

# *Central Bank Digital Currency: A New Instrument of Monetary Policy*

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## SUMMARY

Central bank digital currency is a claim on the central bank, which is accessible by a wide range of customers, digital, flexible and potentially interest-bearing. The new asset is being researched in many countries, and widening the accessibility of financial services, creating the digitalized form of cash with monetary policy considerations being among its motivations. An interest-bearing central bank digital currency could make the central bank's monetary transmission direct, which could improve the efficiency of monetary policy. Furthermore, the asset could help to strengthen competition among banks and could support the spread of financial innovations. Risks related to the instrument, such as disintermediation, can be counterbalanced by the increasing deposit volumes due to higher interest rates after the introduction of the instrument, and by limits set on the maximum holdings of the asset. An interest-bearing central bank digital currency can make targeted monetary policy possible, furthermore, the direct transmission of interest rates could enhance the efficiency of monetary transmission.

**KEYWORDS:** central bank digital currency, monetary policy, monetary transmission, disintermediation, social welfare

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The appearance of central bank digital currency (CBDC) seems to be an issue prevalent in many countries around the world. The new central bank currency may be the instrument of the future in many areas, including monetary policy. Most of the currently running projects focus on the functions fulfilled by the cash in payments, while academic literature places great emphasis on its interest-bearing feature and additional opportunities beyond its functions in payments. This article focuses on the monetary policy aspects of the instrument when reviewing how and why such an instrument can support the effective conduct of monetary policy. In the first part of the article, we review the general issues of central bank digital currency and then present the impact mechanism of monetary policy. Then, relying on academic literature, we examine the effects of the introduction of an interest-bearing central bank digital currency, to be followed by the monetary political and welfare aspects of the instrument, and finally, we close our article with a summary section.

## THE NEW REVOLUTION OF MONEY

The spreading of digital financial services represents a significant advancement, but new entrants face increasingly higher costs due to a transition between platforms, which limits financial activity, and the concentration of transactions poses a risk in financial stability (Fullerton & Morgan, 2022; Vodrážka et al., 2022). In addition, high transaction costs hinder financial access, i.e. the access of low-income actors to the financial system. The collection of data by financial service providers, which also affects the privacy of users, poses a significant data security risk (Srnicek, 2016; Zuboff, 2019). The decrease in the proportion of cash in favour of money held in digital platforms hinders the transmission of

monetary policy, thus carrying a monetary policy risk. These platforms are usually owned by a company registered in a Western country, and users often cannot file a consumer protection complaint in their own countries, so monetary sovereignty is also violated (Horváth & Horváth, 2021; Sveriges Riksbank, 2022). There are many solutions to these problems, among which central bank digital currency will be presented in this study.

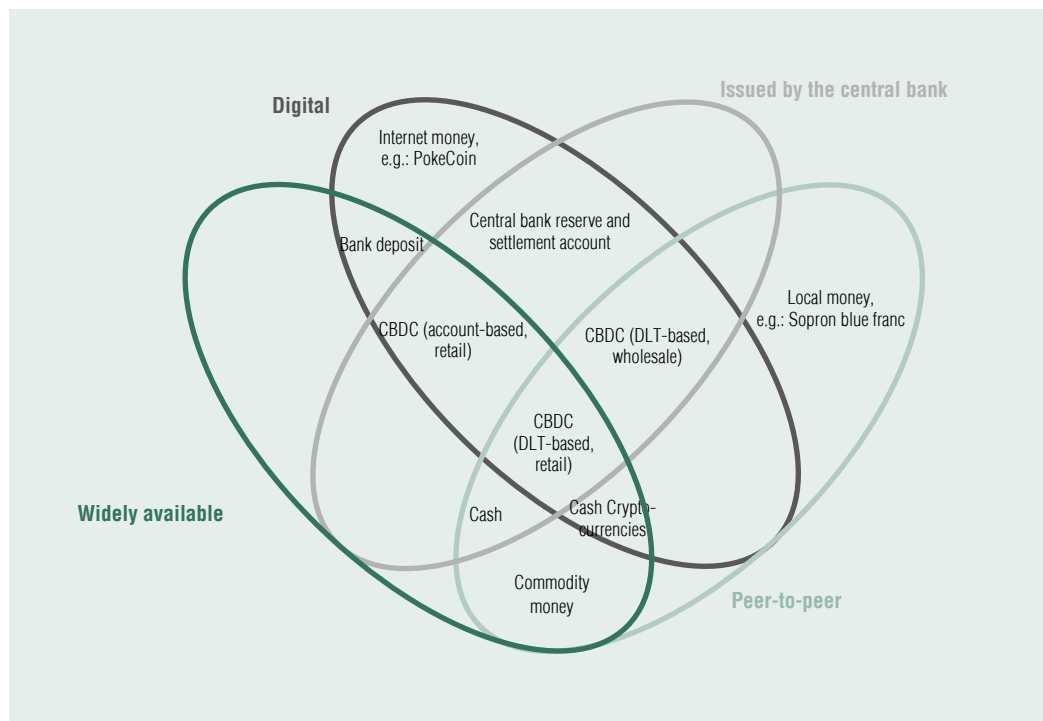
According to the definition of the US central bank, central bank digital currency is a claim against the central bank that exists in digital form and is widely available to citizens (Fed, 2022). According to the definition of Bank of England researchers, with central bank digital currency, the central bank provides access to its balance sheet in a universal, electronic, interest-bearing form denominated in the national currency for a wide group of users (Barrdear & Kumhof, 2021). Such a CBDC:

- ① is more widely accessible than current central bank deposits;
- ② can be used more efficiently than cash for retail banking transactions;
- ③ operates in a system different from other central bank currencies, so its purpose of use can be freely determined;
- ④ may pay interest at an interest rate different than deposits (Ward & Rochemont, 2019). (See *Figure 1*)

Central bank digital currencies are grouped according to several aspects. We can distinguish between systems accessible to the general public and non-financial companies (retail) and systems accessible to financial institutions, mainly banks (wholesale); as well as centralized systems and systems that are based on distributed ledger technology, in which central bank digital currency, which can be introduced both in interest-bearing and non-interest-bearing forms, can be stored in the form of scriptural money or tokens.

