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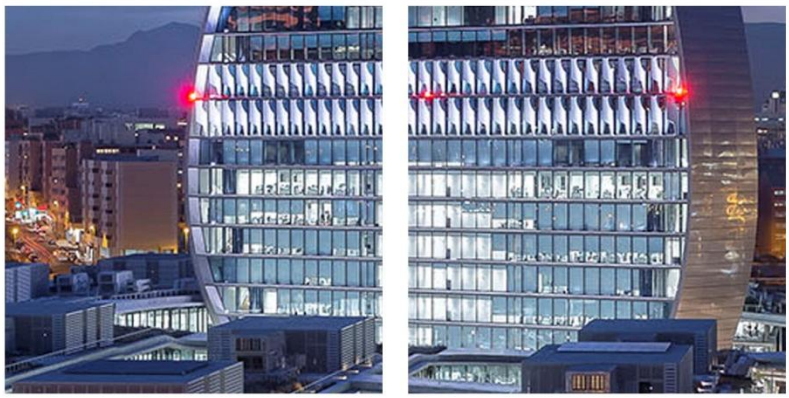

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Central Bank digital currencies: features, options, pros and cons[1]

Santiago Fernández de Lis | Olga Gouveia [2]

Summary

The emergence of cryptocurrencies is opening the way to Central Bank Digital Currencies (CBDCs). This paper highlights the pros and cons of issuing CBDCs under four different variants: from the more modest proposals (limited to the wholesale payments systems), where risk and reward are both relatively small, to the most ambitious ones (accounts in the Central Bank for the whole population), where the ambitious aspiration of ending banking crises is confronted with a serious disruption of financial intermediation as we know it and the political economy problems of an excessive concentration of power in the Central Bank. This paper also incorporates an analysis of the evolution of Central Banks' balance sheets and the risks embedded when their size expands considerably, extending the role of the Central Bank far beyond its present functions.

Keywords: digital currencies, cash, central bank, monetary policy, banks, interest rates, deposits, financial stability

JEL classification codes: E41, E42, E50, E51, E58.

1: Article published in "Anuario del ICO 2018", http://www.fundacionico.es/wp-content/uploads/2019/02/ANUARIO-EURO-2018-FINAL-1.pdf
2: BBVA Research.

1. Introduction

The development of cryptocurrencies in recent years has triggered a debate on whether Central Banks may attempt to issue cash in digital format. An emerging literature on Central Bank Digital Currencies (CBDCs) tries to analyze the viability of digital issuance, the forms it may adopt and the pros and cons of different modalities. This article, largely based on Gouveia et. al (2017), compares four stylized variants of CBDCs and assesses their relative merits. It also incorporates an analysis of the evolution of Central Banks' balance sheets and the risks embedded when their size expands considerably.

The motivation behind this analysis is based on the observation that the first papers on the topic[3] directly focused on what looked like the most disruptive variants, combined with the intuition that there were other modalities that may provide a better combination of pros and cons.

It is important to introduce a caveat upfront: cryptocurrencies have been accompanied by Distributed Ledger Technologies (DLTs), the best known of which is blockchain, that allows for a decentralized mechanism for proving the legitimate possession of the currencies and transfer this property. By analogy, the literature on CBDCs generally assumes that they will rely in a modality of DLT. But scalability remains a challenge for DLTs, and the comparison with traditional Central Bank-based payment systems (Real Time Gross Settlement Systems – RTGS) concludes that the latter are generally more efficient than blockchain- based payment systems, introducing certain doubts on the premises of CBDCs: why would Central Banks move away from a more to a less efficient system? The implicit assumption in this paper is that DLTs are in their infancy and in the near future we will see dramatic improvements in their efficiency, solving the scalability problem, including in energy consumption.

