC operations) displayed in BIS paper (Bank for International Settlements, Central bank digital currency (CBDC) information security and operational risks to central banks, 2023).

Adoption Risks: The success of a CBDC depends on how widely it is adopted by the public. If the public is not willing to use the digital currency, it could undermine its effectiveness and usefulness. Adoption is interdependent: households are more likely to adopt CBDC if more firms accept it, and firms are more likely to accept CBDC if more households use it. The design of CBDC must balance between maximizing adoption and minimizing potential risks to the financial system, such as the disintermediation of banks and payment systems. Greater adoption of CBDC can result in significant benefits for financial inclusion and economic formalization but may also pose challenges for traditional banking models (Tan, 2023).

Legal and Regulatory Risk: The introduction of CBDC may require changes to existing legal and regulatory frameworks, which could be challenging to implement and enforce. Introducing

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a CBDC involves navigating complex legal frameworks, including Central Bank Law, Monetary Law, and various E.U. legislative directives, for the digital euro. Legal frameworks must ensure that the digital euro complies with Anti-Money Laundering (AML) and Counter Financing of Terrorism (CFT) regulations. This includes robust mechanisms for transaction monitoring, identity verification, and reporting obligations. Implementing Central Bank Digital Currencies brings significant data privacy and security challenges. Ensuring robust mechanisms to protect user data while maintaining the integrity and security of the digital currency system is essential. Data Privacy and Security E.U.'s General Data Protection Regulation (GDPR) will apply to the digital euro, requiring strict data privacy and security measures to protect user information (Cipollone, 2022).

Mitigation strategies that could be used to address these risks include designing CBDC to be compatible with existing payment systems, thereby minimizing the risk of a sudden withdrawal of bank deposits; conducting extensive testing and simulation exercises to identify and address operational risks before implementation; ensuring that CBDC infrastructure is secured by adopting robust cybersecurity measures; developing a regulatory framework that takes into account the unique characteristics of CBDC and that is flexible enough to adapt to future changes.

The frequent use of electronic payments by an increasingly large part of the general public, the domination of markets by BigTech companies carrying out financial operations, the emergence of FinTechs, the use of technological progress, the legal vacuum in regulating crypto-assets (here we note the ongoing efforts made at European and international level, for example, the proposal of the MiCA Regulation¹), in addition to the imperative for enhanced financial inclusion and the facilitation of more economical cross-border transactions, there are arguments supporting the adoption of a digital currency issued by central banks.

Currently, the four reports issued by the Bank for International Settlements (BIS 2020, BIS 2021) in collaboration with the world's leading central banks seek to provide as many answers as possible to natural questions in this new field of CBDC. The mandate of the central banks is clear: monetary stability and financial stability, and the promotion of public access to safe and efficient payments is achieved through the primary currency created directly by the central bank (the primary currency, the monetary base is made up of cash and the availability in the current accounts of credit institutions opened with the central bank (Cerna, 2009). This is a condition for central banks to deliver confidence in the new configuration where the continuous digitalization of the economy changes the way people make payments. Each country (jurisdiction) is sovereign in deciding whether to implement a digital currency, and there is no model to follow, but common principles and features of the CBDC are

¹ The European Regulation on markets for crypto-assets, which is part of a broader package on digital finance, requires a unified approach across the European Union that stimulates technological development and ensures financial stability and consumer protection, <https://eur-lex.europa.eu/legal-content/RO/TXT/HTML/?uri=CELEX:52020PC0593&from=EN>

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highlighted in supporting the financial systems needed to contribute to the objectives of the central bank. The principles in these reports emphasize that: (I) a central bank should not compromise monetary or financial stability by issuing a CBDC ("Do no harm" – do not interfere or prejudice the achievement of the central bank's fundamental objective); (II) a CBDC should coexist and complement existing forms of money ('Coexistence' between new forms of money (CBDC) and old forms of primary currency (cash and reserves of commercial banks at the central bank) must complement each other and coexist with scriptural money); and (iii) a CBDC should promote innovation and efficiency ("Innovations and efficiency" so that users do not adopt other less secure instruments or currencies that may harm monetary policy and financial stability (BIS 2020). The negative impact of a CBDC can be manifested by the effects of financial disintermediation (reduction of liquidity in the system), reduction of deposits in commercial banks (migration of money from bank deposits to CBDC), low adoption/acceptance by users, cyber risk, confidentiality, and governance, this sequence being non-exhaustive.