Figure 1

**THE SYSTEM OF DIFFERENT FORMS OF MONEY**



Source: Bech & Garratt (2017); Felcser et al. (2021)

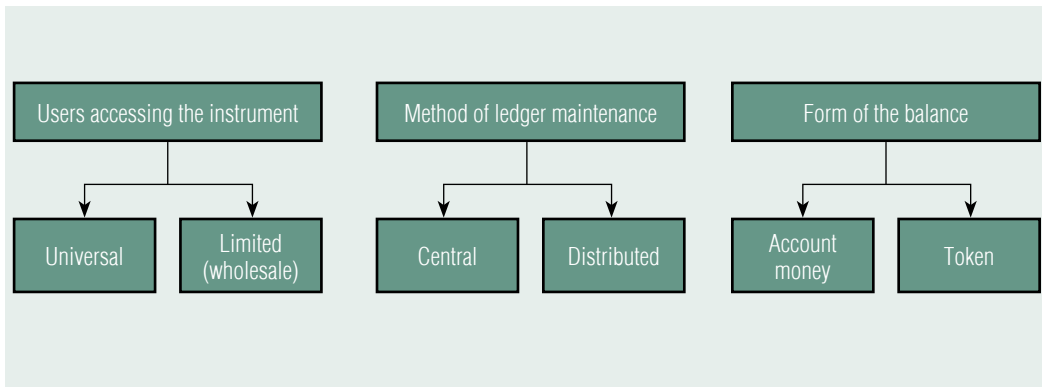
The advantages and disadvantages of the individual systems and planning decisions have been presented in numerous studies (Auer & Böhme, 2020; Bank for International Settlements, 2018; Bank for International Settlements, 2021; Bech & Garratt, 2017; Felcser et al., 2021; Garratt & Zhu, 2021; Syarifuddin & Bakhtiar, 2022). The above systems can in many ways be associated with each other for being implemented, often based on the current financial system, as in the Bahamas, where, in addition to using digital wallets, payments in central bank digital currency can be made with bank cards (Central Bank of the Bahamas, 2019). Building these systems is expensive, so central banks work hand in hand with market players

on the infrastructure thereof (Soderberg, 2022; Wang, 2021). (See Figure 2)

According to a 2021 survey by the Bank for International Settlements, nearly 90% of central banks deal with central bank digital currency in some form (Kosse & Mattei, 2022). One of the main motivations for research into central bank digital currency is the development of a modern, digitalised form of cash and thus the creation of wide and effective access to risk-free central bank currency, an objective that is important due to the preservation of the role of central bank currency, which is being displaced by increasingly popular, convenient, digital financial services, especially in countries that are forerunners in digitalization, such

Figure 2

**THE MAIN DIMENSIONS OF DECISIONS ON CENTRAL BANK DIGITAL CURRENCY**



Source: own edited

as China or Sweden (Chen et al., 2022; Fullerton & Morgan, 2022; Sveriges Riksbank, 2020; Sveriges Riksbank 2022). In addition, the development of financial access and the strengthening of user data security are also important aspects, especially among developing countries, which is clearly shown by the fact that the instrument has been introduced in two developing countries, Nigeria and the Bahamas (Auer et al., 2022). Moreover, central bank digital currency can also help interoperability and cooperation between different financial intermediaries, connecting closed financial platforms, resulting in lower entry and transit costs for new service providers and users (Araujo, 2022; Vodrážka et al., 2022). In some countries, the maintenance of a leading role in the financial system or preserving monetary sovereignty among the major powers is the main motivating factor, such as in the case of the United States or South Korea (Boros & Horváth, 2021; Park, 2022; The White House, 2022). Central bank digital currency is expected to appear widely in the short term and will become a particularly important part of the financial system (Müller & Kerényi, 2022). (See Figure 3)

