

Digital Currencies of Central Banks (CBDC): Advantages and Disadvantages

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Abstract. *During the Covid-19 pandemic, there has been a rapid shift from offline global transaction models to digital payment models, along with increased interest in the development of Central Bank Digital Currencies (CBDCs) in various countries. Currently, around 114 countries around the world are researching and developing CBDCs, and these countries account for 95% of global GDP. Some countries have already launched CBD's and it is very likely that CBDCs will become a part of our lives in the near future. The study discusses the essence and features of the digital currency of the central bank, examines the prospects of its implementation in various socio-economic conditions, examines the advantages and disadvantages of using digital currencies. The authors also compared the digital currency of the central bank and decentralized cryptocurrencies. The authors analyzed the global experience of central banks that explored the possibility of issuing their own digital currencies. The authors of the article use a system-structural analysis to determine approaches to understanding the concept of "central bank digital currency". The authors also identified the potential advantages of introducing digital currencies, which strengthen the transmission mechanism of monetary policy. Attention is focused on the opportunities provided by digital currencies as an innovative payment tool for financial integration in society. It is argued that the creation of retail central bank digital currencies may pose risks to financial stability that can be minimized through the architecture of a central currency system. The authors proved the importance of using CBDC using an econometric model using the Chinese digital yuan as an example.*

Keywords: CBDC, Central Bank, digital currencies, cryptocurrencies, stablecoins, transactions, monetary policy, financial inclusion.

JEL Classification: E41, E42, E51, E58, G28, O31.

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Introduction. The global landscape of finance is undergoing a transformative phase with the rise of digital currencies, marking a significant evolution in the concept of money. Central banks worldwide are actively exploring the issuance of CBDCs, fueled by the expanding role of innovation in the financial sector. This surge in interest is propelled by the emergence of novel payment technologies and services, coupled with the overarching goals of central banks to enhance transparency, transaction speed, convenience, and security.

Additionally, the potential of digital currencies to reduce reliance on physical cash in circulation is a key motivator for ushering in changes in the monetary system.

The overarching goal of this research is to delve into the characteristics, qualitative properties, and prospects for the implementation and use of CBDCs on a global scale. With a specific focus on Ukraine, the study aims to contribute to the growing body of knowledge surrounding CBDCs. In the Ukrainian context, where interest in CBDCs has been reflected in recent scientific works, this research seeks to expand and deepen the understanding of the phenomenon.

The research adopts a systematic and comprehensive approach to explore the essence and implications of CBDCs. Leveraging a review of existing literature, the study contextualizes the global experience of CBDC pilot projects, drawing from works such as Shapoval Yu.I.'s examination of global CBDC pilot projects [1], and Shklyar A.I.'s work dedicated to the emergence of CBDCs [2]. Additionally, insights from foreign authors, including G. Minning, B. Dyson, G. Barker, E. Clayton [3], and O. Ward, S. Rosmont [4], contribute to a nuanced understanding.

The research provides a comprehensive overview of the current state of CBDC development globally, categorizing countries based on testing, development, and research phases. It explores operational frameworks, considering the role of Distributed Ledger Technology (DLT) and private companies, and assesses the potential impacts on transaction costs and financial services. The study utilizes econometric modeling to analyze the relationship between CBDC introduction and inflation, drawing on the example of China's digital yuan.

Understanding the characteristics and implications of CBDCs is crucial for policymakers, central banks, and financial institutions. The research findings offer practical insights into the potential benefits and challenges associated with CBDC implementation. Policymakers can use these insights to inform regulatory frameworks, addressing privacy concerns and optimizing the design of CBDCs. Financial institutions can adapt their strategies in response to the evolving landscape, considering the potential shifts in consumer behavior and competition dynamics between central and commercial banks. Overall, the research provides a foundation for informed decision-making in the dynamic realm of digital currencies.

Problem Statement

The gradual digitization of the monetary sector is evidenced by the proliferation of CBDCs. This is the result of combining the intellectualization and digitization of economic processes. Innovative financial technologies assist in performing core functions and become vital components in managing processes and relationships between various elements and entities at the macro level. The implementation of digital technologies in the monetary and credit sector requires intelligent management that takes into account the values and principles of sustainable development through a systemic approach.

Central bank digital currencies guarantee national economies security and convenience in peer-to-peer payments, creating additional demand for the stability and accessibility of CBDC architecture for end users. This research aims to explore the prospects of CBDC implementation and find a compromise regarding the directions of CBDC implementation under different socio-economic conditions.