The CBDC idea and macro-financial implications were analyzed in a study by the International Monetary Fund (IMF, 2020), where we find complex interactions on the adoption and utilization of CBDC across international borders may give rise to macro-financial repercussions, including heightened pressures to phase out physical coins; exacerbation of vulnerabilities stemming from currency inconsistencies; potential diminishment of the maneuverability of local authorities, particularly central banks, in executing monetary policy and ensuring financial stability. In the absence of adequate safeguards, CBDCs could inadvertently facilitate illicit capital flows, posing challenges for regulators in enforcing capital flow restrictions and implementing regulatory measures. Monetary competition following the adoption of CBDC could lead to better risk-sharing in the long term.

The House of Lords (Committee on Economic Affairs, 2022) has published a study with the Bank of England and the U.K.'s Ministry of Finance (H.M. Treasury), where we find that no decision has yet been made on introducing a CBDC in the U.K. Currently, in the "research and exploration" phase, the answer is being sought as to whether a digital currency issued by a central bank might be necessary or not. In April 2021, the Bank of England and the H.M. Treasury initiated the CBDC Joint Task Force to coordinate the exploration of a potential digital currency where relevant industry, civil society, and academic stakeholders provide strategic and technical input to the work on CBDC (Bank of England and the Ministry of Finance of Great Britain, 2021).

CBDC could affect financial stability as the financial system evolves, changing financial market structures and current business models. The effects of financial disintermediation (decreasing liquidity in the system) and reduced deposits in commercial banks (migration of money from bank deposits to CBDC) are likely to manifest (BIS 2021). Assuming that CBDCs would most likely be offered to minimize the risks of criminal use and money laundering, it examines how any framework of the new currency could also include guarantees, reducing

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uncertainty during any transition, and CBDCs serve mainly as a payment method rather than a savings tool.

The implementation of a CBDC not only entails the related risks but also needs to be seen from the perspective that it could provide several advantages; for example, they could supply households and businesses with a convenient form of electronic money issued by the central bank, providing associated safety and liquidity; provide entrepreneurs with a platform for developing new financial products and services, support faster and more cost-effective payments (including cross-border transactions), and extend access to the financial system for consumers, serving as a bridge between different payment services; maintain the fundamentals of the central bank as a provider of security and trust in the money generated by it, i.e., an adaptation to an economy that is rapidly digitizing. CBDC could affect the market structure of the financial sector and could influence the cost and accessibility of credit, the security and stability of the financial system, and the efficacy of monetary policy. (BIS 2020, BIS 2021).

The European Central Bank, in the "Digital Euro Report" (ECB, 2020), identified a number of elements related to the CBDC, similar to the characteristics and principles reiterated by the BIS (2020). If the digital euro comes into existence, it should promote cooperation, sharing of knowledge, innovation, and efficiency in service delivery to end-users while meeting specific conditions, such as: "easiness, low costs, convertibility, instant settlement, continuous availability and a high degree of security, resilience, flexibility and security" (BIS, 2020). Among the 13 public policy principles of the G7 for central banks' digital currencies (G7, 2021), we find roughly the same attributes for CBDC, namely monetary and financial stability (CBDC must "support and not harm" the central bank's ability to fulfill its monetary and financial stability mandate while respecting the existing strict standards); the existence of a legal framework and economic governance; data protection (to meet the standards of confidentiality, transparency, and responsibility for safeguarding users' data); operational resilience and cybersecurity (must to ensure safety and resilience against cyber risks, fraud, and other operational risks); energy efficient, operating in an open, transparent and competitive manner. CBDCs should be designed to mitigate risks that could harm existing currencies and the financial system, including threats to monetary sovereignty and financial stability; the importance of full interoperability across borders; improving current international payment systems (ability to provide faster, cheaper, transparent international payments); financial inclusion (enhancing access to payment services for individuals excluded from or underserved by the current financial system, while complementing the essential role of cash); fostering innovation in the digital economy and serving as a catalyst for responsible innovation; and ensuring compatibility with both existing and future payment solutions.

An examination conducted by the Federal Reserve System in 2022 underscored various risks associated with a CBDC, including potential shifts in the financial sector market structure,

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concerns regarding the security and stability of the financial system, implications for the efficacy of monetary policy implementation, issues related to privacy and data protection, and challenges in preventing financial crimes. The study aimed to investigate the potential benefits and drawbacks of introducing a U.S. central bank digital currency and its potential to enhance the security and efficiency of the payment system.