**HOW DOES CENTRAL BANK INTEREST RATE TRANSMISSION WORK?**

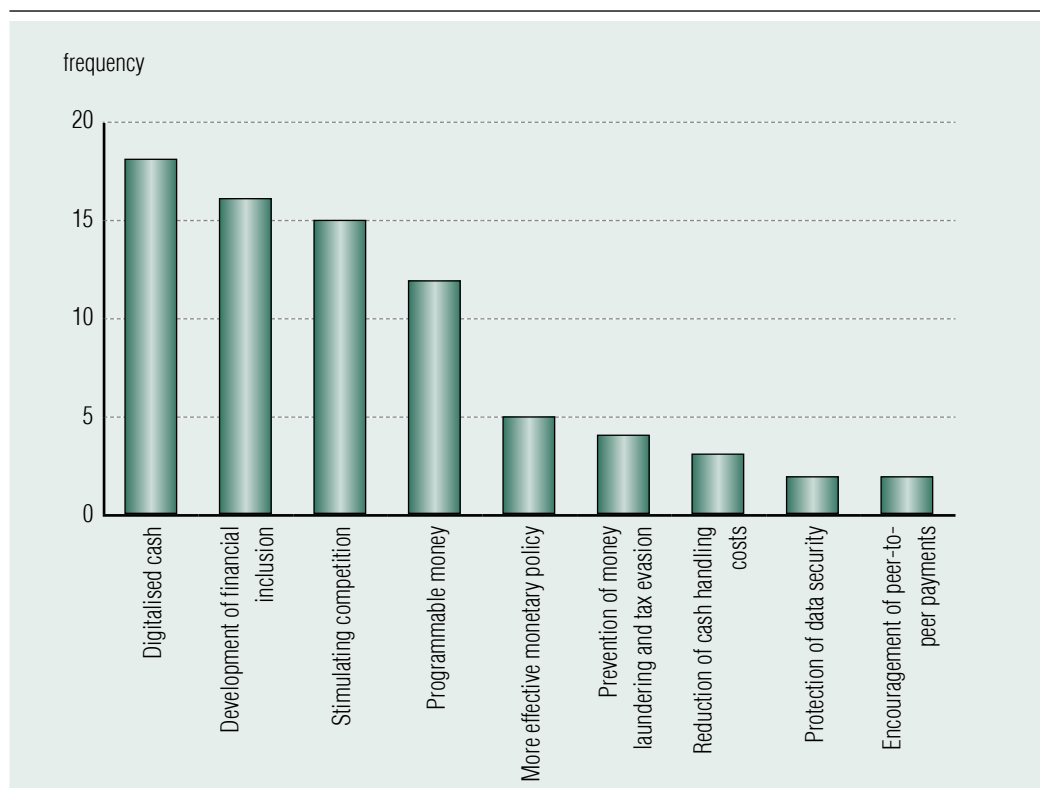
To understand the monetary policy implications of central bank digital currency, we need to examine how it may complement the current monetary transmission mechanism. Since, for this purpose, it is essential to know how the central bank’s interest rate policy influences interest conditions in retail banking, this part of the study briefly presents this mechanism, primarily through the example of the Central Bank of Hungary (CBH).

The primary goal of the Central Bank of Hungary is to achieve and maintain price stability. The central bank realizes its primary goal in the monetary policy framework of inflation targeting, according to which it pursues an interest rate policy that can ensure that inflation stabilizes around the 3% medium-term goal. The central bank applies a ±1% tolerance band around the inflation target.

The interest rate policy of the central bank exerts its effect through several channels, thus making it possible to achieve the inflation target. Transmission channels can

Figure 3

**MOTIVATIONS BEHIND ISSUING A CENTRAL BANK DIGITAL CURRENCY**



Source: Chen et al., (2022)

be categorized in many ways, in most cases they are grouped by using *Mishkin's* approach. According to this, one can distinguish between three main transmission channels: the interest rate channel, the asset price channel (which has a sub-channel: the exchange rate channel) and the expectation channel (Mishkin, 2004). The CBH also distinguishes two additional channels: the cost channel and the risk-taking channel (Balogh et al., 2017). From the point of view of monetary transmission, the most fundamental of the channels is the interest rate channel, whose essence is that the central bank influences the consumption and investment decisions of real economy actors by influencing short-term market interest rates.

Although decisions of actors in economy are primarily determined by long-term real interest rates, *Mishkin* (1996) points out that, owing to prices that are sticky in the short term, changes in nominal interest rates will also affect the real interest rate environment. In the event of a higher interbank interest rate environment, banks raise their rates on deposits and loans, so companies and the general public will find it more expensive to get loans and they will earn higher interest rates on their fixed deposits with banks. An increase in interest rates therefore will lead to households' preferring to save, while investment projects will be less worthwhile in terms of return, so these investments will be postponed. This will

result in lower economic activities and easing inflationary pressure.

Transmission mechanism is a complex, multi-step process. The impact of these steps will first appear in money market interest rates, and then spill over to deposit and loan interest rates. The transmission lag is the result of economic actors gradually making the necessary adjustments associated with changes in the interest rate environment, for example due to the cost of repricing or their different expectations (Gruen et al., 1995). Monetary transmission is also slowed down if the competition between banks is not perfect. In theoretical models, banks compete for customers in a perfect information environment, so banks that offer too low deposit rates and too high loan rates lose their customers. However, reality is more complex than that. The market structure of the domestic banking system has been conserved due to the concentration of customers, partly because the population may find switching banks expensive. This also plays a role in the fact that there is a low level of competition for deposits.

According to the above examples, domestic experience shows that, in the current environment, the interest rate level emerging on the interbank loan market will spill over to loan interest rates faster than to deposit interest rates. During the current monetary tightening cycle of the CBH, interest rates on retail bank deposits fall short of the levels justified on the basis of market interest rates.

Central bank digital currencies provide an opportunity to improve monetary transmission through the interest rate channel. This is possible on both the loan and the deposit side under various schemes; in this study, we primarily deal with how a potential introduction of central bank digital currency can contribute to solving the problem arising on the deposit side, which is adjusting more slowly.

## THE EFFECT OF INTEREST PAYMENT ON THE OPERATION OF COMMERCIAL BANKS

Having central bank digital currency, citizens may have financial claims on the central bank, in digital form. Thus, while the only type of claims on the central bank that households could previously own was cash, new functions may be added to such claims through the central bank digital currency in future. These may include functions relevant to monetary policy (e.g., interest payment), functions of convenience (e.g., transfers, electronic payments) and novel functions (e.g., programmability, smart contracts). In this chapter of our study, we review literature on the interest-bearing feature of central bank digital currency and draw conclusions from it as to aspects of monetary policy.