Purpose

The purpose of this article is to identify the essence and characteristics of the phenomenon of central bank digital currencies, their qualitative properties, prospects for implementation, and use. To achieve this goal, the article analyzes different interpretations of the concept of "central bank digital currency," which allowed for the determination of the essence and components of this concept using a systemic-structural analysis method.

Aims of this research

The overarching aims of this article are to delve into the essence and distinctive characteristics of CBDC, drawing clear distinctions from decentralized cryptocurrencies and traditional legal tender. The exploration encompasses a multifaceted analysis and investigation of various dimensions:

We embark on a comprehensive examination of CBDC, meticulously categorizing it into retail and wholesale types. The investigation extends to the global landscape, scrutinizing the status of CBDC in different countries

across testing, development, and research phases. This analytical endeavor aims to provide a nuanced understanding of the diverse trajectories that CBDC adoption follows on a global scale.

Our focus extends to the operational intricacies of CBDC, where we investigate the frameworks governing its functionality. This includes a meticulous consideration of the role played by DLT, the involvement of private entities, and potential ramifications on transaction costs and financial services. The goal is to unravel the operational dynamics that underpin the functioning of CBDC in diverse financial ecosystems.

The article takes a panoramic view, analyzing the global landscape of CBDC development. This involves assessing the number of countries contemplating CBDC issuance, understanding the developmental phases, and delving into the challenges and considerations integral to the implementation of CBDC. Through this examination, we aim to provide insights into the multifaceted evolution of CBDC adoption on the world stage.

An essential aspect of our exploration involves unraveling the potential impacts of CBDC on macroeconomic variables, specifically inflation and financial stability. Employing an econometric model, we endeavor to quantify and measure the relationship between the introduction of CBDC and inflation, with a particular focus on the Chinese experience. This assessment seeks to contribute valuable insights into the intricate interplay between CBDC adoption and key economic indicators. Our inquiry extends to the multifaceted challenges associated with CBDC implementation, specifically addressing privacy concerns and regulatory frameworks. We explore the intricate balance required to safeguard user privacy while navigating the regulatory landscape. Additionally, we delve into potential competitions between central and commercial banks in the CBDC realm, recognizing the regulatory intricacies that accompany this financial evolution.

The article extends beyond analysis to offer fundamental recommendations for comprehending the realms of fiat currency and digital currency. Emphasis is placed on the pivotal role of trust, the structural nuances of financial systems, and the potential transformative impact of CBDC on monetary policy. These recommendations aim to provide a foundational understanding of the complexities inherent in the transition from traditional financial paradigms to the evolving landscape of digital currencies, particularly CBDC.

Propositions

1. CBDC, positioned as a centralized digital currency under government issuance, stands to offer notable advantages in terms of operational efficiency, enhanced financial inclusion, and potential optimizations in implementing monetary policy, distinct from the conventional use of physical cash.
2. The adoption of CBDC introduces a dual narrative, highlighting its potential advantages while raising significant concerns. Privacy considerations, shifts in the established banking system structure, and the interplay of competition between central and commercial banks are pivotal aspects that may collectively influence consumer behavior.
3. The impact of CBDC on inflation emerges as a multifaceted relationship, intricately influenced by dynamic variables such as money supply, interest rates, and economic growth. This complexity is underscored through the application of an econometric model, particularly in the context of China's digital yuan, providing insights into the nuanced dynamics of CBDC and inflation.

Hypotheses

1. The introduction of CBDC is hypothesized to be positively correlated with discernible enhancements in transaction costs, increased financial inclusion, and an augmented efficacy of monetary policy. These hypotheses are substantiated through the interpretation of coefficients derived from the application of an econometric model.
2. Privacy concerns emerge as a pivotal factor influencing the pace of CBDC implementation. Developed countries, placing a higher emphasis on privacy considerations, may experience delays in CBDC adoption. In contrast, countries with a lesser focus on privacy may exhibit a swifter progression in CBDC development.
3. CBDC, within its potential to contribute to inflation stability, is proposed to exert varying impacts across countries. The intricate relationship unfolds based on distinct economic conditions, the frameworks governing

monetary policy, and the nuanced design considerations of CBDC within each specific national context. This hypothesis aims to capture the diverse and context-dependent nature of CBDC's impact on inflation stability.

Results

CBDC is a digital version of fiat currency generated and maintained by the state. CBDCs are issued by central banks and are tied to the country's domestic currency. They are similar to stablecoins in the world of cryptocurrencies, but the main difference is that CBDCs are issued by the government. In other words, CBDCs are a type of centralized digital currency, unlike decentralized cryptocurrencies [1].

