

Title

Digital Currencies and Banknotes: Developments, Impacts, and Challenges
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Introduction

Technological advancement and innovations transformed the global financial sector from the traditional fiat means of payment into a digital means of payment system today. The changes in technology, digitalization of the economies, and disruptions caused by global financial, pandemic, politics, and war crisis; increased interests by the monetary authorities (central banks) to provide a border, cheaper, faster, and safer means of payment globally. These led to the development of digital financial ecosystem of electronic payments, broadened payment instruments, digital financial transformation, distributed ledger technology (DLT), Fintech firms, and digital depository institutions. CBDC is a new global monetary system in the making which would replace the current global reserve monetary systems. The world needs new definitions, functions, and measurement of money. This study will focus on the developments, impacts, and challenges of the digital currencies and banknotes on the countries that had launched their CBDCs. The study's research questions and interest areas are: What are the impacts and challenges of the digital currencies and digital banknotes on the economy of those countries that had launched their CBDCs? What are the impacts of the CBDCs' performance factor indices on the economy of those countries that had launched their CBDCs? It will address the development of CBDC and provide some policy recommendations. Secondary economic data from the World Bank were collected to run multiple regression analysis to answer the questions. The study's findings will contribute to the literature on monetary and financial economics disciplines; harmonize with previous studies in the disciplines; strengthen the growing awareness among finance, management scholars, formal institutions, policymakers, and regulators on the CBDCs.

Methods

PART I: Developments of CBDCs

The Austrian school of economics pioneered the argument for private currencies / assets / tokens; because it opposed the CB monopoly over national paper money. The Bank of Finland is the architect of CBDC with launching of its Avant smart card in 1993 but abandoned in 2003 (Bank of Finland, 2023; Stanley, 2022; Finance & Development, 2022; CBDC Tracker, 2023). 131 countries are working on different types of CBDCs as at October 2023: 13 launched; 21 pilot; 33 developments; 46 research; 16 inactive; 2 canceled; and 12 countries are currently working on cross-border wholesale CBDC projects. However, countries like France, US, UK, EU, and Canada are still studying and evaluating the feasibility and implication of CBDC adoption. The Bank for International Settlement's (BIS') contributions to the CBDC development came in the form of sponsoring applied technology researches in the Mandala, Mariana, Sela, Polaris, Rosalind, Icebreaker, Tourbillon, mBridge, Dunbar, and Helvetia projects (World Economic Forum, 2023).

Rational Factors For The Development of CBDCs

1. Cryptocurrencies are digital assets; and are not legal tenders.
2. CBDCs are developed and implemented to against the competition of the cryptocurrencies as well as to protect the stability of the national currencies.
3. Digital assets are unregulated and are very risky.
4. A CBDC a sovereign digital currency, a national pride, and CB wants a firm control on its country's monetary system.
5. A CBDC will lower cost, make cross-border payments faster and cheaper, promote financial inclusion, eliminate counterfeiting, and strengthen the monetary supervision and regulatory authorities of CBs.
6. CBDC might be a tool for promoting financial market stability.
7. The COVID-19 health concerns movement lockdowns are in part responsible the interest of some CBs in considering issuing their CBDCs.
8. With the declined cash usage in favor of debit and credit cards and digital assets; CB saw the need to improve its national payment innovation roles.
9. There are needs to provide for seamless and easy flow of monetary and fiscal policy.
10. Some countries are exploring the development of their CBDC to reduce their reliance of the US dollar, sterling, euro, and the SWIFT messaging system with a view to avoiding the US dollar's sanctions leverage.

Technical and Operating Design Models of Digital Currencies

These are account-based (retail CBDC) and wholesale-based (wCBDC) models. In the account-based model (rCBDC); serves as a medium of payment to the public; consumers are allowed to have deposit accounts directly with central bank; its validity verification is on the payees; hence implicitly promotes the dis-intermediation functions of the depository institutions. In the wholesale-based model (wCBDC) is for the financial institutions to be used medium of trade settlements and transactions in the financial markets; the customers have no direct access to the central banks because depository institutions are authorized to circulate and maintain digital accounts for their customers; its validity verification depends on the authentication of the identity of the account holder. The choice between rCBDC and wCBDC by a country is a function of the country's "public good" objectives. World Economic Forum (2023) indicated that the rational reasons to have CBDC by the CBs are based on divergent motives and needs of each country. It identified over ten different factors and elements that could influence the designing of a CBDC by a country (World Economic Forum, 2023). It further categorized the global motives, needs, and priorities to be regional specific.

