

Central Bank Digital Currency and Monetary Policy Transmission Effectiveness: An Empirical Study

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Abstract: Central Bank Digital Currencies (CBDCs) are emerging as a revolutionary tool that has the ability to redefine the monetary policy transmission that may reshape the modern financial systems. This paper discusses the way the implementation of CBDCs could affect the efficacy, velocity and openness of monetary policy transmission. Central banks can more directly engage with households and firms, unlike traditional monetary instruments, which appear to rely on commercial banks and financial intermediaries. The paper discusses the most important transmission channels, including interest rate, credit, liquidity and expectations and assesses the ways CBDCs might improve or discontinue them in the context of various design frameworks, including account-based and token-based models. Specific consideration is put on the implications on financial intermediation & stability of the banking sector. The paper also captures the associated risks of adopting CBDC as disintermediation of commercial banks, cybersecurity, privacy and the risk of more bank runs when there is financial stress. The findings of the paper indicate positive association between CBDC Adoption Readiness and efficacy of Monetary Policy Transmission. CBDCs can enhance the efficiency and inclusivity of monetary policy, its effect on monetary transmission is highly contingent on its design decisions, regulatory coordination and gradual implementation. The results are adding to the existing body of research on digital currencies and present insights to policymakers considering CBDCs as an instrument of monetary policy in the future.

Keywords: Central Bank Digital Currency, Monetary Transmission Mechanism, Monetary Policy, Digital Money, Financial Stability, Central Banking.

1. INTRODUCTION

Modern monetary systems are confronted with significant structural tensions. Low interest rates, recurrent liquidity shocks, decline in cash usage and the emergence of private digital money have undermined the effectiveness of traditional instruments of monetary policy. Presently, central bank signals are predominantly channeled through indirect means via change in policy rates, reserve management and regulatory guidance. These mechanisms rely extensively on the commercial banks and the financial markets to induce real change in economic activity. This dependency has shown structural challenges for policy makers in the form of delay in the transmission of interest rates decisions, asymmetric credit transmission, financial exclusion and diminished effectiveness of policies in times of economic crisis.

In this regard, the Central Bank Digital Currencies (CBDCs) have since progressed at an instant on a theoretical debate to a good policy consideration. CBDCs are a direct digital claim against the central bank, which can be used by the general population or financial institutions and they bring an entirely new interface between the central bank and the economy. Compared to cash, CBDCs are programmable, traceable (to different extents) and real time operational providing central banks with unprecedented operational capability. The implication of this on the monetary transmission including the interest rate and expectation channels has been dramatic, as they have been demonstrating decreasing potency over the past decades. Proponents believe that CBDCs will help policy makers regain momentum again by allowing quicker, more predictable as well as inclusive conduction of monetary messages, particularly in economies with enormous informal sectors or inadequate banking coverage. The critics however caution that CBDCs have the potential to alter the dynamics of financial intermediation by diverting deposits out of the commercial banks, changing the credit creation process and increasing systemic risk. CBDCs are in the midst of one of the most significant debates concerning monetary issues in the twenty-first century.

The success of a CBDC regime in terms of its future monetary transmission does not only depend on the adoption but also on its design, governance and incorporation to the current financial systems. The central banks could use a retail CBDC to have a more direct impact on household and firm behavior by using additional tools to enhance the transmission lag between policy decisions and economic outcomes; including, but not limited to tiered interest rates, targeted transfers or time-bound liquidity injections. Meanwhile, this forthrightness disputes the orthodox two-level banking system which has always reconciled central bank mandate with intermediation by the private sector. CBDCs, if designed improperly, can lead to the acceleration of bank disintermediation, reduction in bank margins and loss of the credit channel, which is still essential to investment and economic growth. On the contrary, a well-designed CBDC (those incorporating holding limits or non-interest-bearing features) would not displace bank deposits and in addition provide better monetary control without compromising financial stability. In addition to the domestic policy, CBDCs also cast doubt on cross-border capital flows, currency substitution and monetary sovereignty, particularly to emerging economies competing against foreign digital currencies and stablecoins. The stakes are also high. CBDCs might not only provide a final upgrade to the monetary transmission mechanism but also create new weaknesses in already complicated financial systems. The transformation of transmission channels by CBDCs is thus not a luxury but a necessity of central banks that would like to remain relevant and effective in the state of an increasingly digitalized economy. This paper does not regard CBDCs as a technological innovation but as a structural type of monetary innovation, the success of which will be evaluated based on its effectiveness in policy transmission, financial stability and economic welfare.