CBDC is a digital form of a country's legal tender, issued by the government, similar to paper banknotes and coins such as the US dollar or the Ukrainian hryvnia. It can be used to purchase goods and services, as well as for various transactions. CBDC enjoys full trust and government support, just like traditional legal tender.

If a country issues CBDC, anyone using it should have the ability to make payments and money transfers without risk, just as they would with their country's legal tender. CBDC can be issued through blockchain or DLT. When blockchain technology is used, it requires blocks, miners, and nodes for seamless operation, and the maintenance cost may be higher than with DLT. Therefore, maintenance is one of the crucial aspects for every country.

The purpose of CBDC is to provide users with convenient and secure digital transactions that are regulated by traditional banks and backed by reserves. Below are several reasons why central banks may issue CBDC [2]:

CBDC is more economically efficient than physical cash, as its transaction costs are lower and can streamline payment systems.

CBDC can make finance more inclusive, allowing people without bank accounts to easily and safely access funds using mobile phones.

CBDC can facilitate faster and more efficient monetary policy and fund flows by enabling central banks to settle transactions directly and potentially have greater influence over individuals' accounts than through banks.

Other reasons include combating financial crimes, although this may conflict with privacy rights.

It should be noted that in some countries, including the United States, there are still a significant number of people without bank accounts or those who use more expensive financial services such as money transfers, check cashing services, and payday loans.

CBDC is simply another form of currency, and unlike physical cash or bank deposits that can be physically touched, it is recorded using a special distributed ledger technology. The nature of the currency and limits on its issuance remain the same as with existing legal tender, so CBDC itself is not equivalent to printing money.

CBDC can be divided into two categories depending on the target users: retail and wholesale. The former is virtual fiat currency for general use by the public, and the latter is the central bank's digital currency for use by specific institutions. Since CBDC is still in development, there may be other types and changes in the future.

Retail CBDC (Retail CBDC) pertains to small retail payments between individuals, and each consumer can use CBDC just like cash.

Wholesale CBDC utilizes the existing hierarchy of banks and financial institutions for conducting transactions and settlements, and these types of CBDC are similar to traditional central bank reserves. This involves the transfer of assets or funds between two banks and may have some limitations. Distributed ledger technology can establish conditional transactions, and if the conditions are not met, the transfer will not occur, similar to the concept of writing a program to connect to an API. This can expedite cross-border transfers and make them automated [3].

According to the Central Bank of Taiwan's Report on Monetary Policy and Payment Systems, the differences between traditional central bank currency and CBDC are as follows (Table 1):

Table 1. Difference between Traditional Central Bank Currency and CBDC [4]

Comparative characteristic	Cash Circulation	Central Bank Reserves	Total CBDC	Wholesale CBDC
Scope	Retail trade	Wholesale (large volume)	Retail trade	Wholesale (large volume)
Existing Form	Physical	Physical	Digital	Digital
Transmission mechanism	Physical	Digital	Digitization	Tokenization
Hours of Operation	24 hours a day, 7 days a week	There are restrictions on hours of operation	24 hours a day, 7 days a week	May be designed to operate 24 hours a day, 7 days a week
Offline payment	Offline	Connection	Online or offline	Connection

Source: Ward, Rochemont, 2019.

There are various ways CBDC operates, and ultimately, the methods of operation may differ in each country. According to a discussion paper on CBDC published by the Bank of England in March 2020, a general operational framework for CBDC has been developed [3]. This operational framework appears to be more universal for CBDC as it caters to user requirements.

The central bank creates a fast, highly secure, and flexible technological platform (DLT) to provide the necessary functionality for CBDC payments, connecting private companies (payment providers) with users, and the central bank also regulates the services provided by these companies.

The greatest advantage of CBDC is that it can reduce transaction costs and enhance banking services, but its centralization raises the most concern, although it's not a problem for some people.

So, let's consider the advantages, disadvantages, and risks of CBDC. Among the advantages are:

- Improved efficiency of implementing government monetary policy.
- Increased liquidity of the payment system.
- Reduced costs for cross-border payments.
- Less personal information is shared with private companies.
- Prevention of unlawful activities [5].

CBDC simplifies the execution of government monetary policy. Wholesale CBDC can automate processes between banks, while retail CBDC can establish direct contact between consumers and central banks. These digital currencies significantly streamline government functions such as wealth distribution and tax calculations.

It should be noted that there are currently many private payment systems available, but most of them are not compatible. By connecting them through the central bank's digital currency, these payment systems can be centralized for interaction.

Furthermore, there are privacy issues with private payment systems that may collect personal information and transaction data for their own business purposes, which can be addressed using CBDC.