Regarding the scenarios for the implementation of the CBDC, we retain the work of the IMF 2022, where we notice six countries on the CBDC border, analyzed with the aspiration to identify and share beneficial aspects and elements, respectively, answers to questions on this area, in which many countries want to step. Clearly, what can be harvested from these experiences does not necessarily apply in another jurisdiction. The sample of countries remains small, and the circumstances of each country differ significantly. However, the perspectives in this paper can inspire further investigations and allow countries to gain time based on the experience of the countries analyzed; the aim of the paper is to study their essential experiences and lessons. The paper studies six advanced CBDCs.² projects, building on collaboration and exchanges with the respective central banks. CBDC can be designed in different ways, with different features and functions, as well as design/design elements. CBDC models are generally intended to support monetary policy objectives or mitigate the risks that may arise from their issuance. These risks relate to financial stability restrictions designed with restrictions that limit the competitiveness of CBDC vis-à-vis bank deposits; through restrictions on CBDC remuneration and quantitative restrictions on holdings and transactions with CBDC.

Recent studies suggest that the risk of disintermediation of credit institutions by substitution of their deposits could undermine the potential benefits of CBDC, a technologically superior means of payment. Thus, an analysis of the estimated impact of information on the issuance of a digital euro (CBDC) on the prices of euro area banks' shares was carried out in the work of the European Central Bank: The optimal amount of CBDC in a bank-based economy (ECB,2022). The estimated effects of the press releases on a CBDC issued in the euro area on the values of commercial banks' shares and the valuation of their lending find that they depend on confidence in banks' deposits and on design features aimed at calibrating the quantity of CBDC. The paper introduces a quantitative DSGE (dynamic stochastic general equilibrium) model that replicates this evidence and integrates key mechanisms through which the introduction of CBDC could influence banking intermediation and the broader economy. The primary advantages of the study include (I) offering empirical evidence on how news about the introduction of a digital euro impacts bank stock prices and lending behavior, (II) urging the ECB to develop and adjust a quantitative DSGE model for the euro area that

² The projects analyzed included: CBDC is already issued — Central Bank of the Bahamas (CBOB); CBDC pilot or being tested involving population and firms — People's Bank of China (PBOC); The Central Bank of the East Caribbean (ECCB); Banco Central of Uruguay (BCDU); An CBDC project placed on the country's political agenda and analyzed by governmental or parliamentary bodies outside the central bank — Sveriges Riksbank; The central bank carried out a CBDC project and decided not to issue a digital currency for the time being — Bank of Canada (BOC).

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incorporates such evidence and includes critical transmission mechanisms through which CBDCs might affect banks and the real economy; and (III) exploring various monetary policy frameworks for CBDCs that maximize welfare, enabling the ECB to provide a nuanced range of estimates for the optimal quantity of CBDCs in circulation.

The introduction of a CBDC or new forms of money, such as stable coins (virtual currencies guaranteed by an underlying asset to ensure price stability of those currencies), could affect the risk of bank panics (running towards safe values), and banks may also need to adapt their own banking practices (Juks, 2022).

The digital euro would not only address the declining role of cash as a payment method, but it could also (1) "support the digitalization of the European economy and the strategic independence of the European Union"; (2) mitigate the potentially significant impact of a foreign CBDC presence in the euro area, which could influence capital flows and euro exchange rates (3) "to become a new transmission channel of monetary policy"; (4) "mitigate risks to the normal functioning of payment services"; (5) "promote the international role of the euro" and (6) "support the reduction of global costs and the environmental improvement of monetary and payment systems" (ECB, 2020).

A study (Barrdear and Kumhof, 2021) analyzes the macroeconomic consequences of the issuance of CBDC – the central bank's right to issue a digital currency as a universally acceptable medium of exchange that is interest-bearing and can compete with bank deposits. In a DSGE model tailored to the U.S. economy pre-2008, their findings indicate that issuing CBDC equivalent to 30% of GDP, backed by government bonds as collateral, could potentially lead to a permanent 3% increase in GDP. This is attributed to reduced real interest rates, altered tax distortions, and lower transmission costs of monetary policy. Additionally, employing CBDC under countercyclical monetary policy guidelines as an alternative tool could significantly enhance the central bank's capacity to mitigate fluctuations in the financial cycle. Risks to banks with regard to CBDC can be minimized by appropriate issuance instruments.

