Would a Retail Central Bank Digital Currency Achieve Its Intended Purpose?

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National central banks and international financial institutions such as the Bank for International Settlements (BIS) and International Monetary Fund (IMF) have been exploring the pros and cons of central bank digital

There is a funny scene in *Delusions of Grandeur*, a film inspired by Victor Hugo's *Ruy Blas*, where Don Salluste, a grandee of Spain, notices by the mere clinking of his gold coins that one is missing. Beyond the humour lies a deeper insight that has stayed with me—good money has a sound. Later, I would learn from another Madrid man that the sound of money also shapes human destiny. It is as if Victor Hugo's choice of setting the scene in Madrid had something of a happy promise. Money has become silent. From the melodic clink of metal to the rustle of fresh, new bills, the sound of money has faded over the centuries. Money may soon be silenced by the monotonous purring of computer fans—sad tones that do not bode well. But let us embrace the great enthusiasm of Jesús Huerta de Soto to face today's challenges with strength and hope.

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currency available to the public (retail CBDC, henceforth) over the last few years.[1] The growing interest in retail CBDC has been driven by a combination of several factors.

First, the decline in the use of cash in several jurisdictions suggests that another form of central bank money should be made available to the public. Second, the growing dependence of the economy on electronic payment systems calls for improving their resilience, perhaps through the establishment of a back-up system based on CBDC. Third, advances in new technologies, such as distributed ledger technology (DLT), big data or artificial intelligence, tend to foster concentration in payment systems. By providing a generally accessible alternative medium of exchange, CBDC would increase the diversity and national sovereignty of payment systems.

According to the BIS (2020) and several economists, such as Barrdear and Kumhof (2016), Bindseil (2020), and Bordo and Levin (2017), the issuance of retail CBDC could potentially provide a solution to these challenges. Others, by contrast—for example, Agur et al. (2019), Bech and Garratt (2017), Jordan (2018) or Stevens (2017)—have expressed skepticism about a broadly available CBDC, highlighting the risks to the stability of the banking system posed by such a scheme.

The substitution of risk-free CBDC for risky bank deposits entails some risk transfer from commercial banks to the central bank. To limit the demand for and supply of CBDC, and the related transfer of risk, the literature proposes two mechanisms: the central bank could apply an unattractive interest rate to CBDC, or set an individual quantity ceiling for CBDC holdings.

This chapter analyses how these mechanisms are likely to affect the demand for CBDC as a medium of exchange and store of value and thus the achievement of the intended purposes for issuing retail CBDC.[2]

[1] For information on central bank attitudes towards CBDC and pilot studies, see, for instance, Mancini-Griffoli et al. (2018), CPMI (2018), Barontini and Holden (2019), Niepelt (2018) and the references therein.

[2] The views expressed in this chapter are those of the author and do not necessarily reflect those of the Swiss National Bank. This chapter provides a summary of Baeriswyl et al. (2021).

Definition, Purposes, and Characteristics of Retail CBDC

Economic and financial writings encompass various monetary proposals under the label "CBDC." As a starting point, we define the concept of retail CBDC and review the main purposes and characteristics proposed in the literature.

Broadly speaking, "CBDC, at the most basic level, is simply monetary value stored electronically (digitally, or as an electronic token) that represents a liability of the central bank and can be used to make payments" (Engert & Fung, 2017). According to this broad definition, CBDC can take very different forms. One of them is sight deposits currently held by commercial banks at the central bank, that is, banks' reserves. However, other forms of CBDC may differ from these reserves in a number of characteristics.

The main distinction to be made is between wholesale CBDC, which is accessible only to financial intermediaries, and retail CBDC, which is accessible to the public. Wholesale CBDC already exists in the form of sight deposits held by commercial banks at the central bank; issuing it in another form or through another technological medium would likely have only minor economic consequences. In contrast, issuing retail CBDC could fundamentally change the monetary system. For the sake of simplicity, CBDC in this chapter refers to retail CBDC.

CBDC does not require any particular technology and can be issued just as well with current technology as it can with distributed leger technology (DLT). Nevertheless, the belief that advances in IT and DLT provide the technology required for CBDC underlies many of the proposals for its issuance. Depending on the desired functionalities of CBDC, one technology may be more efficient and attractive than another. We do not address the choice of technology in this chapter and instead focus on the economic implications of CBDC.

An array of arguments has been made for CBDC issuance (BIS, 2020). The main purposes can be regrouped under three headings: (1) providing the public with a digital central bank money as the use of cash is declining; (2) improving the resilience of payments by providing a back-up system; and (3) promoting diversity and sovereignty in payment systems.