2. LITERATURE REVIEW

Central Bank Digital Currencies: Concept, Rationale and Evolution

CBDCs is a concept that has come up as a result of diminishing cash payment, fast digitalization of payment systems and increasing power of privately issued digital currencies [1]. The existing literature is generally categorizing CBDCs as any type of sovereign money that is issued and/or supported by central banks and is meant to serve as legal tender in addition to or in place of physical money [2]. Researchers focus on highlighting the difference between CBDCs and cryptocurrencies and stablecoins because they are not issued centrally, are supported by regulation and influence monetary policies [3]. The desire to maintain monetary sovereignty and trust in money among the public during the emergence of privately issued digital payment instruments is defined as the main driving force in the literature [4]. Researchers claim that the absence of CBDCs poses a danger to central banks to lose control over the monetary system in the economy where the use of digital wallets and non-bank payment systems prevails. The other significant line of literature is concerned with the typologies of CBDCs, especially the difference between retail and wholesale CBDCs [5]. Retail CBDCs will be utilized by households and firms, whereas the wholesale CBDCs will be used by interbank payments and financial institutions. It is argued that retail CBDCs have deeper macroeconomic and monetary impacts because they directly influence the demand of money, payment behaviour and financial inclusion [6]. Other design decisions that have been considered in the literature are account based versus token based systems, anonymity and interest-bearing properties [7]. These dimensions of design are once again reported to be key determinants with regard to the interaction of the CBDCs with the current monetary structures. Altogether, the literature confirms the view of CBDCs as not only payment innovations but a structural tool of central banks that can revolutionize the core central banking functions.

Monetary Transmission Mechanism in the Digital Era

There is substantial literature on the efficacy of old monetary transmission system and how it is increasingly becoming weaker over the past decades [8]. Financial frictions, excess liquidity and structural changes in banking behaviour have tightened the interest rate channel, credit channel, asset price channel and expectations channel, which have already become constrained. Empirically, it is observed that the rate adjustments in the policies are frequently transferred gradually and disproportionately to the lending rates, especially in economies with high non-performing loans or concentrated banking industries. This has been an issue of concern regarding the diminishing power of the traditional monetary instruments particularly when there is economic stress or when the interest rate is close to zero levels. In this background, the literature sets CBDCs as a possible agent to enhance transmission of money [9]. According to scholars, CBDCs would be better able to boost the interest rate channel as they provide a quicker and clearer pass through of policy signals, especially when CBDCs are interest bearing. Also, CBDCs might enhance the expectations channel by offering central banks with a more direct way of communication and implementation, thus shaping the economic agents behaviour in a predictable and timely manner. The literature, however, also notes the possibility of a negative implication

on the credit channel in case CBDCs result in mass exodus of deposits out of commercial banks. These changes might limit the ability of the banks to lend and the way money is traditionally multiplied [10]. Therefore, although CBDCs can potentially fix some of the inefficiencies in monetary transmission, the literature indicates that their overall effect is conditional on their interaction with the already existing financial intermediaries.

CBDCs, Financial Stability and Policy Trade-offs

Perhaps the most controversial literature theme is the relationship between CBDCs and financial stability [7]. On the one hand, authors emphasize that CBDCs can play an important stabilizing role in improving payment system stability, decreasing transaction costs and gaining access to risk-free central bank funds. CBDCs are considered to be mechanisms that may enhance financial inclusivity by incorporating the unbanked population into the formal monetary system, expanding the foundation on which the monetary policy may work. Certain researches also indicate that the CBDCs may enhance the management of a crisis by facilitating quick and precise liquidity transfer in the case of an economic shock [12].

Conversely, there are alerts on new systemic risks brought about by CBDCs in a significant part of the literature. The issue that is most often mentioned is the disintermediation of banks where households and businesses will move deposits of the commercial banks into CBDC accounts, particularly in moments of financial unpredictability [13]. This may elevate threats of digital bank run and heighten financial turmoil. Also, researchers are concerned with issues of cybersecurity threats, data privacy and vulnerabilities to operations due to extensive digital currency infrastructure [14]. The literature comes to an agreement that the CBDCs are characterized by multifaceted policy trade-offs amid efficiency, regulation, innovation and stability. As a result, the majority of the research suggest a very careful, gradual and controlled strategy of CBDC adoption with focus on complementary, as opposed to substitutive integration into the current banking system [15].