In the context of the evolution of payment technologies, central bankers have an urgent need to understand the implications of the introduction of CBDC for monetary policy, payment efficiency, and financial stability. These implications were analyzed through a model containing a new approach (Williamson, 2022) to bank panic analysis in the overall equilibrium. Banks may go bankrupt, and their insolvency may lead to a bank panic in which payment interruptions may occur in the absence of sequential service limitations. Policy interventions by central banks may include deposit insurance and emergency money market borrowing operations, which provide very short-term liquidity (last resort lender). The central bank's digital currency brings confidence in a banking panic situation, partly because the panic is less disruptive with the central bank's digital currency compared to the physical currency. Eliminating bank panics can be too expensive, so it is optimal to find a model in which banking crises are reduced, as pointed out by the author of the above study. The new

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features aim to illustrate how central bank initiatives to replace physical currency with CBDC could influence the frequency of bank panics and their implications for economic well-being, additionally explore how monetary policy, including conventional interest rate policies and central bank interventions during crises, impacts both physical currency and CBDC regimes.

Another research study (Popescu, 2022) explores the potential impact of a cross-border digital currency issued by a central bank on capital flows and financial stability in an economy from a distinct perspective. The study highlights that the conventional model of banking panic in an open economy can be aggravated by the existence of a credible foreign central bank issuing a digital currency that is accessible to non-residents. This study suggests that the introduction/presence of a foreign CBDC as a reliable international asset could increase the risk of financial disintermediation in the local banking sector. This situation may result in more significant and volatile capital flows, contributing to exchange rate instability and potentially triggering a balance of payments crisis.

The successful development and implementation of CBDCs require central banks to balance innovation with risk management, ensuring that they continue to fulfill their role in maintaining price stability, financial stability, and trust. By doing so, they can enhance the financial system's efficiency and meet the evolving demands of all stakeholders involved

2. Mapping the Literature on Central Bank Digital Currencies (CBDC) and financial stability

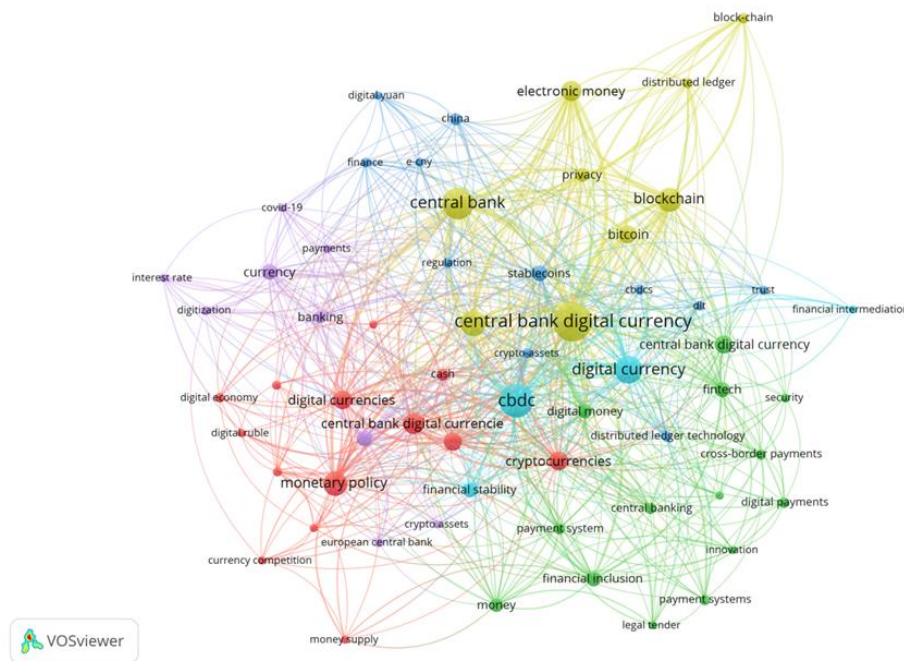
We applied a series of search queries to the Scopus database in order to extract relevant documents. Specifically, we gathered documents that contained the words "Central Bank Digital Currency" within the keywords, title, or abstract. We extracted a set of 412 documents published between 2017 and 2023 through this method. We carefully reviewed the abstracts to exclude documents that did not align with our objectives. This step was also beneficial for identifying irrelevant documents, focusing on fields related to central bank digital currency, and contextualizing it with financial stability.