Ingves (2018) made the case for an e-krona in Sweden as a way to provide the general public with central bank money, as the use of cash, is in decline. Since a bank deposit is a claim on the bank payable in central bank

money, public access to central bank money is a prerequisite for the enforcement of the deposit claim. Without public access to central bank money, the bank's contractual obligation to redeem deposits in central bank money is impossible to fulfil. Thus, if the use of cash declines, CBDC could substitute for cash in this role of providing public access to central bank money.

The issuance of CBDC may improve the resilience of the payment system. CBDC could serve as a back-up emergency medium of exchange in the event of a disruption to the current electronic banking system. Such a back-up would be superior to cash in terms of speed, convenience, and ease of emergency distribution. To the extent that CBDC is provided on a decentralized distributed ledger, it may also be resilient to the risk of single point failure. [3]

The diversity and sovereignty argument for CBDC relies on its potential to mitigate the anti-competitive effects of some financial innovations. The economies of scale and network effects that could arise with the adoption of new technologies (DLT, big data, and artificial intelligence among them) would tend to foster concentration and work against competitive provision of financial services and of payment systems in particular. As a result, payment systems today are highly concentrated in a few large companies that dominate electronic payment networks, and the importance of electronic payments will further grow with the rise of online commerce. By providing a generally accessible alternative medium of exchange, CBDC would make for increased contestability and diversity in payment systems.

Moreover, if an economy depends heavily on payment systems that are in the hands of foreign companies and regulated by foreign authorities, its sovereignty is at stake. A country without its own sovereign payment system depends on foreign providers. As it is issued by the domestic central bank, CBDC would be a means of ensuring the sovereignty of at least one electronic payment system.

[3] A single point of failure is a part of a system that, if it fails, will stop the entire system from working.

Implications for the Conduct of Monetary Policy and the Related Risk Transfer

Since the issuance of CBDC provides a new form of money available to the public, it influences monetary policy. The exact impact of CBDC on the conduct of monetary policy depends largely on the issuance model and potential changes to the monetary system.

We assume in the following that the monetary and banking system remains unchanged, apart from the issuance of CBDC itself. Thus, commercial banks continue to operate under a fractional-reserve system and to issue deposits when granting credit. Money held by non-bank entities therefore enters circulation first as deposits at commercial banks, which can then be converted into central bank money, that is, cash or CBDC. Moreover, to fulfil its mandate of price stability, the central bank continues to influence the expansion of money and credit by steering a short-term interest rate through the issuance of reserves. Finally, we also assume that cash continues to exist.

One of the challenges of issuing CBDC in the current monetary system stems from the transfer of credit risk from commercial banks to the central bank. This risk transfer comes from the coexistence of two kinds of money, that is, central bank money and bank deposits.

As its name suggests, central bank money is issued by the central bank and consists of cash (banknotes), sight deposits that commercial banks hold at the central bank (reserves), and potentially CBDC. Importantly, central bank money is an economic good free of credit risk, as it embodies no credit claim against anyone. It is unredeemable because the holder of central bank money can insist only on the redemption of a given amount of one form of central bank money into another form of the same central bank money. Of course, central bank money is not free of valuation risk with respect to domestic goods (i.e., through inflation) or foreign currencies (i.e., exchange rate depreciation).

In contrast, bank deposits are claims issued by commercial banks redeemable on demand in central bank money. Redemption can be made in cash, possibly in CBDC, or by transferring the funds to another bank. Because their redemption depends on the solvency of the issuing bank, deposits carry a credit risk. They are, however, not (or less) subject to the risk of loss or theft and are more convenient to make payments than cash. Depositors accept deposits as a means of payment in place of central bank money only insofar as they are reasonably confident in the issuing bank's

ability to fulfil its contractual obligation to redeem its risky deposits into credit risk-free central bank money.

Although the central bank may not be legally obliged to accommodate the demand for central bank money, it is induced to do so to fulfil its mandate of price stability. If the central bank does not meet rising demand for central bank money, scarcity leads to an increase in money market rates, which slows down the credit-expansion process of banks and causes inflation to fall below target.

When non-banks request redemption of their deposits in cash or in CBDC, the reserves held by banks with the central bank decrease, which affects money market conditions differently depending on whether excess reserves are small or large. The amount of reserves that banks hold in excess of what is legally required (minimum reserve requirement) or of what banks voluntarily demand for their liquidity management determines the impact of reserve fluctuations on the money market.

When excess reserves are small, the decline in banks' reserves following an increase in the demand for cash or CBDC by the public leads to tighter money market conditions and higher short-term interest rates. To prevent an undesired tightening of monetary conditions, the central bank needs to accommodate this demand with a corresponding increase in bank reserves. This accommodation implies an expansion of the central bank's balance sheet and, thereby, a transfer of risk to the central bank.