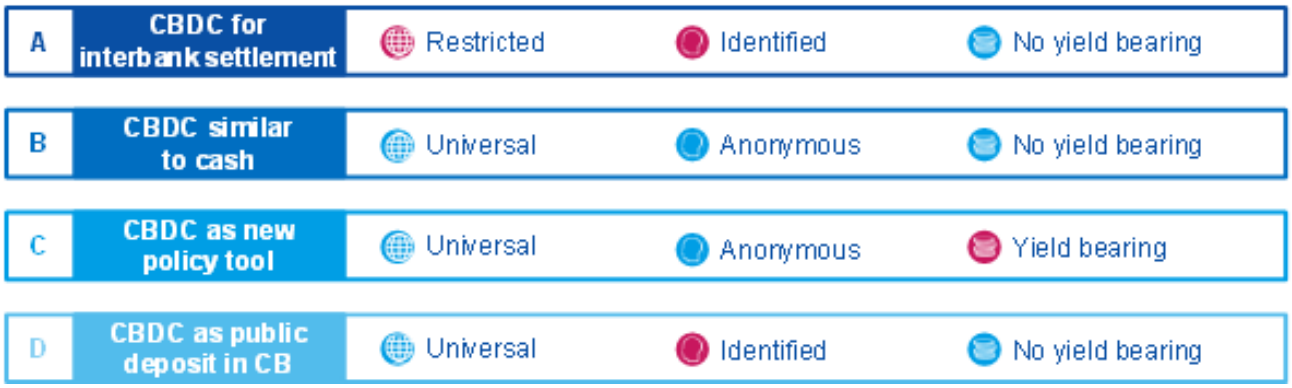
2. CBDCs features and variants

Cash is a very special type of asset that combines four features: (i) it is exchanged peer to peer (without knowledge of the issuer), (ii) it is universal (anybody can hold it); (iii) it is anonymous and (iv) it does not yield any interest. CBDC is an alternative to cash that is also peer to peer (P2P), but it opens the possibility of introducing changes in the other three features:

- They can be universal or restricted to a particular set of users. Likewise, DLTs can be open or closed (for instance, limited to banks or financial institutions).
- They can be anonymous (like cash) or identified (like current accounts). The first corresponds to the idea of token-based CBDCs, and the second to account-based CBDCs.
- They can pay interest or not. The delinking of cash from paper-money opens the possibility of including interest-bearing as a feature, either in the account based or in the token based variant.

3: See for instance Barrdear and Kumhof (2016).

These options can be combined in several ways to generate different modalities of CBDCs. The variants are summarized in the table below.



The choice depends crucially on the objectives pursued with the introduction of CBDCs. There are basically four possible objectives: (i) to improve the working of wholesale payment systems; (ii) to replace cash with a more efficient alternative; (iii) to enhance the instruments available for monetary policy, especially when confronted with the zero lower bound and (iv) to reduce the frequency and cost of banking crises. How do these objectives match with the different options that CBDCs open as compared to cash?

(i) If the objective is **to improve the functioning of wholesale payment systems**, and assuming that DLT technology would in the future be more efficient than RTGS[4], you may introduce CBDCs that are only accessible to banks and other financial institutions that participate in the wholesale payment system. The resulting CBDC would be **restricted, identified and non-interest bearing**: restricted because the general public will not have access to it; identified because participants will be known by the rest; and non-interest bearing because payment systems rely on fixed nominal amount accounts, although they are normally accompanied by yield-bearing (positive or negative) accounts in the Central Bank to and from which these institutions move funds in the context of their liquidity policy. The Central Bank, which in traditional RTGS is at the center of the system, would be in this scheme just another player, although it may retain control over certain features of the system, like for instance admission and membership.

(ii) If the aim is **to replace cash** with a more efficient means of payment you would introduce a CBDC that is **universal, anonymous and non-interest bearing**: universal like cash, which can be used by anyone who holds it; anonymous because this is an essential feature of cash[5]; and non-interest-bearing to emulate cash. Why would the authorities wish to replace cash with a digital variant? Among other reasons, cash logistics are costly (to issue, circulate and retire cash requires an expensive infrastructure), it deteriorates over time, it is dirty and transmits diseases, and it generates crime (theft) and falsifications. A digital variant would be more efficient, cleaner and safer.

