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22 October 2019

Online at <https://mpra.ub.uni-muenchen.de/96663/>  
MPRA Paper No. 96663, posted 24 Oct 2019 13:33 UTC

# Central bank digital currency and monetary policy: a literature review \*

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This version: 22 October 2019

## Abstract

Rapid digitalisation of payments leads to greater cost and time efficiency, yet could also potentially trigger legal and security challenges as well as lead to weakening of financial stability and less effective monetary policy transmission. In order to ensure greater safety, central banks are contemplating and testing solutions thanks to which public using payment innovations could transact in funds that are ultimately backed by central bank. One of these solutions is central bank digital currency, a digital version of cash. The proposed versions of central bank digital currency are very diverse. Depending on the version assumed by a particular central bank, central bank digital currency can have an impact on central bank interest rate setting, monetary policy implementation and transmission mechanism. This relates most notably to effective lower bound which could either rise or fall, conditional on design on central bank digital currently.

**JEL codes:** E42, E52, E58, G21, G28.

**Keywords:** virtual currencies, central bank digital currency, monetary policy, effective lower bound

## 1 Introduction

Recent years have seen an acceleration in payment innovations. The innovations have been concentrated in facilities using private money denominated in currencies backed by the central banks, and virtual currencies, or rather cryptoassets, which are not backed by any entities (ECB

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\*The presented views and ideas should not be associated with the official position of Narodowy Bank Polski. I would like to thank the participants of 2019 Shanghai Forum as well as High-Level Conference on Successes and Challenges in the CEE Region for all valuable comments.

2019). The latter had the advantage of the technological innovation (distributed ledger technology, including Blockchain), yet the drawback of heightened volatility. This has prompted development of stablecoins, pegged to one or several global currencies or to a valuable asset (BIS 2019). Stablecoins, however, share the challenges with virtual currencies, such as oversight, legal and security risks, as well as impairment of monetary policy transmission mechanism which could resemble dollarisation of the economy, financial stability threats related to currency and duration mismatch in households' and corporates' balance sheets and disintermediation of banks. On the top of that, stablecoins, particularly of global reach, could lead to heightened volatility in international financial markets as well as to a fall of supply in high-quality liquid assets globally which could make meeting the Basel III standards harder for commercial banks (BIS 2019). Most importantly, however, growing popularity of the stablecoins could challenge the appropriateness of current payment system solutions.

In order to ensure greater payment safety and financial system stability, some central banks considered providing the individuals with solutions that would allow them to transact with funds that are ultimately backed by the central bank (BIS 2018, Adrian and Mancini-Griffoli 2019). Hence, in mid-2010s, they started to contemplate the concept of issuing their own digital currency, a digital version of cash (Barrdear and Kumhof 2016).

The concept is quite fresh and unstructured, which is reflected in the variety of designs proposed by individual central banks. However, three features of CBDC stand out. It would be a legal tender, available solely in a digital form and issued by the central bank. Most proposals suggest that the amount of CBDC would be very limited, at least in the beginning (Barrdear and Kumhof 2016, BIS 2018, ECB 2019). However, the case when cash is eliminated completely, leaving CBDC the only central bank currency in place, is also subject to research (Borio and Levin 2017, Davoodalhosseini 2018).

The paper aims to provide an overview of still quite scarce literature on CBDC, and more specifically, on monetary policy-related problems. It discusses hypothetical challenges stemming from the appearance of CBDC for monetary policy strategy, implementation as well as the impact on the broader economy. Since, for the time being, the discussion on CBDC is dominated by central banks from advanced economies, the paper highlights some emerging-market economy perspectives, currently almost non-existent in literature.

This remainder of the paper is organised as follows. Section 2 provides an overview of the current state of work on CBDC in central banks, as well as the design options for the CBDC. Section 3 assesses the impact of the emergence of CBDC on monetary policy strategy and implementation, depending on the design option chosen. Section 4 discusses the influence of CBDC on monetary policy transmission mechanism as well as the economy. Section 5 concludes.

## 2 State of work on central bank digital currencies and their design

In line with a BIS survey (conducted in late 2018 among central banks of countries constituting together 90 per cent of global GDP), around 70 per cent of central banks are currently studying the concept of CBDC, and the share of these banks is increasing. However, only 15 per cent seriously consider issuing any form of CBDC over in the coming years; 75 per cent of central banks might not be in position to issue CBDC due to legal constraints (Barontini and Holden 2019).