To enhance the rigor of the research, we outline the criteria for which references were selected and the methodology used to identify the main strands of literature. Summarizing the takeaways from each category of references can provide a clearer understanding of the findings. References were chosen based on their direct relation to the central topic of Central Bank Digital Currency - Relevance to the subject - (documents in scientific journals indexed by the Scopus database); for Credibility and Source, we selected document types related exclusively to journal articles and left out any documents such as conference papers, books, chapters, and the subject area included only Economics, Econometrics and Finance,

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Business, Management and Accounting, Social Science and Computer Science; About Recency- the selection prioritized recent publications to reflect the latest developments and contemporary perspectives in the field of CBDC research, with Geographical Diversity - Studies from various countries were included to provide a comprehensive view of global CBDC initiatives and their implications.

Keyword analysis - we used the VOSviewer software to identify co-occurring keywords. In this way, we could map the essential themes in various macro-areas, as well as the themes' relationships to one another (Fig. 1). The VOSviewer visualization presents a network of terms related to the research on Central Bank Digital Currency. The co-occurrence analysis revealed six main clusters. Each cluster represents a group of related terms that frequently appear together in the literature. The size of the nodes indicates the frequency of the terms, while the lines (edges) show the connections between them.



Source: own elaboration with VOSviewer

Figure 1. Co-occurrence network of author keywords of Central Bank Digital Currency - related publications

Key Clusters:

1. Monetary Policy and Economic Impacts Cluster (Highlighted in Red):

- Central Terms: monetary policy, financial stability, digital euro, money supply, currency competition.

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- **Connections:** This cluster links CBDCs with monetary policy and financial stability, addressing the economic impacts of introducing a digital euro and its effects on money supply and competition among currencies.
 - **Implications:** Research in this area examines how CBDCs might influence traditional monetary policy, the stability of financial systems, and the competitive dynamics between different types of currencies.
2. **Central Bank Digital Currency (CBDC) Cluster (Highlighted in Yellow and Green):**
 - **Central Terms:** CBDC, central bank, digital currency, blockchain, electronic money.
 - **Connections:** This cluster shows the core focus of research on CBDCs, emphasizing the central role of central banks and the integration with blockchain technology and electronic money.
 - **Implications:** Research in this cluster explores the foundational aspects of CBDCs, their technological underpinnings, and the roles of central banks in issuing digital currencies.
 3. **Digital Currency and Cryptocurrencies Cluster (Highlighted in Blue and Light Blue):**
 - **Central Terms:** digital currency, cryptocurrencies, financial inclusion, security, trust.
 - **Connections:** This cluster highlights the relationship between digital currencies and cryptocurrencies, with an emphasis on issues of security, trust, and financial inclusion.
 - **Implications:** Research here focuses on the broader implications of digital currencies, including their potential to enhance financial inclusion and the security challenges they pose.
 4. **Blockchain and Distributed Ledger Technology (DLT) Cluster (Highlighted in Yellow):**
 - **Central Terms:** blockchain, bitcoin, regulation, privacy.
 - **Connections:** This cluster focuses on the technological aspects of CBDCs, particularly the use of blockchain and DLT, and the regulatory and privacy issues associated with these technologies.
 - **Implications:** Research here delves into the technical challenges and regulatory frameworks needed to support the implementation of CBDCs using blockchain technology.
 5. **Cross-Border Payments and Innovation Cluster (Highlighted in Green):**
 - **Central Terms:** cross-border payments, digital payments, innovation, payment systems.
 - **Connections:** This cluster emphasizes the role of CBDCs in facilitating cross-border payments and driving innovation in payment systems.
 - **Implications:** Research focuses on the potential of CBDCs to streamline international transactions, reduce costs, and foster innovations in the global payment infrastructure.
 6. **Economic Effects and Financial Intermediation Cluster (Highlighted in Purple and Pink):**
 - **Central Terms:** financial intermediation, banking, digital economy, interest rate, covid-19.

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- **Connections:** This cluster links CBDCs to broader economic effects and the role of financial intermediaries, including the impact of interest rates and the economic changes accelerated by the COVID-19 pandemic.
- **Implications:** Research explores how CBDCs might affect traditional banking models, the digital economy, and the overall economic landscape, particularly in the context of crises like COVID-19.

