

The Impact of Central Bank Digital Currency on Commercial Banks

تأثير العملات الرقمية المركزية على البنوك التجارية

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Abstract: This study examines the impact of central bank digital currencies (CBDCs) on commercial banks, focusing on liquidity coverage ratios, return on assets (ROA), return on equity (ROE), and banking transactions. The findings reveal that CBDCs can positively and negatively affect lending practices and asset preferences. Central banks have responded variably, with some canceling projects and others implementing them. The study concludes that CBDCs are essential and calls for further research to explore their effects on additional performance indicators.

Keywords: Central Bank Digital Currencies (CBDCs), commercial banks, financial indicators.

المخلص: تستكشف هذه الدراسة تأثير العملات الرقمية للبنوك المركزية (CBDCs) على البنوك التجارية، مع التركيز على نسب تغطية السيولة والعائد على الأصول (ROA) والعائد على حقوق الملكية (ROE). تكشف النتائج أن هذه العملات يمكن أن تؤثر إيجاباً وسلباً على ممارسات الإقراض وتفضيلات الأصول، وقد استجابت البنوك المركزية بطرق متنوعة، حيث ألغى بعضها المشاريع بينما قام الآخرون بتنفيذها، وتخلص الدراسة إلى أن العملات الرقمية للبنوك المركزية أصبحت ضرورة، وتدعو إلى مزيد من البحث لاستكشاف تأثيراتها على مؤشرات الأداء الإضافية.

الكلمات المفتاحية: العملات الرقمية للبنوك المركزية، البنوك التجارية، المؤشرات المالية.

JEL classification code : E42, E51, G21

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1. Introduction:

Digital currencies, as a new form of currency, profoundly impact the future of money. In this evolving digital landscape, Central Bank Digital Currencies (CBDCs) have the potential to revolutionize the financial sector, particularly in emerging economies and low-income nations where access to traditional financial services is limited.

The introduction of CBDCs may lead to shifts in the role of banks, as they face heightened competition for funding and the substitution of deposits (Mancini-Griffoli, 2021). Despite these challenges, commercial banks are expected to play a critical role in large-scale CBDC rollouts. By leveraging their expertise and deep understanding of customers, they can drive adoption through network effects.

However, the successful implementation of CBDCs could have significant implications for the banking sector, such as reduced commercial bank revenue and declining payment volumes. The impact on key performance metrics, including liquidity coverage ratios (LCR), return on assets (ROA), and return on equity (ROE), remains under investigation and will depend on the specific design and deployment of CBDCs.

1.1. Background

The Global Financial Crisis marked a pivotal transformation in the financial sector, severely eroding public trust in the banking system. The emergence of cryptocurrencies—most notably in 2009 with Bitcoin, created by the pseudonymous entity Satoshi Nakamoto—was a predictable consequence. Cryptocurrencies offer an alternative means of preserving wealth and conducting transactions, independent of traditional banking systems and government oversight. This evolution is closely tied to the 2008 financial crisis, which undermined confidence in conventional financial institutions and created fertile ground for the rise of digital currencies.

The expansion of the digital currency market has drawn increased attention from central banks, particularly in light of illegal

activities associated with cryptocurrencies. Consequently, central banks are now compelled to integrate digital currencies into their assets to meet their obligations. Wholesale CBDCs have the potential to serve as a new settlement tool for financial institutions, while retail—or general-purpose—CBDCs would function as central bank liabilities, accessible to the broader public.

2.1. Problem discussion:

Central bank digital currencies (CBDCs) have the potential to significantly impact commercial banks. As roughly 90% of the world's central banks are exploring or developing CBDCs, it is crucial to understand their implications. CBDCs could lead to a decline in bank deposits and commercial bank reserves, potentially increasing the cost of bank credit.

They may also disrupt traditional banking models, leading to changes in bank operating models and the potential disappearance of fractional reserve banking in some jurisdictions.

However, some research suggests that the introduction of CBDCs could enhance banks' competitiveness, raise deposit rates, and expand their financial intermediation activities.

Overall, the impact of CBDCs on commercial banks is a complex and multifaceted issue that requires careful consideration. Commercial banks will need to adapt their operating models and payment systems to integrate CBDCs effectively. The potential consequences, both positive and negative, should be thoroughly evaluated to ensure a smooth transition and minimize any adverse effects on the stability and functioning of the banking system.