The scope of studies on CBDC is in most cases purely hypothetical (Mancini-Griffoli 2018, BIS 2018), with slightly more than 60 per cent of central banks currently being at the research phase. Around 30 per cent of them are already experimenting, and around 10 per cent have launched pilot projects (Barontini and Holden 2019). The most recent example is the People's Bank of China that said it was almost ready to launch its own CBDC. CBDC for wholesale purposes are being developed in Canada or Singapore (Bank of Canada 2018, Monetary Authority of Singapore 2017). At the same time, according to the BIS survey, almost 90 per cent of central banks are contemplating offering CBDC to the general public as the ultimate target of their respective projects.

Most central banks cite providing safe and/or efficient payment system as their main motivation behind launching CBDC projects. This motivation clearly stands out in individual reports issued by central banks being at an advanced stage of research on CBDC (Sveriges Riksbank 2017, Sveriges Riksbank 2018, Norges Bank 2018).

The need for CBDC in advanced economies does not seem particularly urgent. Cash remains popular means of payment, and supervision framework is strong, also with respect to digital payments, facilitated by the central bank (ECB 2019, Danmarks Nationalbank 2017). However, as Lowe (2017) points out, in less developed emerging market countries, due to a lack of sufficient infrastructure in the first place, innovative payment solutions, developed beyond the central banks supervision, can play a predominant role in payment services. In effect, they might cause distortions in financial system, monetary policy implementation and interest rate transmission mechanism, which is reflected in compelling motivations related to these areas in these economies. In addition, emerging market economies mention the reduction in the size of the shadow economy as another important motivation behind the work on CBDC (Barontini and Holden 2019).

Judging from the available literature, the idea of what CBDC should be differs very much across central banks. In line with i.a. BIS (2018), Mancini-Griffoli (2018), Norges Bank (2018) and Sveriges Riksbank (2018), the division lines concern, but are not constrained to,

the following criteria: (i) accessibility (only for financial institutions or for the general public), (ii) technology (account-based or value/token-based), (iii) remuneration (interest-bearing or not).

The stage of development of a version of CBDC that is accessible only to financial institutions, also called a wholesale CBDC, is quite advanced in a number of economies. Such a version of CBDC is simply a technological advancement. Within such a framework, monetary policy strategy and implementation would be unchanged if central banks stopped at this stage. Yet, as highlighted above, most central banks assume that CBDC will eventually be available to the general public. In such a case, the central bank would be simply another commercial bank (Lowe 2017, Danmarks Nationalbank 2017), with a great market power, which might potentially lead to a conflict of interests between monetary policy or financial stability and commercial activity. If corporations are also allowed to set up an account with the central bank, this idea would resemble an inefficient monobank system in communist Central and Eastern European economies before 1990 (Racocha 2004, Rod 2014, Szpunar 2018), even if in a very narrow form, restricted to deposits. Meanwhile, commercial banks have a greater expertise in offering deposits as well as risk management practices related to these services (Norges Bank 2018).

Such reservations are particularly valid in case when the CBDC's design were account- or registered-based, with accounts held by individuals at the central bank, as suggested by Sveriges Riksbank (2017, 2018). In line with Norges Bank (2018), Sveriges Riksbank (2017) and BIS (2018), in an account-based system, financial assets would be kept in a centralised system, preferably at the central bank or within a system controlled directly or indirectly by the central bank. The consequence is that any transactions by individuals cause a change in the central bank balance sheet, and, hence, the need for adjustment, thus complicating the central banks balance sheet management policy.

The alternative to the account-based system is a value- or token-based system (Sveriges Riksbank 2017, Lowe 2017). Within this system, the public would have an access to CBDC through payment instruments, not accounts. The most commonly cited solution is that the user might for instance draw on a commercial bank deposit with an app, which resembles the conventional solutions already in place. According to Norges Bank (2018), with such a system, there should be hardly any changes in monetary policy, as the central bank balance sheet would not be directly affected. This system is also labelled as a “two-tier” CBDC because CBDC would still be channelled to the public through the financial sector. Currently, the central banks that are contemplating the introduction of their own digital currencies are increasingly inclined towards value-based CBDC.

However, the most important distinction regarding CBDC with respect to monetary policy-

related issues is the question of whether the account-based CBDC would be remunerated or not. The answer to that would determine the impact of its introduction on the effective lower bound, and, indirectly, the level of the inflation target, as discussed in the following section.