Through our analysis of the literature, we identified four main strands:

Impact on Monetary Policy:

- Research indicated that CBDCs could provide new tools for central banks to implement monetary policy, including negative interest rates and more direct control over the money supply.
- The ability of CBDCs to serve as a complement or substitute for traditional bank deposits was a focal point, with implications for interest rates and economic stability.

Financial Stability:

- Several studies highlighted the risks and benefits of CBDCs concerning financial stability. Risks include potential disintermediation of banks and increased susceptibility to digital bank runs.
- Benefits involve greater financial inclusion, improved efficiency in payment systems, and enhanced resilience against economic crises.

Payment Systems:

- The integration of CBDCs into existing payment infrastructures was examined, with discussions on how CBDCs could streamline cross-border transactions and reduce transaction costs.
- The role of CBDCs in promoting digitalization and innovation in the financial sector was underscored.

Technological Aspects of CBDCs:

- Studies explored the design features and functionalities of CBDCs, emphasizing the importance of blockchain technology and distributed ledger systems.
- Key findings include the potential for CBDCs to enhance transaction security and efficiency while posing challenges related to privacy and cybersecurity.

We also analyzed the geographical distribution of the sampled journal papers. Table 3 showcases the top-performing countries (first twelve from the sample) as per the affiliations of the authors. The papers represented below account for 86.17% of the total documents.

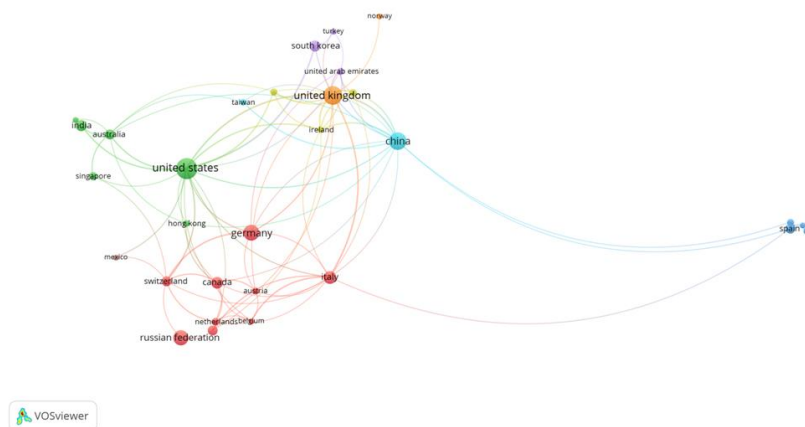
BUZURIU, B. C. (2024).*Central Bank Digital Currencies and Financial Stability: Literature Review and New Questions***Table 3. The most productive countries**

Country	Documents	Citations	Total link strength
USA	61	1064	30
United Kingdom	48	748	26
China	42	709	21
Germany	36	291	11
Russian Federation	33	198	2
Italy	23	188	16
Canada	20	284	9
South Korea	18	250	6
India	17	476	5
Spain	15	404	4
Switzerland	14	202	13
Australia	14	99	9
France	14	181	6

Source: own elaboration on VOSviewer

The geographical analysis reveals that the USA, United Kingdom, and China are the leading contributors to CBDC research, both in terms of quantity and impact. These countries have strong collaborative networks, as indicated by their high total link strengths. Other countries like Germany, Italy, and Canada also play significant roles, contributing to the global research efforts on CBDCs. This distribution highlights the global interest and collaborative efforts in understanding and developing Central Bank Digital Currencies, with key contributions from multiple regions around the world.

The VOSviewer visualization presents a network of countries based on their collaborative research efforts in the field of Central Bank Digital Currencies (CBDCs) Fig.2. The size of the nodes represents the volume of research output. At the same time, the lines (edges) indicate the strength and frequency of collaborative relationships between countries.

BUZURIU, B. C. (2024).*Central Bank Digital Currencies and Financial Stability: Literature Review and New Questions**Source: own elaboration with VOSviewer***Figure 2.** A network of countries based on their collaborative research efforts in the field of Central Bank Digital Currency

The visualization highlights the central role of the United States, China, and the United Kingdom in driving CBDC research. These countries not only contribute the most but also facilitate extensive international collaborations. European countries demonstrate robust regional networks while emerging collaborators like India and Australia are increasingly engaging with global hubs. To maximize the impact and development of CBDCs, fostering more inclusive and widespread international collaboration is essential.