4: As mentioned before, this is a very strong assumption. At the same time, however, closed DLTs (like the ones needed in option (i)) do not face the scalability problem of open DLTs (like those under options (ii) to (iv)). Although DLTs are less efficient now than RTGS, the distance between both is not huge. This implies that a little improvement in DLTs can offer a suitable alternative to RTGS.
5: According to some studies, the demand for cash in in a significant part driven by anonymity and related to fraud, criminal activities or tax evasion. Rogoff (2016) mentions that in some countries this type of demand reaches as much as 40%.

(iv) If the authorities want to **enhance the instruments of monetary policy**, in particular in the proximity of the zero-lower bound, they would introduce a CBDC that is **universal, anonymous and yield-bearing**. It should be universal because you want to reach the public (and ultimately replace the banknotes in the hands of the population); yield-bearing because you want to exploit the opportunity digital money provides of carrying interest rates, either positive or negative; and anonymous also for similarity with cash, although it could be identified too (but for reasons of clarity of the different models this option is reserved to the next variant). As mentioned above, interest rates may be positive or negative. Historically the former is much more frequent than the latter, but the objective of this proposal being overcoming the problems of the zero-lower bound, the proponents are rather thinking on negative interest rates situations.

(v) If the aim of introducing CBDCs is **to reduce (or even eliminate) the likelihood and destabilizing impact of banking crisis**, then the modality would be **universal, identified and non-interest bearing**. Universal because the idea is to open accounts for the population in the Central Bank; identified like in the case of bank deposits; non-interest bearing because, like in the previous variant, we want to differentiate option (iv) from option (iii), although the possibility of combining both features (identified and interest bearing) is always an option. According to the logic behind this proposal, banking crises are the result of fractional reserves, which implies that sight deposits with fixed nominal value are behind longer-term credit with and uncertain value and limited liquidity. This mismatch makes banks vulnerable to bank runs. If the Central Bank provided deposits to the population in the form of CBDCs, the provision of payments would be delinked from the provision of credit and, following this logic, most banking crises would be avoided.

3. Pros and cons of the different variants

These variants have very different implications, and their viability would also be quite different. Option (i) is less ambitious and would "only" imply a change in the functioning of wholesale payment systems, whereas options (ii), (iii) and (iv) are potentially very disruptive, and probably increasingly so. Replacing cash with a digital variant would change many of our habits, but in option (ii) only cash changes, not the economy or the financial system. In option (iii) the possibilities of monetary policy would be significantly enhanced, and the Central Bank would have at its disposal a very powerful instrument. In option (iv) the financial system would be completely transformed from what we know.

Assessing the pros and cons of these variants is not easy. In general, the most radical modalities are potentially more rewarding, but also riskier. And the uncertainty of this assessment also increases with the ambition of the proposals.

In **option (i)** one may expect an increase in the efficiency of the wholesale payment systems. Current RTGS infrastructure provided by Central Banks is secure and reliable, but expensive from the point of view of collateral consumption. An alternative based on DLT has the potential to reduce the collateral needs. Also the role of the Central Bank as guarantor of the transactions would be decentralized, with potential efficiency gains. And it would probably be opened to more participants beyond banks, which would increase competition and reduce costs. Admittedly, the latter is a trend that is in any case ongoing in existing payment systems, and that will take place anyway as the implications of new regulations like the PSD2 in Europe extend their impact[6].

6: Mersch (2018) defends the idea that conventional technology, not virtual currencies, is the one that is making real progress in the payments field.

One area where there is a huge potencial for efficiency gains is in cross-border payment systems[7]. Cryptocurrencies offer an opportunity for dramatic cost reductions, which may translate into faster and less expensive transactions, for instance in remittances. But it is unclear whether CBDCs may compete with cryptocurrencies in this, being based on national payment systems. Central Banks may, however, have incentives to develop interconnected payments systems for cross-border transactions if threatened by the competition of cryptocurrencies.