When excess reserves are large, the decline in bank reserves does not lead to tighter money market conditions and higher short-term interest rates. Thus, the central bank does not have to accommodate the demand for cash or CBDC by non-banks to maintain its monetary policy stance. However, because banks' excess reserves decline, the central bank loses its ability to reduce subsequently its balance sheet and the risk associated with it in case this becomes necessary. Large excess reserves are the result of previous increases in the central bank's balance sheet. By reducing excess reserves, the redemption of deposits into cash or CBDC "locks in" the risk on the central bank's balance sheet.

Does Limiting Risk Transfer Hinder the Achievement of CBDC Purposes?

The previous section has shown that the issuance of CBDC leads to a transfer of risk from commercial banks to the central bank. The risk transferred depends on the quantity of CBDC issued, that is, the size of the

central bank's balance sheet, and on the quality of the assets held by the central bank or taken as collateral in lending operations.

One way to limit the transfer of risk is therefore to define a conservative portfolio of eligible collateral or to apply significant haircuts to collateral assets. Although these measures mitigate the materialization of risk for the central bank, they raise at least two issues, which are particularly acute when the demand for CBDC is large and fully accommodated.

First, the choice of the portfolio of eligible collateral by the central bank shapes the allocation of bank lending in the economy. In turn, the central bank would be indirectly involved in the credit allocation process. For example, if the portfolio of eligible collateral consists of government bonds only, banks will have to lend to the government—rather than to households or companies—to obtain the collateral needed to meet CBDC demand. If the portfolio of eligible collateral includes mortgages to households but not loans to businesses, banks will lend more to households and less to businesses. Second, the application of haircuts to collateral assets does not fully eliminate their risk, particularly if the central bank lends massively to commercial banks, leaving the challenge of risk transfer fundamentally unsolved. Moreover, increasing the required haircut increases the volume of eligible collateral needed to meet CBDC demand and thus amplifies the undesirable effect on lending allocation described above.

It is technically possible to leave the supply of CBDC demand-determined and to mitigate the materialization of risk for the central bank with conservative collateral requirements and haircuts, as Brunnermeier and Niepelt (2019) point out. The banking system could then gradually slide—de facto if not de jure—toward a 100%-reserve (i.e., full-reserve or sovereign) monetary system. Nevertheless, most authors, such as Bindseil (2020), Kumhof and Noone (2018), or Panetta (2018), believe that it is desirable to contain the amount of CBDC to avoid sliding toward a 100%-reserve monetary system and to guarantee the competence of commercial banks to grant credit to the economy.

At least two mechanisms can be imagined to limit the amount of CBDC demanded by the public and issued by the central bank: unattractive interest rate and a quantity ceiling.

The transfer of risk can be limited by charging interest on CBDC holdings, much like negative interest rates have been applied in recent years to bank reserves in the euro area or in Switzerland. Digital money is more convenient than cash because of the lower risk of loss or theft and ease of payment; making CBDC more expensive to hold than cash would limit its

demand. In normal times, a moderately negative interest rate might limit the demand for CBDC and, thereby, the risk transfer. During crises, interest on CBDC would probably need to be lowered sharply, which would yield uncertain results because even a very negative annual interest entails only small costs over a short period.

Another way to limit the risk transfer is to set a maximum amount of CBDC that each person or firm can hold. A quantity ceiling can be strictly enforced so that any surplus above an individual threshold is automatically transferred into another account at a commercial bank (related to the CBDC account). Alternatively, it can be implemented in a more flexible way by applying an unattractive interest rate to any surplus above a specific threshold, which would induce the holders to rapidly reduce their CBDC holdings. Bindseil (2020) suggests, for example, applying an attractive interest rate up to a ceiling and an unattractive rate on the amount above that ceiling to encourage the use of CBDC as a medium of exchange but not as a store of value.

We now assess the implications of these mechanisms for achieving the various purposes put forward for issuing a retail CBDC. One criterion for evaluating a CBDC's fitness to purpose is to ask whether it is the only and best means for achieving the desired purpose. Moreover, the CBDC design that is fit for one purpose may have unwanted side effects on another of the listed purposes.

Providing the public with central bank money: The disappearance of cash is not a universal phenomenon. With the possible exception of some Scandinavian countries (Sveriges Riksbank, 2018), cash continues to be widely demanded across the world. Even in countries where the use of cash to settle transactions is declining, such as Switzerland (SNB, 2018), the demand for cash as a store of value is increasing, driving up the amount of cash in circulation per capita. As long as the public has access to cash, the issuance of CBDC does not seem necessary to provide it with central bank money.