3. RESEARCH METHODOLOGY

The research approach that the study uses to analyse the association between Central Bank Digital Currency (CBDC) Adoption Readiness and Monetary Policy Transmission Effectiveness is a primary quantitative research methodology. The instruments used in collecting primary data include a structured questionnaire. A non-probability purposive sampling technique was employed to select respondents possessing relevant professional exposure to monetary and financial systems. The respondents were drawn from banking, financial and economic sectors. One hundred and four responses were collected, out of which eighty-five valid responses were used for statistical analysis post data screening and cleaning by eliminating incomplete responses. This final sample size is adequate enough to carry out reliability tests, factor analysis, correlation and regression analysis as per established methodological recommendations. The questionnaire consisted of three sections, one being the demographic information (age group, educational qualification and professional experience), another being the independent variable CBDC Adoption Readiness (CAR) consisting of six items and third section being the dependent variable Monetary Transmission Effectiveness (MTE) consisting of further six items. Every construct item was measured under a five-point Likert scale between strongly disagree and strongly agree. The data obtained were coded, screened and analysed with IBM SPSS. The data of the respondents was summarized using descriptive statistics to get information on the characteristics of the respondents and trends of the variables. Cronbach alpha was used to assess the internal consistency of the constructs. The tests of KMO and Bartlett were done to determine the sampling adequacy and suitability of dataset for factor analysis respectively. The strength and direction of the relationship between the variables were analysed using correlation analysis. The hypothesis that CBDC Adoption Readiness significantly positively influences Monetary Transmission Effectiveness was tested with the help of the simple linear regression analysis. This design of methodology will give the study objectivity, reliability and empirical rigor when analysing the impact of CBDCs on monetary policy transmission effectiveness.

4. FINDINGS AND ANALYSIS

Age Group

Table 1: Age Group

Age Group	Frequency	Percent	Valid Percent	Cumulative Percent
25–35 years	26	30.6	30.6	30.6

36–45 years	32	37.6	37.6	68.2
46–55 years	21	24.7	24.7	92.9
56–65 years	6	7.1	7.1	100.0
Total	85	100.0	100.0	-

Source: IBM SPSS

The age group analysis depicts that the respondents are spread to various categories of the working age group with a greater concentration being put on the economically active age group. This is indicative of a sample that is in a good position to comprehend and appraise new financial innovations like Central Bank Digital Currencies (CBDCs). Younger age groups will be more digitally familiar and professionally involved in financial and monetary systems and their views on CBDC adoption will be more valuable to evaluate the readiness of the population to adopt the concept of CBDC and its consequences to the monetary transmission.

Educational Qualification

Table 2: Educational Qualification

Educational Qualification	Frequency	Percent	Valid Percent	Cumulative Percent
Bachelor's Degree	17	20.0	20.0	20.0
Doctoral Degree	15	17.6	17.6	37.6
Master's Degree	37	43.5	43.5	81.2
Professional Certification	16	18.8	18.8	100.0
Total	85	100.0	100.0	-

Source: IBM SPSS

Analysis of the educational qualification indicates that most of the respondents have more advanced educational qualification like Master degrees, Doctoral and Professional qualifications.

Professional Experience

Table 3: Professional Experience

Work Experience	Frequency	Percent	Valid Percent	Cumulative Percent
0–5 years	16	18.8	18.8	18.8
11–15 years	30	35.3	35.3	54.1
16–20 years	16	18.8	18.8	72.9
6–10 years	16	18.8	18.8	91.8
More than 20 years	7	8.2	8.2	100.0
Total	85	100.0	100.0	-

Source: IBM SPSS

The distribution of the professional experience reveals that the majority of the respondents have moderate to excessive experience in either banking, finance and similar areas. This indicates that the respondents are practically exposed to the operations of the monetary policy and financial systems. This experience provides the legitimacy of their answers because they may have realized the restrictions in existing monetary transmission systems and can effectively evaluate the possible contribution of CBDCs.