3.1. problem formulation and purpose:

What are the impacts of the Central Bank's Digital Currencies on commercial banks?

4.1. research questions:

The present study seeks to examine the influence of CBDC on the operational efficacy of commercial banks, particularly in response to the evolution of cryptocurrencies. In pursuit of this objective, the research endeavors to explore and address the following inquiries.

- . What is the impact of CBDC's on liquidity coverage ration?
- . What is the impact of CBDC's on ROA and ROE?
- . What is the impact of CBDC's on banking transaction?

5.1 Hypotheses:

. CBDCs may reduce the Liquidity Coverage Ratio (LCR) of commercial banks by increasing competition for high-quality liquid assets.

. CBDCs could decrease ROA and ROE due to reduced deposit margins but may offer opportunities for efficiency gains.

. CBDCs are likely to enhance transaction efficiency and volume while potentially reducing transaction-related revenues for banks.

6.1. Methodology:

The existing literature offers numerous effective methodologies to evaluate the impact of central bank digital currencies (CBDCs) on commercial banks. Among these, the descriptive analytical approach stands out as a straightforward and suitable method for analyzing the relationships between CBDCs and financial indicators within the banking sector. This methodology was adopted to achieve the study's objectives.

To support this analysis, aggregate data on commercial banks in Kenya, the Bahamas, Malaysia, and Zimbabwe for the years 2018–2022 was utilized. The dataset included four groups of indicators: liquidity, the volume of digital transactions, return on assets (ROA), and return on equity (ROE).

2. Literature review /Theory

1.2. literature review:

Numerous studies have explored the topic of central bank digital currencies (CBDCs) from various perspectives. This research will review a range of these studies, highlighting their key features while offering commentary that identifies points of agreement and disagreement, as well as outlining the scientific gap addressed by the current study. Notably, the studies under review span the period from

2020 to 2022 and cover a diverse range of regions, including China, Vietnam, and Europe, demonstrating both temporal and geographical diversity.

These studies have been categorized based on the primary variables of interest: those that focus on CBDCs and those that examine commercial banks. Following this classification, the research provides an overview of these studies, detailing points of agreement and divergence among them. The scientific gap is clarified by identifying how the current study differs from and builds upon prior investigations. Lastly, the integration of insights from these previous studies into the present research will be discussed.

Undoubtedly, this study has greatly benefited from prior research, leveraging earlier efforts to thoroughly diagnose the problem and address it comprehensively. Drawing from an extensive review of the literature, the current research has refined its methodology and defined a clear research focus: “The Impact of Central Bank Digital Currencies on Commercial Banks.” Previous studies have provided valuable guidance in formulating research questions and selecting appropriate tools, such as examining “the effects of China's Central Bank Digital Currency (CBDC) on domestic commercial banks” and “verifying the impact of CBDC issuance on the net interest income of Vietnamese commercial banks.”

By building on existing knowledge, this study aims to contribute novel insights to the field of CBDCs and their implications for the banking sector. While there is a substantial body of literature addressing CBDCs and their impact on commercial banks, a methodological gap persists—namely, the lack of comprehensive research methods to assess these impacts effectively. Further research is needed to examine the period from 2018 to 2022 and to analyze a broader scope, incorporating data from four countries worldwide.

2.2. Theory

a) The definition of CBDC:

In order for a Central Bank Digital Currency (CBDC) to be classified as such, it is important that it fulfills essential monetary roles, regardless of its particular structural attributes or modalities (account-based or token-based). The BIS also defined CBDC as a kind of legal tender in digital form (al, 2020). and in an earlier study, the BIS refers to (CBDC) as a digital representation of money issued by a central bank that possesses distinct characteristics when compared to the balances held in conventional reserve or settlement accounts (Houben, 2018). CBDC is the next step in the evolution process from metal currency to metal-backed banknotes and then to fiat money. Additionally, CBDC will bring new opportunities and challenges to the domestic banking industry.