From the aspect of monetary policy, the interest-bearing feature may be one of the most important innovations, when compared to cash, the instrument currently available to citizens. As we presented in the previous chapter, one of the main channels for achieving the central bank's goal of price stability is the interest rate channel. Interest rate transmission in the financial system takes place with the help of intermediary actors, so the central bank's conditions will exert their impact through the financial intermediary system. This situation could radically change through the introduction of an interest-bearing central bank digital currency, as the central bank could, in contrast to usual operations, directly influence interest conditions offered to citizens (Bordo & Levin, 2017).

Bank of England economists *Barrdear and Kumbhof* (2021) used a DSGE (dynamic stochastic general equilibrium) model to analyse the effects of an interest-bearing central bank digital currency. Their model features lending activities of the banking

system; processes of creating money in the banking system; the imperfect conversion between the currency of commercial banks and central bank digital currency; as well as costs of adaptation. They examined what impacts it would have on the functioning of the economy if central bank digital currency amounting to 30% of the GDP was introduced and used for purchasing public debt. When listing the effects of such a move, they highlighted that, owing to the introduction of the instrument, the long-term equilibrium GDP would increase by 3%, a trend they claimed to be caused, among others, by a decrease in the equilibrium real interest rate as a result of (i) the appearance of this safe instrument, which is not threatened by bankruptcy and, therefore, has a lower interest rate and (ii) a decrease in the amount of public debt financed by the market. So a decrease in the amount of funds to be raised by the government would lead to a decrease in taxes and their effects distorting economic operation. One of the additional effects the economists mentioned is that the central bank would be able to stabilize business cycles more effectively when using an additional monetary policy instrument. Finally, they also highlighted that, provided the instrument is issued under appropriate conditions, aspects of financial stability also point towards the introduction of the instrument. According to their findings, launching such an instrument would represent a transition to a new kind of monetary and financial system, a move that has risks. Among them, they primarily highlighted those affecting the volume and pricing of lending, as well as risks related to the stability of the banking system, e.g., bank runs. More efficient central bank operations may contribute to preserving the equilibrium of the economy, which is one of the requirements for growth and sustainable catch-up (Matolcsy, 2020).

The introduction of an interest-bearing central bank digital currency may also increase the efficiency of monetary transmission in developed countries. This possibility is perceived by the ECB and the Fed, as illustrated by one of the statements of *Fabio Panetta* (2022), a member of the Governing Council of the ECB; and the monetary policy effects of the currency are mentioned in many places. The instrument may have such effects even if it is not interest-bearing. This is based on the fact that, if such an instrument is sufficiently popular, it may significantly influence the amount of liquidity appearing on the market and, through this, levels of effective interest rates. This is mentioned also in a discussion paper by the *Fed* (2022), which highlights that, in the current environment of abundant liquidity, this would probably not have significant effects on market interest rates. However, if the amount of excess liquidity deposited with the central bank were to decrease, even a minor change in the instrument could have a significant impact on levels of interest rates.

One of the strongest counter-arguments against the introduction of central bank digital currency is typically a slowdown foreseen in lending activities and an increase in lending costs. There are complex effects underlying to such trends. On the one hand, the appearance of a central bank digital currency similar to commercial bank deposits may withdraw funds from the banking system and, on the other hand, an interest-bearing central bank digital currency may be able to raise the lowest interest rates offered by commercial banks, thus increasing financing costs for banks, which may, on the asset side, lead to an increase in the pricing of loans or a decrease in the volume of loans extended.

Most of the studies dealing with this issue assume effective competition in the banking system and effective transmission of interest

rates. In comparison, *Andolfatto's* study (2021) is important to highlight, in which he analysed the effects of monopolistic banking systems and interest-bearing central bank digital currencies in an OLG (overlapping generations) model. Banks keep deposit interest rates at lower levels than opportunity costs and loan interest rates – or service fees – at higher levels than such costs, owing to their market power. According to the findings of the study, in such an environment, an interest-bearing central bank digital currency introduced with interest rates determined independently of the base rate will not reduce lending activities as long as its interest rate remains below opportunity costs. If the interest rate of central bank digital currency is below the money market interest rate, it will be in the interest of banks to offer the same interest rate to citizens, as banks can still make a profit on deposits placed with the central bank. Due to more favourable deposit conditions, the supply of deposits will increase for two reasons. On the one hand, such favourable conditions will lead to an increase in savings by those who already have bank deposits and, on the other hand, the improvement in conditions will induce households with no previous bank deposits to appear on the deposit market. More bank deposits will enable banks not lending before due to liquidity constraints to expand their lending activities, owing to the introduction of the new instrument, which may also lead to lower loan interest rates. All this also means that, as it strengthens competition, the central bank digital currency will reduce monopolistic bank profits.

According to a study by economists at the Bank of Canada (Chiu et al, 2019), the introduction of central bank digital currency will not lead to a decline in lending in a banking system where banks have market dominance on the deposit market. This is

explained – as in the findings of *Andolfatto* (2021) – by the fact that, when introduced at an interest rate level that is not too high, the instrument will increase the portfolio of bank deposits, thus having no negative effect on intermediation in the banking system. In such an environment, the interest rate on the central bank digital currency may act as an interest rate floor, below which commercial banks cannot lower their interest rates. As long as this interest rate is not too high, the increasing supply of deposits may increase the value of lending by banks. When such an instrument is introduced, it can exert positive effects even without reaching some market share, which is in line with the finding of *Andolfatto* (2021), saying that the instrument will reduce the monopoly profits of banks.