### **3 Impact on monetary policy strategy and implementation**

The sole introduction of CBDC would have an impact on the overall conditions in which monetary policy is carried out, even if, over longer run, central banks should ensure that CBDC, like cash now, is a neutral, autonomous factor for monetary policy.

In line with the literature consensus, the largest impact on monetary policy would be for the account-based CBDC available to the general public. This is because, as discussed above, value-based systems and solutions restricting CBDC provision to commercial banks would be rather a technological change within the current payment system. Meanwhile, with an account-based system, CBDC would have to set conditions under which it would run the accounts for the general public, competing with the ones offered by commercial banks.

The discussion in literature is centred around the impact of CBDCs introduction on the effective lower bound, which would be very different, depending on the remuneration of CBDC accounts.

If CBDC accounts were non-interest bearing, then, as long as the policy rates were significantly above zero, CBDC would simply be an autonomous factor for monetary policy. The situation would change once the central bank tried to cut interest rates below zero, and commercial banks tried to pass it on to deponents. Since the cost of holding CBDC is close to zero, the deposit holders would most probably switch to CBDC accounts with the central bank. The situation would hence be different from now when, due to costs associated with holding cash, slightly negative interest rates are possible. This means that the introduction of non-interest bearing CBDC leads to higher effective lower bound, thereby narrowing the room for manoeuvre for monetary policy. This conclusion is an adaptation of a liquidity trap concept, as drafted by Keynes (1934).

A rise of the effective lower bound to zero has further important implications not only for interest rate setting itself, but also for monetary policy communication. As Norges Bank (2018) points out, the ability of central bank to influence expectations, for instance with forward guidance, would be weaker than it is now.

If CBDC accounts were remunerated, the CBDC rate would constitute the floor for the policy rates. With cash still in place, the effective lower bound would be largely unchanged. It would still be the yield on cash, i.e. slightly below zero (Barrdear and Kumhof 2016). As

the role of cash diminishes, the effective lower bound might even fall, since it would be easier for the central bank to impact interest rates in the economy with CBDC interest rate setting, thereby increasing the monetary policy space (Sveriges Riksbank 2018). Effective lower bound might be even eliminated along with cash, which, by allowing unrestricted monetary policy space, could prompt central banks to lower their inflation targets (Bordo and Levin 2017).

Although the view is not consistent with the literature consensus, it seems that for value-based CBDC, the effective lower bound would also be impacted. The scale and direction, however, would vary with time. Initially, due to a technological change in place, CBDC might be costly to hold and transact in, therefore the effective lower bound could even fall. However, as the technology becomes cheaper and more widespread, the effective lower bound could rise. Since it is assumed that value-based CBDC would be non-interest rate bearing, the effective lower bound might even approach zero over longer run, and so be higher than now.

As long as cash is in circulation, a rise in popularity of CBDC could actually be conducive narrower policy space (Norges Bank 2018). This is because of a pick-up in risk premia stemming from higher financial stability risks (Danmarks Nationalbank 2017). In addition, the reduction in deposits held with commercial banks could lead to a rise in wholesale funding and collateral-based central bank funding, and hence higher interest rates in interbank market and risk premia, respectively (Mancini-Griffoli et al. 2018).

The literature also offers considerations on further monetary policy instruments that arise from the emergence of CBDC.

The first proposal concerns the spread between the CBDC rate and the central bank reference rate. According to Norges Bank (2018), in normal times, this spread should be kept unchanged and be sufficiently large to for instance to insulate demand for CBDC from interest rate decisions, and hence neutral character of the digital version of cash. Yet, the spread might be narrowed in extraordinary circumstances, such as a rapid rise in demand for cash.

The second suggestion is imposing restrictions on access to CBDC, mainly to avoid purchasing for this currency for speculation motives. However, as Sveriges Riksbank (2018) argues, restrictions could cause lower efficiency of payment systems. More importantly, it would be hard to maintain parity with cash under such circumstances. Hence, Sveriges Riksbank considers imposing fees on CBDC as an alternative to volume restrictions. This concept is not new. Agarwal and Kimball (2015) proposed abandoning parity between cash and digital form of currency and introducing, conversely, a time-varying paper currency deposit fee which would allow to reduce the effective lower bound. Time-varying relation between CBDC and cash could be hence another monetary policy option, yet it might raise credibility issues and practical problems, such as parallel exchange rates.