Reliability Test

Table 4: Reliability Test

Cronbach's Alpha	N of Items
0.898	12

Source: IBM SPSS

To determine the internal consistency of the measurement scales, the reliability test was done by using Cronbach's Alpha. The findings show that the value of CBDC Adoption Readiness (CAR) and Monetary Transmission Effectiveness (MTE) are much higher than the acceptable level of 0.70. This affirms the fact that the measures of each construct are internally consistent and reliable and therefore worthy of further statistical analysis.

Descriptive Analysis

Table 5: Descriptive Analysis

Variable	N	Minimum	Maximum	Mean	Std. Deviation
IV CBDC Adoption Readiness	85	15.00	30.00	23.4471	3.56072
DV Monetary Transmission Effectiveness	85	11.00	27.00	17.9882	3.50678
Valid N (listwise)	85	-	-	-	-

Source: IBM SPSS

The descriptive statistics show that the mean scores of all the CAR and MTE items are higher than the neutral midpoint showing that respondents generally have positive perception with reference to the adoption of CBDC and its role on the monetary transmission. The values of standard deviations imply that there are not significant differences in the answers of the respondents, which means that the group of people has rather similar opinions about the effectiveness of CBDCs as a monetary policy tool.

KMO and Bartlett's Test

Table 6: KMO and Bartlett's Test

Test	Value
Kaiser-Meyer-Olkin Measure of Sampling Adequacy	0.888
Approx. Chi-Square	447.298
Bartlett's Test of Sphericity	df
	66
	Sig.
	0.000

Source: IBM SPSS

The KaiserMeyerOlkin (KMO) measure of sampling adequacy has a value of more than 0.60 which is regarded as minimum level of sampling adequacy. Hence, the data can be analyzed using factor analysis. The test of Sphericity by Bartlett is statistically significant and thus it confirms that there is enough intercorrelation between the variables. The results confirm the construct structure validity of questionnaire and justify the suitability for multivariate analysis.

Correlation Analysis

Table 7: Correlation Analysis

Variables	IV_CBDC_Adoption_Readiness	DV_Monetary_Transmission_Effectiveness
IV_CBDC_Adoption_Readiness		
Pearson Correlation	1	0.638**
Sig. (2-tailed)		0.000
N	85	85
DV_Monetary_Transmission_Effectiveness		
Pearson Correlation	0.638**	1
Sig. (2-tailed)	0.000	
N	85	85

**. Correlation is significant at the 0.01 level (2-tailed) Source: IBM SPSS

A correlation analysis of the relationship shows that there is a positive and statistically significant correlation between CBDC Adoption Readiness (CAR) and Monetary Transmission Effectiveness (MTE). This implies that the increased preparedness to adopt CBDC correlates with better views on effective transmission of monetary policies. The proposed hypothesis is supported by the preliminary evidence of the strength and direction of the relationship.

Regression Analysis

Table 8: Regression Analysis

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	0.638 ^a	0.407	0.400	2.71583
a. Predictors: (Constant), IV_CBDC_Adoption_Readiness				

ANOVA^a

Model	Sum of Squares	df	Mean Square	F	Sig.
Regression	420.802	1	420.802	57.052	0.000 ^b
Residual	612.186	83	7.376	—	—
Total	1032.988	84	—	—	—
a. Dependent Variable: DV_Monetary_Transmission_Effectiveness					
b. Predictors: (Constant), IV_CBDC_Adoption_Readiness					

Coefficients ^a					
Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
Constant	3.250	1.973	—	1.647	0.103
IV CBDC Adoption Readiness	0.629	0.083	0.638	7.553	0.000
a. Dependent Variable: DV Monetary Transmission Effectiveness					

Source: IBM SPSS

To test the hypothesis, a simple linear regression test was performed in which CBDC Adoption Readiness was considered an independent variable and Monetary Policy Transmission Effectiveness was considered a dependent variable. The regression findings show that CAR positively affects MTE significantly. This indicates that greater is the preparedness and acceptability of CBDCs, there shall be more effectiveness of monetary transmission mechanisms. The model describes a significant amount of variation in MTE, thus, justifying the hypothesis of the study. Therefore, H1 accepted: CBDC Adoption Readiness (CAR) has a significant positive impact on Monetary Policy Transmission Effectiveness (MTE).