Procedures

PART II: Impacts of CBDCPFI on CBDC: Methods and Materials

The past studies focused on: On the (1) definition, characteristics, classification, and main models of CBDC; (2) the policy debates were on implications, potential benefits and shortcomings of CBDC, financial stability, banks' disintermediation through deposit substitution; (3) areas of CBDCs' design theory, technological innovation, and model optimization; (4) CBDCs' security and privacy; (5) impacts of the CBDCs on the GDP relative to government bonds; (6) implications of CBDCs for the macro-economy and financial systems; (7) impacts of CBDCs on monetary systems and policy; (8) relationships between the depository financial institutions and central banks in the aftermath of the CBDCs; and (9) impacts of CBDCs on the financial markets. There is no study on the individual users' access to CBDC. There is a need to examine the missing gap of CBDCs accessible, otherwise called CBDC's performance factors of each country. This research gap is the focus of this paper. This paper came up with 23 CBDCs' performance factor indices (CBDCPFI). This paper hypothesizes that CBDCPFI will contribute to the variations in the performance of CBDCs and this worth being examined. In the less developed countries; poor GFKF and poor internet connections will reduce the potential benefits of CBDC to the public. The CBDCs' reliance on smart devices and technology might make the CBDCs unsuitable for the elderly. GPR, GFSI, and GEPU might create uncertainties globally; these will reduce the CBDCs' performance globally. Hence, the CBDCPFI is used to investigate the potential performance, effectiveness, efficiency, and optimization of the CBDCs. The paper identified twenty-three performance attributes but selected six important factors. These are gross fixed capital formation (GKFF), internet usage per population of a country (IUPP), rate of urbanization (RURB), senior citizens of over 65 years (AGED), global economic policy uncertainty (GEPU), and global financial stress index (GFSI). The CBDC data were estimated based on the works of Smets et al, (2022) and Butlon, et al, (2022); and set the optimal CBDC rule to be 30% of quarterly GDP. All the data for this paper were taken from the World Bank Data for all the 13 countries that had launched their CBDCs for the period 2013 to 2022.

The paper's structural equation is:

$$CBDC_{i,t} = f(GKFF, IUPP, RURB, AGED, GEPU, GFSI) \dots \dots \dots \text{Eqn. 01}$$

Using the panel fixed regression analysis model with a total of 130 annual observations, equation 01 can be written as:

$$CBDC_{i,t} = \beta_0 + \beta_1 GKFF_{i,t} + \beta_2 IUPP_{i,t} + \beta_3 RURB_{i,t} + \beta_4 AGED_{i,t} + \beta_5 GEPU_{i,t} + \beta_6 GFSI_{i,t} + \epsilon_{i,t} \dots \dots \dots \text{Eqn. 02}$$

Using time series regression analysis model with a total of 10 annual observations, equation 01 for the individual countries analysis, can be written as:

$$CBDC_{i,t} = \alpha_0 + \alpha_1 GKFF_t + \alpha_2 IUPP_t + \alpha_3 RURB_t + \alpha_4 AGED_t + \alpha_5 GEPU_t + \alpha_6 GFSI_t + \epsilon_t \dots \dots \dots \text{Eqn. 03}$$

For the individual country analysis, the paper selected one country from four regions of the world.

Results

TABLE 1: FOR EQUATION 02--FOR PANEL FIXED REG. MODEL	Coefficient	Std. Error	t-Value
LNGFCF	0.6811	0.0398	17.1290***
RURB	-0.0174	0.0017	-10.5160***
IUPP	0.0000	0.0000	4.1638***
GEPU	0.0003	0.0001	2.6308***
AGED	0.0168	0.0120	1.3967
GFSI	-0.0067	0.0275	-0.2419
C	9.1018	0.9723	9.3609***