Several approaches are available to counter the unwanted effects of a central bank digital currency, as we have seen in the examples so far. *Barrdear and Kumbhof* (2021), for example, propose a quantity of central bank digital currency that is proportional to GDP, the value of which may, however, vary depending on the state of business cycles. In an upswing cycle, which is different from the value proportional to GDP, the central bank may moderate the portfolio of central bank digital currency and, in line with that, may hold fewer government securities, thus exerting a countercyclical effect. While, in a downturn cycle, the portfolio of the instrument may grow, which will increase the amount of liquidity available in the economy.

A central bank digital currency stock tied to the level of GDP and the state of the economy's business cycle will cause considerable uncertainty and considerable delay in the stock of such a system. Compared to this, a simpler solution is proposed by *Bindseil* (2020), who examines how to manage the two most significant risks usually raised in connection with central bank digital currencies. The first



risk is that the introduction of central bank digital currency will, through the withdrawal of funds, represent a system-level risk for institutions of financial intermediation. The second risk is that, in the event of bank runs, the instrument will significantly increase the possibility of capital outflows. *Bindseil* would manage these risks by introducing a central bank digital currency of variable interest rate. There could be a lower band with a relatively favourable interest rate and, above that, a wider band of a negative interest rate. The lower band, bearing interest at a higher rate, could serve to satisfy the demand of private individuals, while the band of higher portfolios above this band could act as a deterrent against the holding of excessively large quantities; thus, the stock of the instrument could evolve in accordance with the central bank's goals even without the introduction of strict limits.

As the literature suggests, a central bank digital currency will influence monetary conditions, regardless of its interest-bearing feature. This influence can be further strengthened by adding an interest-bearing feature to the central bank currency, a move that can significantly speed up and strengthen interest transmission. As a result, even more bank deposits than before may appear on the market, which may ultimately cause a favourable change in financial intermediation and macroeconomic indicators. The further the banking system is from perfect competition, the greater these favourable effects may be; in this case, the introduction of this instrument may cause a significant improvement in efficiency. Risks related to its introduction – a decline in financial intermediation, as well as bank runs – may be effectively managed by quantitative limits applied to the central bank currency, which may, among others, be effectively shaped by factors of a price nature, such as tiered interest rates.

## WELFARE EFFECTS OF AN INTEREST-BEARING CENTRAL BANK DIGITAL CURRENCY

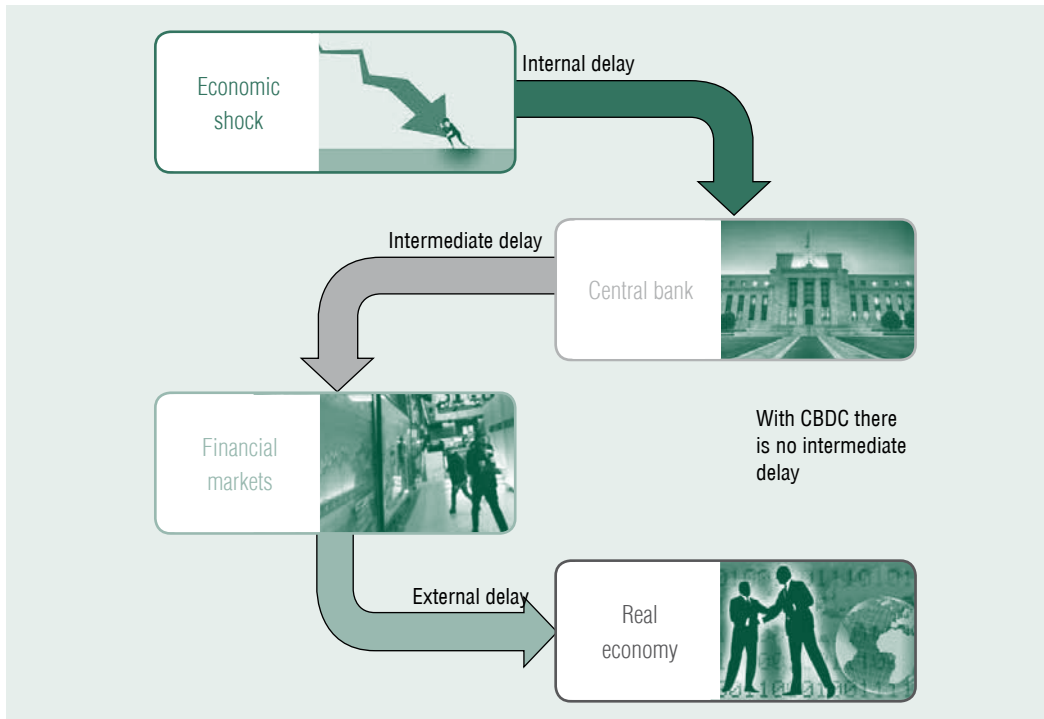
An interest-bearing central bank digital currency and its interest rates would represent a new instrument of monetary policy in the hands of the central bank. An improvement in the efficiency of the mechanism would simultaneously mean an increase in speed and effectiveness, and the transmission would also become wider. This expanding set of tools would contribute to the realization of the central bank's goals, primarily low and stable inflation, but it would also moderate the fluctuations of business cycles and enable a more flexible conduct of monetary policy.