Given the varying stages of financial development and the unique missions and needs of different countries, multiple definitions of central bank digital currencies (CBDCs) have emerged from a broad spectrum of perspectives. This diversity is reflected in an expanding body of literature on the subject. Table 1 provides a summary of common definitions of CBDCs, drawn from announcements and reports issued by prominent institutions and organizations.

The international monetary fund (IMF), widely known as the central bank of all banks provides a categorization of money and CBDCs based on four distinct attributes: *issuer* of money (central bank or not); *form* (digital or physical); *accessibility* (widely or restricted) and *technology*. And below is a taxonomy of money in the form of Venn-diagram referred as the money flower (Garratt M. B., 2017)

Figure1: the money flower.

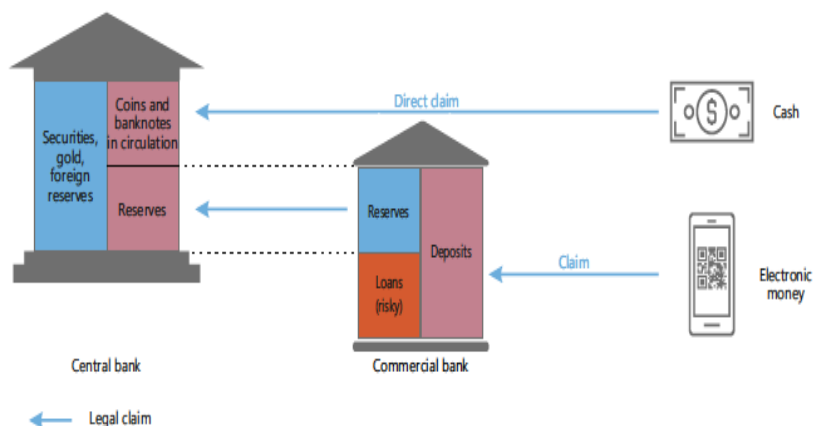


b) Types of CBDC

The novelty of Central Bank Digital Currencies (CBDCs) and its contingency upon two key factors, namely the degree to which this digital obligation of the central bank is accessible to the private sector, and the various technologies and systems employed to facilitate its implementation and foster further advancements. In relation to the availability of CBDCs, two models can be identified:

- **Retail CBDC:** One characteristic of retail central bank digital currencies (CBDCs) is that they do not involve any credit risk for participants in the payment system, as they represent a direct claim on the central bank. A retail CBDC is akin to a digital form of physical currency, and the central bank holds the responsibility for its provision. Conversely, other types of digital retail currencies are based on a claim to an intermediary. These intermediaries may encounter issues of illiquidity due to temporary lack of funds or even insolvency, which could result in disruptions to the payment process. Although measures such as collateralization and other safeguards already significantly mitigate such risks in most cases, the implementation of retail CBDCs would eliminate any remaining risk. (Bank for International Settlements, 2021)

figure 2: The monetary system with a retail CBDC



Source: R Auer and R Böhme, “Central bank digital currency: the quest for minimally invasive technology”, *BIS Working Papers*, no 948, June 2021.

- **Wholesale CBDC:** Wholesale CBDCs are similar to holding reserves in a central bank. The central bank grants an institution an account to deposit funds or use to settle interbank transfers. Central banks can then use monetary policy tools, such as reserve requirements or interest on reserve balances, to influence lending and set interest rates.

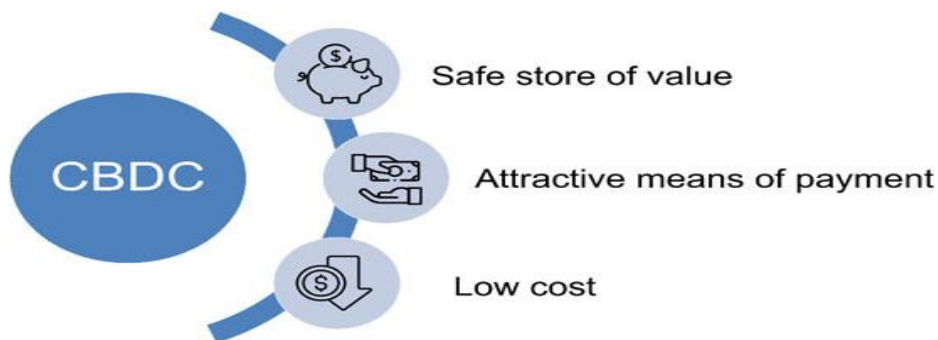
c) Features of CBDC:

Cash is a unique asset class defined by four key characteristics: (1) it is transferred directly between individuals (without the involvement of the issuing entity), (2) it is accessible to all individuals; (3) it maintains a level of anonymity, and (4) it does not generate any form of interest. Central Bank Digital Currency (CBDC) serves as a viable substitute for physical cash.