TABLE 2: EQN 03--FOR TURKEY	COEFFICIENT	STD. ERROR	T-VALUE
GFCF	4.15E-12	1.05E-13	39.59199
AGED	-0.023746	0.008798	-2.699197
GEPU	-7.16E-05	2.61E-05	-2.749316
GFSI	0.007308	0.004973	1.469466
IUPP	-7.87E-14	5.08E-14	-1.549076
RURB	0.014762	0.003750	3.936211
C	24.31260	0.228519	106.3923

Results (Continued)

EXPLANATION OF TABLE 01: FOR EQUATION 02

On the panel fixed regression analysis model with a total of 130 annual observations; the results indicated the follows: The R² of the equation 02 was 99.95; which indicated that all the explanatory variables are good fits for the model. There are positive relationships between CBDC performance and GFCF, IUPP, GEPU, and AGED; and being inversely related to RURB and GFSI. The results of GFCF, RURB, IUPP, and GEPU were significant at one degree of freedom. The logical implication of the results is that GFCF, RURB, IUPP, and AGED are key CBDC's performance indicators. However, the signs of GEPU, RURB and AGED results were contrary to rational expectations. The coefficients for GEPU and AGED were expected to be negative; RURB was negative instead of positive. However, none of the regression coefficients of GEPU, RURB, and AGED was significant.

EXPLANATION OF TABLE 0: FOR EQUATION 03 ON TURKIYE

On the time series regression analysis; one country was chosen from each global region. Russia for Asia Pacific region; Turkiye for Europe; Nigeria for Africa; and Bahamas for South America and the Caribbean. Due to lack of space, only Turkiye's regression results were produced as a sample on the poster. The R² for the individual countries were 99.71, 99.98, 65.67, and 91.58 for Russia, Turkiye, Nigeria, and Bahamas, respectively.

As for Russia, only RURB's regression coefficient was contrary to the rational expectation at about 5% confidence level. All other regression coefficients for Russian analysis were significant at not more than 5% confidence level.

With regards to Turkiye; only IUPP regression coefficient had a non-rational expectation sign. However, all Turkiye regression coefficients are significant at less than 5% confidence level.

As for Bahamas, only GFSI regression coefficient had a non-rational expectation sign and none of the regression coefficients of Bahamas was significant.

None of the regression coefficients for Nigeria was statistically significant; and only RURB and GEPU had the rational expected signs.

Conclusion

PART III: Challenges, Policy Recommendations, and Conclusion

The Challenges of the CBDC

1. Uncertainty of the future (a) structure of the financial systems; (b) effectiveness and efficiencies of CBDCs. Designs; (c) roles and functions of CBs.
2. No global consensus on the CBDCs' infrastructure and its underlying technology.
3. The non-anonymity of CBDCs raise some ethics, legal, and privacy concerns for the public.
4. Cybersecurity problems.
5. CBDCs' developments and implementations are being hindered by technology, economic, social, political, environment, and ethical concerns (Elsayed and Nasir, 2022).
6. CBDC could trigger the disintermediation of the financial institutions.
7. CBDC's CIPS system would replace the SWIFT system (Walker, 2021; Goldman, 2022).
8. Cryptocurrency, geo-health pandemic (GHP), geo-financial stress, and Geo-political risk (GPR) uncertainties will affect the performance of CBDC globally.

PART IV: Policy Recommendations

1. For a CBDC to be a reliable means of payment; the CBDC's designs must be very efficient.
2. All the CBs need to work together and coordinate their designs before putting the world into a new global financial mess and chaos.
3. Before adopting CBDC; CBs should evaluate and understand what it is entry into.
4. To prevent large-scale criminal activities, the CBs should adopt design options that have privacy safeguards.
5. Interoperable, cross-border CBDC systems, national laws, and international technical standards need to be coordinated among the global CBs before international payments can be beneficiary
6. Financial-service providers and investors need optimize design choices for interoperability with digital currencies.

PART V: Conclusions

CBDC would have far-reaching consequences (advantages and challenges) for the global monetary systems which nobody can predict now.

References

Bank of Finland, 2023; BIS, 2022; Burlon et al, 2022; CBDC Tracker, 2023; Elsayed and Nasir, 2022; Finance & Development, 2022; Goldman, 2022; Smets et al, 2022; Stanley, 2022; Walker, 2021; World Bank, 2023; World Economic Forum, 2023.