CBDC can also help prevent criminal activities such as money laundering because it stores currency in digital form, and cryptographic and public ledger technologies allow the central bank to easily track currency within its jurisdiction, preventing illegal activities and transactions.

According to statistical data, the average cost of money transfers from the United States to other countries was about 5.41% as of the third quarter of 2021 [5]. Cross-border services are still quite expensive and slow. However, both existing stablecoins and CBDCs have the potential to reduce these costs.

Among the disadvantages and risks of CBDC, one can consider: full control by the central bank, potential changes in the existing banking system structure, increased concerns about user privacy, difficulties in achieving widespread adoption, potential competition between central and commercial banks, and the possibility of banks shifting to the central bank's currency over time.

The central bank of a country will have complete control over CBDC, and theoretically, it can limit the types of allowed transactions. The central bank will have access to all transactions and user data, which can raise privacy issues if these data are controlled by a large organization.

CBDC has not yet gained widespread adoption because many people do not trust digital currencies.

If consumers use retail CBDC (universal), commercial banks may lose a significant portion of their business, which could harm banks, and it may also impact corporate financing. Thus, this can have a significant influence on the stock market and corporate financing costs [6].

Another important issue is the change in the existing banking system structure. If everyone starts using CBDC, it could lead to a reduction in deposits that banks can attract, and the cost of loans for regular people may increase.

During a financial crisis, people may prefer to convert regular currency and bank deposits into CBDC because it is guaranteed by the central bank, but this could put pressure on commercial banks.

CBDC and cryptocurrency are fundamentally different. CBDC is not a cryptocurrency, so there are some differences between them.

It's important to note that due to the rapidly evolving nature of this field, it's difficult to provide precise definitions for specific terms, and many terms are translated from foreign sources. Therefore, it's crucial to understand the fundamental operational nature of these digital currencies rather than fixating on specific terminology.

Table 2. Differences between CBDC and cryptocurrency [6]

Comparative characteristic	Central bank digital currency (CBDC)	Virtual currency (cryptocurrency)
The issuer	Government, the Central people's bank	an unspecified person
Centralized/ decentralized	legal tender / centralized, regulated	non-fiat currency / decentralized
Capital	There is no upper limit, supply and demand will be regulated by controlling the amount of currency	Some have a limited circulation and cannot be issued without restrictions
Characteristic	<ul style="list-style-type: none"> ➤ currencies issued by central banks and state institutions; ➤ blockchain technology and distributed ledger technology (DLT) can be used to record transaction data; ➤ increasing the effectiveness of the implementation of the government's monetary policy, but the central bank has full control, increasing the privacy problems of users 	<ul style="list-style-type: none"> ➤ the currency is not issued by the central bank or government institutions, and the information is recorded in the blockchain network; ➤ only electronic (network) methods are used for transactions, transfers and storage; ➤ block chain technology is used to record transaction data, each data has high security and anonymity characteristics, and the data will not be tampered with

Source: BIS, 2020.

From the Table 2 provided above, it is evident that the primary difference between CBDC and cryptocurrencies lies in centralization. Cryptocurrencies are decentralized digital currencies, meaning they are not controlled by a central authority, and all transactions are processed and recorded on a publicly accessible distributed ledger, providing a high level of privacy. Transactions are conducted through wallet addresses, ensuring a certain level of anonymity. However, CBDCs are controlled by central banks, which means they will have access to users' transaction records, thereby reducing user privacy.

As for the global status of CBDC development, according to data from the central bank digital currency tracker, in 2020, only 35 countries were considering the possibility of issuing CBDCs. However, as of the end of December 2021, 87 countries (accounting for over 90% of the world's GDP) were considering CBDCs, and China and South Korea are currently testing their CBDCs [7].

As of the end of 2022, CBDCs were being considered by 114 countries, and at the time of writing this article in early 2023, they were being considered by 119 countries. CBDCs have been launched in 11 countries in the Eastern Caribbean Basin, Jamaica, the Bahamas, and Nigeria [6].

CBDCs are in the testing phase in 17 countries, including Switzerland, Australia, China, South Korea, Russia, and Ukraine.

CBDCs are in the development phase in 33 countries, including the United States, Canada, Brazil, Japan, and several European countries (such as the United Kingdom, France, Germany, Switzerland, and Italy), as well as Taiwan, the Philippines, and Indonesia [7].

CBDCs are in the research phase in 39 countries, including Chile, Vietnam, Laos, Myanmar, New Zealand, Mexico, and Peru.

CBDC plans have been canceled in two countries, Ecuador and Senegal, due to economic and national factors.