- They possess the ability to transcend boundaries and encompass a broad range of users or alternatively, they may be confined to a specific group of individuals. Similarly, DLTs can be open or closed (for instance, limited to banks or financial institutions).
- They can be anonymous (like cash) or identified (like current accounts). The first corresponds to the idea of token-based CBDCs, and the second to account-based CBDCs.

- They can pay interest or not. The separation of cash from paper currency introduces the potential for incorporating the characteristic of interest-bearing, whether in the form of an account or a token.

Figure 3. features of CBDCs



Source: Implications of CBDCs for Monetary Policy Transmission (IMF)2023

Objective of CBDC:

- to improve the functioning of wholesale payment systems:
- to replace cash with a more efficient means of payment:
- to enhance the instruments available for monetary policy:
- to reduce the frequency and cost of banking crises:

d) The financial indicators of commercial bank:

The financial indicators of commercial banks can be summarized in the following table:

Table 2: Key Financial Indicators of Commercial Banks

Metric	Description	Formula	Source
Liquidity Coverage Ratio (LCR)	Ensures banks hold sufficient high-quality liquid assets (HQLA) to meet short-term obligations during stress periods.	$LCR = \frac{HQLA}{\text{Net Cash Outflows (30 days)}}$	Bank of International Settlements, 2013.

	HQLA includes assets easily convertible to cash. Classified into Level 1, Level 2A, and Level 2B.		Ibid.
Return on Equity (ROE)	Measures profitability relative to shareholder equity; indicates how efficiently equity is used to generate profits.	$\text{ROE} = \frac{\text{Net Income}}{\text{Average Shareholder Equity}}$	Brealey, R., Myers, S., & Allen, F. (2020).
	$\text{Average Shareholder Equity} = \frac{(\text{Beginning Equity} + \text{Ending Equity})}{2}$		
Return on Assets (ROA)	Measures efficiency in using total assets to generate profits; compares profitability across companies and tracks performance over time.	$\text{ROA} = \frac{\text{Net Income}}{\text{Average Total Assets}}$	Ibid.
	$\text{Average Total Assets} = \frac{(\text{Beginning Total Assets} + \text{Ending Total Assets})}{2}$		
ROE vs. ROA	ROE excludes debt, focusing on shareholder equity, while ROA includes debt, focusing on total assets. Higher debt leads to ROE being greater than ROA.		Brealey & al. (2020).

3. Case study of Kenya, Malaysia, Zimbabwe, Bahamas

The annual reports of each country were utilized to gather the necessary data for this study. The development of financial indicators within the banking sectors of these countries during the period from 2018 to 2022 is summarized in the tables below:

Table2: Analysis of Financial Performance and Liquidity Coverage Ratio Trends in the Banking Sector of Kenya:

Andicator/years	2018	2019	2020	2021	2022
LCR %	52.68	50.92	70.83	42.1	73.3
Transacation (Billion usd)	11.882	11.844	9.938	14.472	16.173
ROA %	2.8	2.5	2.1	3.3	3.7
ROE %	22.5	21.2	13.9	22.0	26.3

Source: central bank of Kenya annual report (2018-2022).

Between 2018 and 2022, key financial metrics in Kenya's banking sector, including Return on Assets (ROA), Return on Equity (ROE), and Liquidity Coverage Ratio (LCR), fluctuated, reflecting dynamic market conditions. In 2019, both ROA and ROE declined slightly, while in 2020, the COVID-19 pandemic led to further declines. However, performance improved in 2021 and 2022, with ROA rising from 2.1% to 3.7% and ROE increasing from 13.9% to 26.3%. LCR dropped to its lowest point at 42.1% in 2021 but rebounded to 73.3% in 2022. Transaction volumes also showed a steady increase, from 11.88 billion USD in 2018 to 16.17 billion USD in 2022.