The available literature suggests that the introduction of CBDC might impact monetary

policy transmission mechanism only if CBDC is interest-bearing (BIS 2018). In the opposite case, the transmission mechanism is affected only if the interest rates are close to zero (Sveriges Riksbank 2018).

The interest-rate channel would be most affected, since the level of the CBDC rate would influence deposit rates in commercial banks more directly than currently. The influence on bank lending rates, and lending channel in general, is less obvious, and would depend on the source of external funding chosen by the banks in place of deposits declining due to outflow of funds to the central bank. If commercial banks resort to central bank funding, the transmission of central bank rates to lending rates could be stronger. However, if banks prefer interbank funding, the central bank might not be able to influence lending rates to the extent it does now (Mancini-Griffoli 2018, Sveriges Riksbank 2018, Norges Bank 2018). Yet, it should be kept in mind that the outflow of deposits from commercial banks and the associated need to provide external funding from different sources do imply financial stability challenges, with potential implications to efficiency of monetary transmission mechanism as a whole (Danmarks Nationalbank 2017).

The exchange rate channel of monetary policy transmission mechanism would be affected only if non-residents were allowed to use CBDC, and decided to do so for speculative purposes. The problem would not, however, be restricted only to a limited number of advanced economies during flight to safety episodes. Conversely, it could be an issue for emerging market central banks most of the time, due to a probable large swings in flows into and out of CBDC, depending on risk appetite, such as it is the case currently for other emerging market assets (BIS 2018).

The literature on the impact of CBDC's introduction on real economy and inflation is, for the time being, scarce, heterogenic and inconclusive. This is because the topic is relatively new, and, as discussed above, the construction of CBDC has not crystallised yet. Consequently, the models used in the available papers are built on different concepts of CBDC, which makes them hardly comparable.

The most comprehensive papers on the subject (Barrdear and Kumhof 2016, Davoodalhosseini 2018) base on DSGE models, albeit with different assumptions. Barrdear and Kumhof (2018) consider the case when (account-based and interest-bearing) CBDC initially constitutes around 30 per cent of GDP, and cash is still in use. Davoodalhosseini (2018), in turn, elaborates on three different major (and a number of minor) scenarios, with only cash in place, with only CBDC in place, and with both cash and CBDC. The latter paper considers in addition different forms of CBDC, with a particular focus on remunerated form of this instrument.

Davoodalhosseini (2018) finds that the introduction of CBDC could lead to welfare gains, yet only if the cash is entirely eliminated. The rise in consumption due to CBDC being the

only legal tender in the United States is estimated to reach 1.6 per cent. With both cash and CBDC available to the general public, monetary policy is found to be more constrained (due to a presence of the effective lower bound), yielding higher inflation and lower welfare. Results improve if CBDC is interest-bearing, yet, still, the welfare is lower and inflation is higher than in cases with just one legal tender in place.

According to Barrdear and Kumhof (2016), in turn, the introduction of CBDC could lead to higher output (but also inflation), also if cash is still in use. The positive impact would result from a fall in real interest rates and transaction costs. These results are only partly reflected in more comprehensive reports issued by central banks. As Sveriges Riksbank (2018) points out, CBDC could reduce transaction costs and thereby lead to marginally higher output, however, it would be counterweighted by financial stability concerns due to outflows from commercial banks to CBDC. The fall in real interest rates produced by model proposed by Barrdear and Kumhof (2016) could result simply from a rise in inflation.

## 4 Conclusions

From the above considerations, one can conclude that the introduction of CBDC would most probably have an impact on monetary policy implementation, transmission mechanism, and, in extreme cases, even the monetary policy strategy. However, the scale of these effects would depend on demand for this new form of money, as well as design. The bulk of the impact on wider economy would come through the interest rate channel, most notably deposit rates. With interest-bearing CBDC, the effective lower bound below zero could be preserved, or, even lowered, depending of the degree of popularity of this digital currency. The impact of CBDC on broader economy would be rather mixed. On the one hand, it should lead to lower transaction costs, which is conducive to higher output and welfare (but also inflation). Lower interest rates would work in the same direction, yet it is not obvious that introduction of CBDC would have a net dampening effect on them. On the other hand, there are substantial financial system stability risks, associated most notably with the account-based CBDC, stemming from an outflow of deposits to the central bank.

The research on CBDC and its impact on monetary policy is still ongoing. Although this innovation has been researched from the angle of challenges for the domestic economy, the international aspects of CBDC are still relatively underinvestigated, and require more thorough insight.

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