In today's financial system, monetary policy faces three types of delays that hinder the achievement of the goal of price stability. These include the internal delay, the intermediate delay and the external delay (*Figure 4*). The internal delay refers to the time required for the central bank to react to shocks to the economy. The intermediate delay captures the late response of the financial system to the central bank's steps. The external delay refers to the subsequent delayed reaction of actors in the real economy. An interest-bearing central bank digital currency would partially eliminate the intermediate delay, since changes in the interest rate of central bank digital currency would become immediately noticeable to households and companies. The partial elimination of the intermediate delay would thus speed up the transmission.

Since people would be more comfortable paying with central bank digital currency than with cash, they would presumably prefer to hold it over cash. This effect is reinforced by the fact that an account-based central bank digital currency is better protected against fraud and theft than cash. Thus, non-financial private actors would show a higher demand

Figure 4

**DELAYS CHARACTERISTIC OF MONETARY POLICY**



Source: own editing (Bofinger, 2001., p. 73)

for even a zero interest rate central bank digital currency than for cash (Figure 5, panel A). A higher demand would make central bank currency more expensive, i.e. the opportunity cost of holding central bank currency, the deposit interest rate, would rise. As a result, the deposit interest rate would get closer to the reference interest rate, which means more effective interest transmission, in the case of suitable starting conditions (e.g., abundant liquidity, insufficient competition in the banking system).

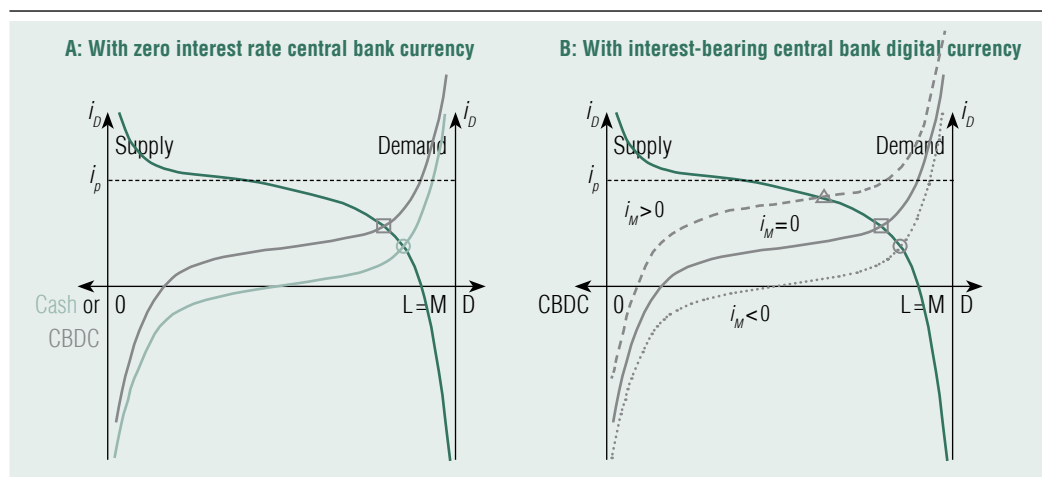
A central bank digital currency with favourable pricing and conditions for users could increase the number of households having relations with banks. As a result of their financial involvement, actors previously using cash and accumulating their wealth in it would enter the

bloodstream of the financial system, so they would also be affected by changes in interest conditions as influenced by the central bank for various financial instruments, primarily the central bank digital currency itself.

The interest rate of central bank digital currency as a new monetary policy instrument would expand the central bank's scope of action. While the non-financial private sector currently only has access to one of the central bank currencies, namely cash, whose interest rate is zero, the amount of interest rate paid on central bank digital currency could be adjusted as desired. The higher the interest rate paid on the central bank digital currency, the greater the demand for it (Figure 5, panel B). If the combined value of the various types of currency can be considered to be constant,

Figure 5

FINANCIAL MARKETS



Note:  $D$  denotes the deposit portfolio,  $i_D$  denotes the deposit interest rate,  $i_p$  denotes the reference interest rate,  $CASH$  denotes the cash portfolio,  $CBDC$  denotes the central bank digital currency portfolio,  $L$  denotes the portfolio of bank loans,  $M$  denotes the money supply and  $i_M$  denotes the interest rate of the central bank digital currency. We assume that commercial banks only hold  $L$  on the asset side (they have no reserves with the central bank) and that they finance this from  $D$  and loans from the central bank. The central bank's only asset is credit to commercial banks, and its only source of funds is central bank currency. Central bank loan interest rate =  $i_p$ . Thus, the balance sheet total of the banking system consolidated with the central bank is  $L$ , which it financed exclusively from  $M$ .  $M$  = central bank currency +  $D$ , where central bank currency is either  $CASH$  or  $CBDC$ . If we look at the figures from left to right (from point 0 towards point  $L = M$ ), we can see  $D$ 's market. If, on the other hand, we look at them from right to left (from point  $L = M$  towards point 0), then we can examine the market for central bank currency (or, as its equivalent, the market for loans from the central bank). Demand curve has a turn because of the liquidity-related properties of the different currencies, and the supply curve has a turn because of the risk of a bank run and the collateral nature and stigma effect of central bank borrowing. The circle, square and triangle show market equilibria.

Source: own edited

then this also entails a decrease in the demand for commercial bank money (bank deposits). All this results in rising deposit interest rates, similar to the introduction of central bank digital currency. Thus, using a given reference interest rate, deposit interest rates can be adjusted flexibly. In theory, in extreme cases, central bank digital currency may also pay negative interest, which can be used to restore today's allocation, which includes cash and bank deposits. Furthermore, different sectors could have access to central bank digital currency under different conditions (quantity, price). This would enable the central bank to shape the monetary conditions of the sectors in a targeted manner. *Barrdear and Kumhof* (2021) argue in favour of flexibility, according to whom the interest rate (or

quantity) of central bank digital currency may be an additional instrument of countercyclical monetary policy, and may primarily be suitable for handling shocks in demand for money.