The introduction of a Central Bank Digital Currency (CBDC) in Kenya was under consideration, as it could influence liquidity management and profitability indicators. However, the Central Bank of Kenya (CBK) concluded that CBDC adoption was not a priority in the short-to-medium term due to high implementation costs and concerns about disintermediation, given the country's advanced digital payments system and high financial inclusion. The CBK is continuing to monitor global CBDC developments for future assessments.

Table3: Analysis of Financial Performance and Liquidity Coverage Ratio Trends in the Banking Sector of Malaysia:

Andicator/years	2018	2019	2020	2021	2022
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LCR %	143.2	149.1	148.2	153.4	154.1
Transaction (RM Trillion)	83.3	90.2	124.8	154.7	163.8
ROA %	1.4	1.4	1.0	1.1	1.4
ROE %	12.7	12.2	8.4	9.7	12.4

Source: Bank Negara Malaysia annual report (2018-2022)

Between 2018 and 2022, Malaysia's banking sector experienced fluctuations in key financial metrics such as Return on Assets (ROA) and Return on Equity (ROE). In 2018, ROA was 1.4% and ROE was 12.7%, indicating strong profitability and efficiency. However, in 2020, both metrics declined to 1.0% and 8.4%, respectively, due to economic challenges. In the following years, the sector showed recovery, with ROA returning to 1.4% and ROE rising to 12.4% by 2022.

The Malaysia's banking transactions grew non-linearly from RM83.3 trillion (2018) to RM163.8 trillion (2022), driven by a **38.3% surge in 2020** (COVID-19 digital adoption, fiscal stimulus) and moderated post-pandemic (**5.8% in 2022**), reflecting structural shifts toward digital payments and reduced market volatility.

The Liquidity Coverage Ratio (LCR) remained consistently above 100% since 2018, with the highest value recorded in 2022 at 154.1%. This reflects the sector's ability to meet short-term obligations even during financial stress, demonstrating stability in line with Basel III requirements.

In terms of Central Bank Digital Currency (CBDC), Malaysia has been exploring its potential impact on the banking sector. The increase in LCR alongside stable ROA and ROE suggests that banks have effectively managed liquidity and profitability. Malaysia has also participated in international initiatives, such as "Project Dunbar," to develop platforms for cross-border transactions using multiple CBDCs, aiming to reduce costs and enhance transaction speed.

Overall, the banking sector in Malaysia has shown resilience, effectively managing liquidity and profitability, with ongoing exploration into the role of CBDCs

Table4. Analysis of Financial Performance and Liquidity Coverage Ratio Trends in the Banking Sector of Zimbabwe:

Andicator/years	2018	2019	2020	2021	2022
LCR	68.45%	72.42%	73.06%	67.37%	59.50%
Transacation	No data				
ROA	4.56	8.99	13.55	12.04	17.43
ROE	30.23	31.98	45.54	43.16	54.33

Source: Reserve Bank of Zimbabwe annual report (2018-2022).

Between 2018 and 2022, the banking sector in Zimbabwe demonstrated significant growth in key financial metrics, with Return on Assets (ROA) and Return on Equity (ROE) showing a consistent upward trend. In 2018, ROA was 4.56% and ROE was 30.23%, reflecting solid performance. By 2020, both ROA and ROE had increased substantially to 13.55% and 45.54%, respectively. The sector continued its growth in 2022, with ROA reaching 17.43% and ROE climbing to 54.33%, signaling increased profitability and operational efficiency.

Prudential liquidity ratios within the sector remained above the regulatory minimum, with the average ratio standing at 71.97% in 2018 and continuing to rise over the years, reaching 59.50% by 2022. This indicated a cautious and conservative approach to lending and risk management.

The introduction of a gold-backed Central Bank Digital Currency (CBDC) in Zimbabwe, starting in 2023, has influenced the banking sector's operations and financial landscape. The CBDC has provided an alternative to traditional banking, offering peer-to-peer and peer-to-business transactions and serving as a store of value. This shift has likely contributed to the growth in ROA and ROE, driven by increased digital transactions and operational efficiency.