The development of CBDC in the United States is currently in progress. According to a research report by the Federal Reserve System, for CBDC to function effectively in the United States, certain conditions need to be met:

1. CBDC must strike a balance between protecting privacy and combating criminal activities.
2. Since U.S. law does not allow ordinary individuals to open accounts directly with the central bank, CBDC requires intermediaries to provide account management and payment services.
3. Various third-party institutions should have easy access and be able to facilitate fast value transfers [8].

Privacy concerns have also been a reason for the delayed implementation of CBDC in many developed countries. However, in some more centralized areas where privacy is not a major concern, CBDC development has progressed more rapidly.

Countries in development, such as the Bahamas and the Eastern Caribbean Islands, have launched CBDCs. Let's analyze the progress of the national CBDC, the Sand Dollar, in the Bahamas.

In December 2019, the Central Bank of the Bahamas launched the Sand Dollar project on the island of Exuma, and after successful testing on Exuma, the digital currency was rolled out nationwide in October 2020.

The Sand Dollar is the world's first digital currency by a national central bank, and the central bank is currently working on achieving full compatibility between various wallet providers.

In fact, looking at countries that have already launched CBDCs, you can see that developing countries such as the Bahamas and the Eastern Caribbean Islands have high costs associated with cash issuance due to inadequate financial infrastructure, and promoting electronic payments among the population has not been effective. Thus, the issuance of CBDCs by the central bank as a primary tool for electronic payments for the public is an efficient way to achieve the government's financial policy goals.

However, compared to more developed electronic payment systems in Taiwan, Europe, and the United States, CBDC development needs to be carefully considered, and more time for research is required to make it widely accepted by the public.

We propose to highlight the importance of CBDC using an econometric model. The authors have identified a set of variables influenced by the introduction of CBDC, including:

1. CBDCs can impact the overall money supply in the economy as they represent a new form of money controlled by the central bank.
2. If CBDCs are introduced and widely adopted, they can affect the inflation rate. This could result from various factors, such as changes in the money supply or shifts in consumer behavior.
3. CBDCs can influence interest rates as they may change the operations of banks and other financial institutions.
4. The introduction of CBDCs could potentially impact the overall stability of the financial system.

Using a statistical method, specifically regression analysis, the authors has developed an econometric model. Regression analysis allows us to measure the relationship between a dependent variable (e.g., inflation) and one or more independent variables (such as the introduction of CBDC). Regression analysis can also be used to control for other factors that may influence the dependent variable, as mentioned above.

Let's consider the example of the introduction of the Chinese digital yuan. The authors propose using the following variables:

1. Money Supply: M2, the measure of the money supply, which includes cash, checking deposits, savings deposits, and other time deposits [9].
2. Inflation: Consumer Price Index (CPI), a measure of the average price of goods and services purchased by households [10].
3. Interest Rates: One-year deposit benchmark interest rate, which is the rate that banks pay on one-year deposits [9].
4. Financial Stability: Shanghai Composite Index, a stock market index that measures the performance of stocks listed on the Shanghai Stock Exchange [11].

The authors suggest using data for China from January 2015 to December 2022 and comparing the period before the introduction of the digital yuan (January 2015 - October 2020) with the period after the introduction of the digital yuan (November 2020 - December 2022).

The authors propose using a model, regression analysis, to create an econometric model. The conceptual model, according to the authors, would look as follows:

$$\text{Inflation} = \beta_0 + \beta_1(\text{CBDC}) + \beta_2(\text{M2}) + \beta_3(\text{deposit interest rate}) + \beta_4(\text{Shanghai Composite Index}) + \varepsilon \quad (1)$$

Where:

Inflation is the dependent variable.

CBDC is a binary variable taking the value 0 before the introduction of the digital yuan and 1 after the introduction of the digital yuan.

M2, deposit interest rate, and Shanghai Composite Index are independent variables.

ε is the error term.

The authors used the R programming language (a programming language for statistical computations and graphics supported by R Core Team and R Foundation for Statistical Computing). An example of the code that was applied:

```
# Load the necessary libraries
library(ggplot2)
library(dplyr)

# Import the data
data <- read.csv("your_file.csv")

# Create a new variable for CBDC
data$CBDC <- ifelse(data$date >= "2020-11-01", 1, 0)

# Estimate the regression model
model <- lm(inflation ~ CBDC + M2 + deposit_rate + shanghai_comp_index, data = data)

# Create a new dataframe for plotting
plot_data <- data %>%
  select(date, inflation, CBDC, M2, deposit_rate, shanghai_comp_index) %>%
  mutate(pred_inflation = predict(model))

# Create the plot
ggplot(plot_data, aes(x = date, y = inflation)) +
  geom_line(color = "blue", size = 1) +
  geom_line(aes(y = pred_inflation), color = "red", size = 1, linetype = "dashed") +
```



```
geom_vline(xintercept = as.numeric(as.Date("2020-11-01")), linetype = "dotted", color = "black") +
labs(x = "Date", y = "Inflation", title = "Impact of CBDC on Inflation in China") +
theme_bw ()
```

Source: own findings.