Assuming a heterogeneous society, we can examine the social welfare impact of the emergence of central bank digital currency. In this part of the study, we divide society into three types of households: many small depositors, a few (wealthy) bank owners and many (less wealthy, borrower) actors having liquidity constraints. We consider the central bank's balance sheet total and the income realized on its assets as given facts, assuming that the central bank's interest income (seigniorage) is distributed equally among households. Commercial banks hold reserves with the central bank and finance such reserves

from deposits. The central bank pays the reference interest rate on commercial banks' reserves. Upon the appearance of central bank digital currency, due to a decrease in deposits, bank reserves start to decrease, so the amount of interest paid on them also decreases, i.e. the central bank's profit improves. This fact increases the income of households, but, in the case of the banker, the declining bank profit overcompensates for this increase, and the deposit interest rate rises. It is clear that, in this system, following the introduction of central bank digital currency, the current consumption of small depositors would not change significantly, and that of bankers would decrease, and that of actors with liquidity constraints would increase (*Figure 6*).

**A** In the case of small depositors, the permanent increase in income alone increases current and future consumption (income effect). At the same time, an increase in the deposit interest rate increases savings, i.e. it reduces today's consumption, while future consumption

continues to increase (substitution effect). As a result of these two effects, today's consumption may remain approximately unchanged, while future consumption rises.

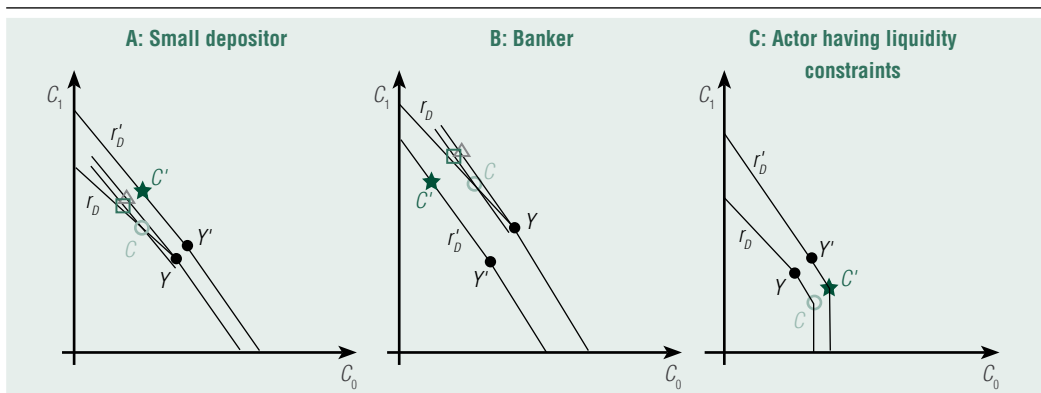
**B** In the case of the banker, the substitution and income effects on today's consumption reinforce each other, as their permanent income decreases, while the increase in the deposit interest rate encourages them to save more. In their case, however, future consumption can be assumed to remain approximately unchanged: the decreasing income will reduce it, while the increasing savings will increase it.

**C** The actor with liquidity constraints takes out a loan today and repays it in the future. Since we assume that the introduction of central bank digital currency will not affect loan interest rates, a permanently higher income will only have an income effect in their case: the consumption, both current and future, will increase.

Since there are more actors with liquidity constraints than bankers, and assuming a diminishing marginal utility of consumption,

Figure 6

**THE IMPACT OF THE INTRODUCTION OF CENTRAL BANK DIGITAL CURRENCY ON THE CONSUMPTION OF VARIOUS ACTORS**



Note: an intertemporal decision is depicted, where  $C$  denotes consumption,  $Y$  denotes income and  $r_D$  denotes the deposit interest rate. Variables without apostrophes refer to today's monetary system, those with apostrophes are values after the introduction of central bank digital currency. The circle is the original decision, the star is the new one. The square is the decision concerning an  $r'_D$  at which  $C$  is just affordable. The triangle is the choice at  $r'_D$  and  $Y$ . We assume that actors have well-behaved preferences.

Source: own edited

the welfare loss resulting from the decrease in consumption of bank owners would be exceeded by the welfare gain due to the increase in consumption of individuals having liquidity constraints. In addition, future aggregate consumption would also increase without any substantial decrease in the future consumption of any actors. As a result of all this, social well-being may increase.

In general, it can be said about economic policy interventions that 'there is no such thing as a free lunch', i.e. it is not typical for a measure to have only advantages. This also applies to central bank digital currency, as its introduction carries many risks. In this paper, we only include risks affecting monetary policy, social welfare and costs.