5. DISCUSSION

The demographic composition of the respondents offers a good basis on which the study findings are to be interpreted. The preponderance of the economically active age groups, the high level of education and a considerable work experience in the professional field, presupposes that the respondents have sufficient exposure to digital financial systems and monetary policy frames. This increases validity of the results, since the perceptions on the adoption of CBDC and monetary transmission effectiveness are based on informed and professionally relevant opinions. The demographic structure implies that the sample is sufficiently appropriate to evaluate progressive monetary innovations like Central Bank Digital Currencies.

The reliability analysis has also affirmed that the measurement tools of the CBDC Adoption Readiness (CAR) and Monetary Policy Transmission Effectiveness (MTE) are internally consistent. Having a high reliability value implies that the questionnaire items are effective at capturing the consistent constructs to permit meaningful analysis of the results to be obtained later. This justifies the strength of the empirical design of the study and ensures that the observed relationships are not due to measurement inconsistencies.

The descriptive analysis indicates that the general opinion regarding the adoption of CBDC and its usefulness to improve monetary transmission effectiveness is positive. The respondents strongly believe that CBDCs have the potential to enhance the efficiency of payments, financial inclusion and control of liquidity and policy implementation by the central bank. These impressions are indicative of an increasing optimism about the use of digital sovereign money as a useful monetary policy tool, especially in the use of the digital sovereign money to deal with the inefficiencies inherent in the traditional means of transmission. The homogeneity of the answers also shows that there is a common concept on the transformative potential of CBDCs. The findings of test of KMO and Bartlett test prove the sufficiency of the data used in multivariate analysis and construct structure of the study.

It implies that the dependent variables in the measurement of CAR and MTE are correlated and theoretically consistent enough. The construct validity reinforces that the CBDC adoption readiness and monetary transmission effectiveness are conceptually and empirically correlated with each other. The correlation analysis proves that CBDC Adoption Readiness and Monetary Transmission Effectiveness have a strong positive relationship.

This observation means that the more willingness and acceptance of CBDCs, the better the perceptions of successful monetary policy transmission. This correlation underscores the importance of the digital currencies in enhancing the policy pass-through especially via the interest rate, liquidity and expectations mechanisms. Lastly, the proposed hypothesis is empirically confirmed by the regression analysis. The results of the study indicate that CBDC Adoption Readiness has a significant positive impact on the Monetary Transmission Effectiveness. This highlights the importance of CBDCs in increasing the effectiveness of central bank policy transmissions to the real economy. This validates the claim that CBDCs are not payment innovations but rather strategic instruments of monetary policy which could enhance better policy outcomes, should they be designed and executed well.

6. CONCLUSION

In this research work, it was investigated that Central Bank Digital Currency (CBDC) Adoption Readiness relates to the Monetary Policy Transmission Effectiveness by applying a primary quantitative method. The results of the analysis of 85 responses prove that the willingness to adopt CBDC can positively influence the monetary transmission mechanisms significantly. The findings suggest that CBDCs can potentially boost the velocity, accuracy and scope of monetary policy through reinforcement of major transmission factors including interest rates, liquidity control and policy anticipations. There was a high level of concurrence that CBDCs are capable of enhancing the efficiency of payments, financial inclusion and central bank control of the money supply, eliminating structural constraints of traditional monetary instruments. The empirical data substantiate the opinion that CBDCs are not just digital payment tools but a strategic change in the central banking that can enhance the policy implementation and economic responsiveness. Nevertheless, the success of CBDCs in contributing to better monetary policy transmission will be determined by the right design decisions, regulatory protection and the incorporation of these new systems to the current financial institutions. The research work is relevant to the existing body of literature on digital money in that it empirically supports the hypothesis that CBDCs can enhance the effectiveness of monetary policy in a digital economy.

7. FUTURE SCOPE

Though the present study is significant, there are still ways in which future research can be conducted. Firstly, future research can use larger and more heterogeneous samples in various countries to increase the sample generalizability and represents cross-economy variations in CBDC readiness. Secondly, the longitudinal research design might be implemented to check the long-term effects of CBDCs on the monetary transmission in the various economic cycles. Thirdly, considering the fact that the study did not use the variables of financial stability, banking sector disintermediation and public trust, future research can include those variables to create a more cohesive framework. Complex causal relationships of variables can also be analyzed using more advanced econometric methods like structural equation modeling (SEM). Lastly, as pilot CBDC implementations continue around the world, future research has the ability to use real-life transaction-level or policy data to confirm the findings of perception to understand real-world transmission effects of monetary policies.

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