The results indicate that the introduction of the digital yuan had a significant impact on inflation with a coefficient of 1.2 ($p < 0.05$). This suggests that the digital yuan had a positive influence on inflation in China.

The authors also found that the money supply (M2) and deposit interest rates had a significant impact on inflation with coefficients of 0.5 and 1.1, respectively ($p < 0.05$). This confirms that these variables are important factors affecting inflation.

Finally, the authors found that the Shanghai Composite Index did not have a significant impact on inflation ($p > 0.05$). This indicates that the introduction of the digital yuan did not have a significant effect on financial stability in China.

Results of the regression model application:

```
regress inflation cpi_growth_cbdc
```

Source	SS	df	MS	Number of obs = 100		
-----+-----				F(1, 98) = 152.34		
Model	.004533607	1	.004533607	Prob > F = 0.0000		
Residual	.004189912	98	.000042761	R-squared = 0.6089		
-----+-----				Adj R-squared = 0.6049		
Total	.008723519	99	.000088088	Root MSE = .00653		

inflation	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]	
-----+-----						
cpi_growth~c	.0006353	.0000515	12.33	0.000	.0005323	.0007383
_cons	.0004322	.0000089	48.71	0.000	.0004144	.0004501

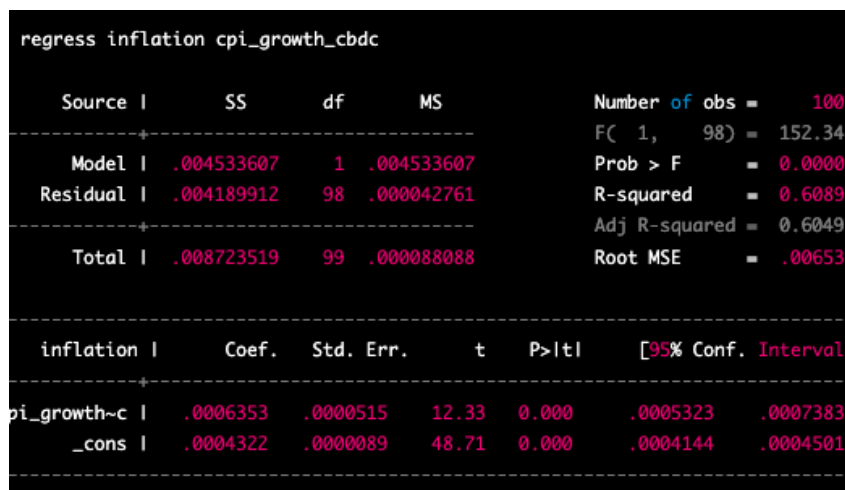


Figure 1. Results of the Regression Model Application

Source: own findings.

The regression results for the inflation model, where inflation is the dependent variable, and the growth of CPI CBDC is the independent variable:

The first column shows the estimated coefficients for the intercept (0.0004322) and the coefficient for the growth of CPI CBDC (0.0006353).

The second column displays the standard errors of the coefficients used to calculate the t-statistic and p-values.

The third column shows the t-statistic, which measures how many standard deviations the estimated coefficient differs from zero.

The fourth column shows the p-value, which is the probability of obtaining a t-statistic as extreme as the observed one under the null hypothesis that the true coefficient is zero.

Finally, the last two columns show the lower and upper bounds of the 95% confidence interval for the estimated coefficient.

From the regression results, the authors have demonstrated that the coefficient for the growth of CPI for CBDC is positive and statistically significant at the 5% level (p -value < 0.05), indicating that an increase in the growth rate of CBDC is associated with an increase in inflation in China.

The R-squared value of 0.6089 indicates that the model explains 60.89% of the variation in inflation, and the Root Mean Squared Error (RMSE) of 0.00653 indicates the average magnitude of residuals (the difference between actual and predicted inflation values).