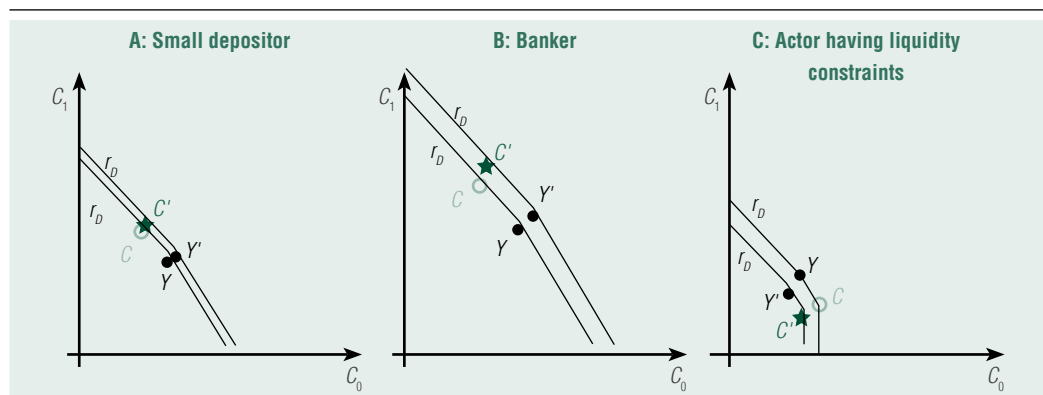
Social welfare may be expected to moderate if the central bank introduces an interest-bearing central bank digital currency that primarily replaces cash. In such a case, the central bank's interest expenses will increase, which may reduce the central bank's profit. As

a result of the lower seigniorage, the income, and thus the consumption, of actors having liquidity constraints will decrease (Figure 7). It is true that the income and consumption of the other two actors may increase, since they exchange their cash for interest-bearing central bank digital currency. Still, it may happen that the utility decline of households having liquidity constraints will dominate due to the decreasing marginal utility of consumption.

The cost of the monetary system can be divided into fixed and variable parts. Fixed costs primarily mean the costs of setting up the system (for example, in the case of cash, the construction of the mint, the printing house to print cash, and the distribution network; and, in the case of scriptural money, the development of the payment and settlement infrastructure). Variable costs, on the other hand, are costs arising from the use of the system, which depend on the amount of money and payments (for example, in the case of cash, the costs of operating

Figure 7

**THE IMPACT OF THE INTRODUCTION OF INTEREST-BEARING BUT CASH-REPLACING CENTRAL BANK DIGITAL CURRENCY ON THE CONSUMPTION OF VARIOUS ACTORS**



Note: an intertemporal decision is depicted, where  $C$  denotes consumption,  $Y$  denotes income and  $r_D$  denotes the deposit interest rate. Variables without apostrophes refer to today's monetary system, those with apostrophes are values after the introduction of central bank digital currency. The circle is the original decision, the star is the new one. We assume that actors have well-behaved preferences.

Source: own edited

logistics, raw materials, human resources, and transportation; and, in the case of scriptural money, the costs of operating the IT system, keeping accounts, and electricity). During the examination of the introduction of central bank digital currency, the total cost of the new system must be compared with the variable costs of the existing systems, since the system of cash and commercial bank currency would remain, and their fixed costs would not have to be paid again. Building a central bank digital currency system would entail fixed costs, even if it were to be built on the existing payment infrastructure with the cooperation of public and private sectors (Public-Private Partnership, PPP). At the same time, in such a case, the variable costs of central bank digital currency would presumably not differ substantially from today's system of scriptural money. On the other hand, *Turján et al.* (2011) suggest that the social cost of the cash system is the highest, within which the variable costs represent the determining factor. *Deák et al.* (2022) also claim that the total social costs of cash were the highest among payment methods in 2019 as well. Based on the above, the cost of the entire monetary system would be reduced if, on the one hand, the introduction of central bank digital currency involved only moderate development, which is primarily possible within the framework of a PPP, and, on the other hand, the new money would significantly replace socially expensive cash. But these conditions are not automatically fulfilled, so it is possible that the total cost of the monetary system will increase.

## CONCLUSION

Central bank digital currency may be a new and modern form of money, which almost all central banks are dealing with. This new type of money has at least three important

characteristics for its owners: first, it would provide security through its issuance by the central bank; secondly, it would be convenient to use owing to its digital form; and thirdly, it would provide a favourable return through potential interest payments. The technology of the 21<sup>st</sup> century has made it possible to issue such money and, accordingly, almost all central banks around the world deal with this topic.

Even if this form of money is not a panacea for everything, it can be considered a universal instrument in the sense that it can be suitable for dealing with various challenges. Central banks can determine the goals expected of central bank digital currency based on the different characteristics of their respective economies.

In Sweden or China, due to the high degree of digitalisation, central bank currency is being pushed out of the market. A central bank digital currency would compete with private money, commercial bank deposits or mobile money more effectively than cash.

In Peru, the high magnitude of gray economy represents a problem, which could be partially addressed by introducing an account-based central bank digital currency. In South Africa or Mexico, there may be a latent demand for digital money, which is not being met by commercial banks. Central bank digital currency may also be suitable for reducing the number of people without any relationships with banks.

For example, where bank deposit interest rates only slightly or slowly follow the central bank base rate, it may be worth considering the introduction of an interest-bearing central bank digital currency. This type of money would make monetary transmission stronger and faster, as well as allow a more flexible monetary policy. By setting the interest rate of the central bank digital currency appropriately, the outflow of deposits from commercial banks

may be avoided and, moreover, the deposit portfolio and thus the loan portfolio, as well as the GDP, may increase.

It may be necessary to apply individual and aggregate portfolio and transaction limits, as well

as tiered interest rates. In order to manage risks, central banks should generally act cautiously and gradually, so that the integration of central bank digital currency into the financial system is carried out smoothly. ■

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#### NOTE

- <sup>1</sup> According to the stigma effect, when a bank turns to the central bank for a loan, it gives a negative signal about its own financial situation (Hu & Zhang, 2021). That is why banks try to avoid borrowing from the central bank.

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