Moreover, the Reserve Bank of Zimbabwe introduced the ZiG digital token, backed by physical gold, as part of efforts to stabilize the economy and promote local currency use. This initiative, launched in

April 2023, aims to reduce reliance on the US dollar and boost local investment.

In conclusion, the implementation of the gold-backed CBDC has profoundly influenced Zimbabwe's banking sector. It has not only driven profitability but also enhanced liquidity management and fostered financial stability, thereby supporting the sector's sustained growth."

Table.5 Analysis of Financial Performance and Liquidity Coverage Ratio Trends in the Banking Sector of Bahamas:

Andicator/years	2018	2019	2020	2021	2022
LCR%	26.06	30.1	32.4	33.8	37.3
Transacation (billion USD)	30.0	32.0	45.5	36.0	43.1
ROA%	2.3	2.4	(0.1)	2.3	2.5
ROE%	8.8	10.7	(0.3)	10.9	17.9

Source: Bahamas central bank annual report (2018-2022).

The Bahamian banking sector has experienced fluctuating performance in profitability and liquidity from 2018 to 2022. In 2018, the Return on Assets (ROA) was 2.3% and Return on Equity (ROE) was 8.8%. These improved slightly in 2019 but dipped in 2020 due to the impact of the COVID-19 pandemic, with ROA at -0.1% and ROE at -0.3%. However, the sector rebounded in 2021 with ROA at 2.3% and ROE at 10.9%, and saw the highest profitability in 2022, with ROA reaching 2.5% and ROE at 17.9%.

Liquidity-wise, the sector has shown steady improvement in its Liquidity Coverage Ratio (LCR), increasing from 26.06% in 2018 to 37.3% in 2022. This growth reflects the sector's ability to maintain sufficient liquid assets in line with Basel III requirements, which helps ensure resilience during liquidity crises.

The introduction of the Sand Dollar, a digital currency by the Central Bank of The Bahamas, began in 2020. Initially slow, its adoption grew significantly by 2022, with monthly transactions increasing by 160%. This rise in transactions has impacted the banking

sector's liquidity, contributing to a higher LCR as demand for liquid assets increased. Additionally, the Sand Dollar likely boosted profitability by generating more transaction fees, aiding the sector's recovery and growth.

In conclusion, the Bahamian banking sector has experienced a mixed performance, characterized by fluctuating profitability. However, liquidity has shown consistent improvement, largely supported by the introduction of the Sand Dollar, which has strengthened liquidity management and contributed to profitability gains.

IV- Conclusion:

The introduction of Central Bank Digital Currencies (CBDCs) has had varying impacts on the banking sectors of different countries. In Kenya, the Central Bank initially explored CBDCs but later abandoned the idea due to challenges such as lack of bank intermediation, high implementation costs, technological risks, and an incompatible financial system. Similarly, in Malaysia, Bank Negara Malaysia (BNM) has been conducting a multi-year study to evaluate the benefits and risks of CBDCs, focusing on improving payment systems and enhancing financial inclusion. However, concerns remain, including potential disintermediation of banks and impacts on monetary policy."

On the other hand, Zimbabwe and the Bahamas have successfully implemented CBDCs. Zimbabwe unveiled the gold-backed digital currency, ZIG, as a response to public distrust and inflation concerns, which has boosted profitability and strengthened liquidity within its banking sector. Meanwhile, the Bahamas introduced the Sand Dollar, the world's inaugural CBDC, designed to promote financial inclusion, fortify payment system resilience, and mitigate money laundering risks.

Key Results:

- CBDCs have the potential to improve payment efficiency, enhance financial inclusion, and provide more resilient payment systems.
- The adoption of CBDCs in Zimbabwe and the Bahamas improved liquidity and profitability in their banking sectors.
- Malaysia and Kenya have been cautious, weighing the risks and costs, such as disintermediation and cyber risks.

Recommendations:

1. Countries should assess the compatibility of their financial systems with CBDCs before introduction.
2. A careful design of CBDCs is needed to minimize risks such as cyber threats and disruption of monetary policy.
3. Ongoing research and multi-year studies should be conducted to evaluate costs and benefits, especially in terms of financial inclusion and system stability.
4. CBDC adoption should focus on improving payment systems, enhancing transparency, and addressing potential financial system risks.

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