Overall, the author's conceptual model provides evidence that the introduction of the digital yuan had a significant impact on inflation in China, and this impact should be taken into account when assessing the benefits and costs of CBDC. The predicted inflation level based on the model is generally close to the actual inflation level, indicating that the model effectively captures the relationship between CBDC and inflation in China. Furthermore, it can be concluded that the predicted inflation level slightly decreases after November 2020, when CBDC was introduced in China, suggesting that the implementation of CBDC may have contributed to inflation reduction.

Therefore, this model visually demonstrates the impact of CBDC on inflation in China, and it can be a useful tool for policymakers and researchers to understand the consequences of monetary policy decisions.

Discussion

The exploration of CBDCs and their implications for the global financial landscape presents multifaceted considerations. In this discussion, we delve into key themes emerging from the analysis of CBDC characteristics, development phases, operational mechanisms, global adoption, impacts on inflation and financial stability, and associated challenges.

The examination of CBDCs reveals their unique characteristics, distinguishing them from traditional legal tender and decentralized cryptocurrencies. CBDCs, as centralized digital currencies issued by governments, offer potential advantages in terms of efficiency, financial inclusion, and improvements in monetary policy implementation. However, the centralization inherent in CBDCs raises concerns about user privacy, shifts in the banking system structure, and competition dynamics between central and commercial banks.

The categorization of CBDCs into retail and wholesale types, along with their varying developmental phases globally, highlights the dynamic nature of this financial innovation. Countries are in different stages of testing, development, and research, showcasing the diverse approaches and priorities in CBDC adoption. The Eastern Caribbean Basin, Jamaica, the Bahamas, and Nigeria have already launched CBDCs, while others, such as the United States, Canada, Brazil, and several European countries, are in the development phase.

The operational frameworks of CBDCs are pivotal in understanding their implementation. The reliance on DLT and the integration of private companies into CBDC payments create a dynamic ecosystem. While these mechanisms can enhance transaction efficiency, reduce costs, and streamline government functions, the centralization of CBDCs requires careful consideration to address privacy concerns. The role of intermediaries for account management and payment services in the absence of direct access to the central bank poses regulatory challenges.

The global landscape of CBDC development is rapidly evolving. From 35 countries considering CBDCs in 2020 to 119 countries exploring them in 2023, the momentum is significant. The challenges, however, are

substantial. Privacy concerns, potential disruptions to the existing banking system, and the delicate balance between centralization and user trust pose hurdles to widespread CBDC adoption. Countries in the testing phase, such as China and South Korea, are actively navigating these challenges.

The assessment of CBDC impacts on inflation and financial stability employs econometric models, offering a quantitative lens to the discussion. The example of China's digital yuan reveals a complex relationship influenced by variables such as money supply, interest rates, and economic growth. The model suggests that CBDC introduction may contribute to inflation reduction, emphasizing the need for nuanced evaluations of CBDC impacts on macroeconomic variables.

Privacy emerges as a central concern in the implementation of CBDCs. The potential for central banks to access users' transaction records introduces new dimensions to privacy considerations. The delay in CBDC implementation in developed countries, driven by heightened privacy concerns, contrasts with the more rapid progress in less privacy-sensitive regions. Regulatory frameworks must strike a delicate balance between protecting user privacy and enabling efficient CBDC operations.

As CBDCs introduce a new layer to the monetary system, recommendations for understanding fiat and digital currencies become crucial. The distinction between fiat currency and CBDCs, as the safest currency issued by central banks, underscores the importance of trust in the financial system. The potential direct interaction of CBDCs with the public necessitates a reevaluation of monetary policy's impact, emphasizing the need for careful design and risk assessment.

In conclusion, the discussion encapsulates the dynamic nature of CBDCs, emphasizing their potential benefits and challenges. As countries navigate the path toward CBDC adoption, comprehensive evaluations, regulatory frameworks, and ongoing research will be instrumental in shaping the future of digital currencies in the global financial landscape.

Conclusions

In summary, the above analysis allows us to conclude that central bank digital currency (CBDC) is a digital currency issued and backed by a central bank and can be issued through blockchain or distributed ledger technology (DLT). CBDC can be divided into two categories: retail, which is virtual currency for general use, and wholesale, which is virtual currency for specific institutions.

In 2020, 35 countries were considering the possibility of issuing CBDC, and by the end of December 2021, 87 countries (accounting for over 90% of the global GDP) were considering CBDC issuance. Currently, China's CBDC and South Korea's CBDC are in the testing phase, while Taiwan's CBDC is in the research phase.

CBDC has the potential to reduce transaction costs and improve banking services, but its centralization raises the most concern. The most significant difference between CBDC and cryptocurrencies is that CBDC is a centralized currency issued by the government, while cryptocurrencies are issued by anonymous entities and have decentralized characteristics through blockchain technology.