5. Conclusions

The issuance of a Central Bank Digital Currency (CBDC) represents a significant shift in the monetary policy landscape, and thus, it is important for central banks to meticulously evaluate the potential benefits (protecting monetary sovereignty, supporting competition, and encouraging innovation; an alternative to the new forms of private money; improving the availability and usability of central bank money; establishing a monetary anchor role in the digital era) and risks (directing to partial substitution of bank deposits, exploring the role in systemic bank runs during periods of stress) associated with its issuance.

The literature on CBDCs and financial stability presents a complex and multifaceted picture. While CBDCs offer potential benefits such as enhanced monetary policy effectiveness, improved payment system efficiency, and greater financial inclusion, they also pose significant risks, including bank disintermediation, cybersecurity threats, and regulatory

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challenges. The overall impact of CBDCs on financial stability will depend on their design, implementation, and the regulatory frameworks that govern them. Central banks and policymakers must carefully weigh these factors to harness the benefits of CBDCs while mitigating their risks.

The decision to introduce a CBDC is not only influenced by economic considerations but also has significant social, political, and technological implications. The natural response to the current challenges is the emergence of digital currencies issued by central banks, not only to support innovation and efficiency but also to underline the role of central banks in ensuring and maintaining price stability and financial stability.

The research on Central Bank Digital Currencies (CBDCs) highlights several important policy implications that central banks and policymakers need to consider:

1. **Balancing Innovation with Stability:**

Central banks must navigate the tension between fostering financial innovation through CBDCs and ensuring that these innovations do not compromise financial stability. This includes designing CBDCs in a way that prevents excessive disintermediation of commercial banks and mitigates the risk of digital bank runs.

2. **Regulatory Frameworks:**

Implementing CBDCs requires robust legal and regulatory frameworks that address data privacy, cybersecurity, and anti-money laundering (AML) measures. Policymakers must ensure that these frameworks are flexible enough to adapt to evolving technological landscapes.

3. **Economic and Monetary Policy Impacts:**

The introduction of CBDCs could significantly impact monetary policy, including the transmission of interest rates and the overall money supply. Policymakers need to carefully assess how CBDCs will interact with existing monetary policy tools and the broader financial system.

4. **Social and Political Considerations:**

Beyond economic and financial implications, CBDCs have the potential to influence social and political dynamics. This includes the relationship between citizens and the state, privacy concerns, and the potential for CBDCs to reshape global financial power structures.

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5. Cross-Border Coordination:

Given the global nature of financial markets, the successful implementation of CBDCs may require international coordination to ensure compatibility across borders, minimize the risk of regulatory arbitrage, and support global financial stability.

The key takeaway from the research on Central Bank Digital Currencies (CBDCs):

- CBDCs offer both opportunities and risks: While they can enhance payment system efficiency, improve financial inclusion, and provide central banks with new tools for monetary policy, they also pose risks to financial stability, privacy, and the existing banking system.
- The design and implementation of CBDCs are tremendously important: The ultimate impact of CBDCs will depend heavily on how they are designed and integrated into the existing financial system. This includes decisions around privacy, the extent of central bank control, and how CBDCs coexist with physical cash and bank deposits.
- Need for ongoing research and dialogue: As the landscape of digital currencies evolves, continuous research and dialogue among central banks, policymakers, and other stakeholders are essential to navigate the complex challenges and maximize the benefits of CBDCs.

This research serves as a foundation for understanding the multifaceted implications of CBDCs and provides a roadmap for future exploration and policy development.

The introduction and implementation of Central Bank Digital Currency have sparked discussions (Auer et al., 2020) on whether it represents an evolution or a revolution in the monetary system. Some argue that CBDC can be considered an evolution of the current monetary system, as it serves as a digital version of traditional fiat currencies issued by central banks. In this regard, CBDCs offer the potential for faster and more efficient payment systems, improved financial inclusion, and greater transparency and accountability in the financial sector.

However, others contend that CBDC represents a revolution in the monetary system, depending on the specific design and implementation of each CBDC. For example, a CBDC that is fully decentralized and based on blockchain technology has the potential to obviate the necessity for intermediaries like banks and even replace traditional fiat currencies altogether. This would represent a significant departure from the current monetary system and would be a revolutionary change in the way we understand and use money.

Ultimately, whether CBDC is classified as an evolution or a revolution in the monetary system hinges on various factors, such as its design, implementation, and the broader economic and political context, yet numerous questions continue to arise in this domain.

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