The mechanisms to limit the demand for CBDC have differentiated effects on the role of CBDC as central bank money. First, if the central bank applies an unattractive interest rate to CBDC, CBDC will be an effective provision of central bank money because the deposit claim against the bank will be fully payable in CBDC (as well as in cash). Although the demand for the redemption of deposits in CBDC may be low due to unattractive remuneration, such a CBDC would enable the bank to fulfil its legal obligation to the depositor. Second, if the central

bank applies a quantity ceiling to CBDC holdings, the deposit claim against the bank will be payable in CBDC only up to the ceiling. This naturally hampers the role that CBDC would be intended to play.

In summary, if the purpose for issuing CBDC is to provide the public with central bank money, then applying an unattractive interest rate to CBDC is the most appropriate way to limit its demand.

Improving the resilience of the payment system: The mechanisms to limit the demand for CBDC also have differentiated effects on the achievement of a CBDC-based back-up payment system. To be effective, a back-up payment system must be usable by a large part of the population at all times. This requires that the vast majority of people permanently hold a certain amount of CBDC.

First, if the central bank charges an unattractive interest rate on CBDC, then most people will probably not hold CBDC permanently, thereby making a CBDC-based payment system ineffective as a back-up.

Second, if the central bank applies a quantity ceiling to CBDC holdings, then most people will probably hold CBDC permanently, provided that no unattractive interest rate is charged on those deposits. In this way, CBDC could be used as a means of payment if the current electronic system fails.

In summary, if the purpose of issuing CBDC is to improve the resilience of the payment system, then applying a quantity ceiling to CBDC is the most appropriate way to limit its demand.

Promoting diversity and sovereignty in payments: Mechanisms to limit the issuance of CBDC greatly reduce the chances of widespread use of a CBDC-based payment system for everyday transactions. First, if CBDC earns an unattractive interest rate, one wonders why anyone would make a payment in such a CBDC in the first place. The comparison with cash is useful because it pays no interest, which is, in normal times, unattractive compared to the interest rate on bank deposits. However, cash has the advantages of being free of credit risk and of offering a different technology from the electronic banking payment system, which guarantees anonymity. Those who value the absence of credit risk demand cash typically as a store of value, while those who value cash technology demand cash as a medium of exchange. In contrast, a CBDC-based payment system does not offer a fundamentally different technology to its users than the current electronic banking payment system. Therefore, the main reason why people would hold CBDC with an unattractive interest rate is the

absence of credit risk, which is valuable for money hoarded, not for money spent in daily transactions.

Second, if a quantity ceiling applies to CBDC, one may question why people would use CBDC rather than bank deposits to settle transactions. Since CBDC is, unlike bank deposits, free of credit risk, Gresham's law teaches us that people will hoard CBDC (i.e., the "good" money) as a store of value and get rid of bank deposits (i.e., the "bad" money) by making payments with them. This is true regardless of the interest rate applied up to the CBDC ceiling. If CBDC earns an attractive interest rate (compared to bank deposits) up to the ceiling, people would maximize their profits by continuously hoarding their CBDC holdings at the ceiling. In contrast, if CBDC earns an unattractive interest rate (compared to bank deposits) up to the ceiling, we are back to the considerations made in the previous paragraph.

In summary, both mechanisms limiting its issuance will make CBDC unlikely to increase the diversity and sovereignty of payment systems because CBDC will not be used widely as a medium of exchange.

Conclusion

This chapter started by presenting various purposes that would justify the issuance of a retail CBDC. It has pointed out that mechanisms to limit the risk transfers make the use of CBDC as a medium of exchange unlikely. There is thus a trade-off between limiting the risk transfer to central banks and achieving certain CBDC purposes.

If the purpose for issuing CBDC is to provide the public with central bank money, its holding should not be subject to quantity ceilings. Applying an unattractive interest rate to CBDC may then contain its demand in normal times; an unattractive interest rate, however, is likely to contain demand much less in times of financial crisis.

If the purpose of CBDC is to improve the resilience of the payment system as a back-up, the vast majority of people need to hold a certain amount of CBDC at all times. This requires CBDC to be attractively (or at least not unattractively) remunerated up to a certain quantity ceiling. By applying an attractive interest rate up to a ceiling and an unattractive interest rate above that ceiling, CBDC would be able to fulfil its roles as central bank money and as a back-up payment system but may facilitate massive runs in times of financial crisis.

However, mechanisms limiting the demand for CBDC seem to undermine its widespread use as a medium of exchange for everyday transactions. As Gresham's law teaches us, people will hoard their credit risk-free CBDC and spend their risky bank deposits instead. A CBDC-based payment system is therefore unlikely to promote the diversity and sovereignty of payment systems. This purpose would be more easily achieved with a system based on privately issued bank deposits rather than on central bank money.

Overall, the implications of issuing a retail CBDC would depend on its precise design. At worst, if its demand were not limited, it would lead to substantial risk transfers from commercial banks to the central bank. At best, limiting its demand would severely hamper its intended purposes.

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