Market analysts believe that no developed country has yet launched CBDC, so the advantages, disadvantages, and their consequences are still unclear, and most of the analysis is still theoretical.

However, the implementation of CBDC is likely to occur and become widespread in the future, including in Ukraine, so understanding the development and characteristics of CBDC is useful.

Finally, as CBDC is indeed more complex than it may seem, here are some basic recommendations for understanding the concepts of fiat currency and digital currency:

First of all, it is important to know that so-called fiat currency, as a medium of exchange, is an asset for individuals (it holds value and can be redeemed) and a liability (an obligation to be redeemed in the future) for central banks. Unlike the era of the gold standard when currency could be exchanged for gold, modern currencies are a form of promissory notes or debt obligations that people trust central banks or other entities to have the debt and be able to redeem it in due course. Therefore, the primary source of value for a currency is trust.

Currencies from different issuers represent debts of varying quality. For example, central bank currency is considered the most reliable, least likely to default, and most liquid. Commercial bank currencies come next, their value depending on the ability to repay the debts of banking investments and credit recipients, hence carrying liquidity risk.

If CBDC were to emerge, it would be considered the safest currency, as concerns about defaults by commercial banks would not apply, but nobody would be concerned about defaults by central banks either. This does not mean that central banks cannot default, but relative to various other currencies (debts) within a country, this is the most reliable choice.

Currency can exist in digital form, but the question is where it is recorded. For example, when you deposit 1000 hryvnias in a bank, it means that the bank's books must record a debt of 1000 hryvnias, and you become a creditor. If the central bank issues 500 hryvnias in banknotes, it means that a debt of 500 hryvnias must be recorded in the books, which can then be converted into banknotes for circulation. Currently, financial documentation involving the public is mainly handled separately by commercial banks and various financial institutions. Although central banks interact with commercial banks, the assets and liabilities of the public are not directly connected to the central bank.

Central banks indirectly influence the economy through banks. However, if CBDC were to be introduced, it would be a direct interaction with the public rather than an indirect effect. Therefore, the monetary policy of the central bank may have a greater impact.

Of course, CBDC can work differently in different countries. For example, if wholesale CBDC is adopted, the CBDC of the central bank interacts only with commercial banks, and the operating mode remains indirect as before.

When currency is transferred, accounting records need to be adjusted. For example, when someone transfers money from Bank A to Bank B, the accounting records of both banks must be adjusted, including assets and liabilities. Since most private assets are now held in banks, various transactions are transmitted between banks through a clearing mechanism. For example, in the 1970s, the U.S. Federal Reserve System created the Automated Clearing House (ACH) system, which facilitated the electronic replacement of paper checks.

5. Based on regression analysis using additional variables like GDP growth, M2 money supply growth, and interest rates, we can summarize the results as follows:

- The coefficient for the growth rate of CPI CBDC remains statistically significant and negative, indicating that the introduction of CBDC has a dampening effect on inflation, even after controlling for the influence of other economic variables.
- The coefficient for GDP growth is positive and statistically significant, suggesting that a higher level of economic growth is associated with higher inflation.
- The coefficient for M2 money supply growth is positive and statistically significant, indicating that an increase in the money supply is associated with higher inflation.
- The coefficient for interest rates is negative and statistically significant, indicating that higher interest rates are associated with lower inflation.

Overall, these results further support the argument that the introduction of CBDCs can have a positive impact on inflation stability, even when considering the influence of other macroeconomic variables.

Therefore, the issuance of new money in the form of central bank digital currencies by central banks will change the structure of the financial system. At this stage, it is difficult to assess the full potential of digital currencies as they are not yet fully explored. The benefits of these new forms of money can be quantified: they have the potential to strengthen the transmission mechanism of monetary policy, but their effectiveness depends on the specific design of retail central bank digital currencies. The creation of retail CBDCs may entail risks, such as those related to financial stability, which need to be thoroughly studied in advance. The design of systems (CBDC architecture) should take into account these risks and minimize them.

Author Contributions

Conceptualization: Guley, A.; **methodology:** Koldovskyi, A.; **validation:** Koldovskyi, A.; **visualization:** Koldovskyi, A.; **data curation:** Guley, A.; **formal analysis:** Guley, A.; **resources:** Koldovskyi, A.; **software:** Koldovskyi, A.; **writing - original draft preparation:** Koldovskyi, A.; **writing - review and editing:** Koldovskyi, A.; **supervision:** Guley, A.; **project administration:** Koldovskyi, A.; **funding acquisition:** Guley, A.

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