Option (ii) opens the possibility of replacing cash with a far more efficient alternative. As mentioned before, cash is costly to produce and replace, requires a heavy infrastructure, and is also easily lost or stolen. CBDCs open the possibility of Central Banks offering a far more efficient alternative to facilitate P2P payments. The incentives for Central Banks to develop this new type of cash can be enhanced if the competition of cryptocurrencies is seen as a threat for seignoriage. This is not the case now, due to the huge volatility of cryptocurrencies, but this may change, especially with the development of new, more stable cryptocurrencies (the so called “stablecoins” – see below).

The main drawback of this option lies in the anonymity. One thing is to issue banknotes that by their very nature are anonymous and a very different one is that Central Banks issue a digital means of payment that is deliberately chosen to be anonymous and therefore a channel of illegal payments and criminal activities. It is very difficult that the same Central Banks that require commercial banks to implement costly mechanisms to prevent money laundering and the financing of terrorism (the AML/CFT regulation) are issuing at the same time the means to carry such activities. One may argue that this is already the case with cash. But anonymity is intrinsic to cash, whereas in the case of CBDCs it would be a deliberate decision. This is the reason why most Central Banks consider that, in case they issue CBDCs, they would do it under the account modality (option (iv) in our taxonomy) rather than under the token modality (option (ii)). This implies that the demand for cash driven by anonymity would move to other currencies, including cryptocurrencies. The loss of income (seignoriage) for Central Banks (and ultimately treasuries) would be significant. If Central Banks decide to opt for the account based modality it would have far reaching implications, analyzed under option (iv) below.

Option (iii) would open new possibilities for monetary policy. The recent crisis, to which Central Banks reacted with aggressive monetary easing, opened new questions related to the zero-lower bound of interest rates. As rates approached this limit, but the economy continued to require stimulus, Central Banks embarked in new Quantitative Easing (QE) strategies, including entering into negative interest rates territory in some of their operations with banks. But the existence of cash, with fixed nominal value, sets a limit to the scope of negative interest rates. If they go too far into negative territory, arbitrage will lead to cash hoarding. In practice this means that Central Banks cannot go beyond a few basis points, perhaps as far as minus one percentage point, but no farther. This constraint is a limitation to the expansionary monetary policies that can be implemented in a recession.

Hence the proposal to introduce CBDCs to extend the negative interest rate territory (Rogoff (2016)). The firing power of monetary policy would be greatly reinforced. But this proposal has profound implications. To start with, physical cash would need to be eliminated (or limited to very small denominations), to avoid arbitrage. Furthermore, this option would probably require the introduction of capital controls, because with negative interest rates on domestic cash, the population would probably tend to resort to foreign currency (dollarization). Capital controls may limit deposits denominated in other currencies, but cash in dollars or other foreign currency would be much more difficult to control. We would enter into a world of “financial repression”, in the terminology of Carmen Reinhart (2012).

The key question is whether an independent Central Bank in charge of maintaining price stability would have the legitimacy to impose such policies. Central Banks are vulnerable to democratic legitimacy criticisms; more so the more functions they accumulate. Accountability is easier when you have just one objective (price stability), but

7: See IMF (2017).

much more difficult with several objectives whose weighting is arbitrary. Having at their disposal a tool that may imply the impoverishment of the whole population (at least in nominal terms) and that is in the frontier between monetary and fiscal policy is probably incompatible with Central Bank independence.

Finally, **option (iv)** opens the possibility for the general public to open an account at the Central Bank. This is the most disruptive and ambitious option. Proponents of this modality in general want to address the question of recurrent banking crises and banks vulnerability. In their view, crises are a consequence of the fractional reserves of banks as well as their role as providers of deposits with a fixed nominal value in their liability side and as providers of credit with a variable an uncertain value on the asset side. According to this view, technology offers now the possibility to delink the generation of deposits from the provision of credit, radically transforming the role of banks and Central Banks. There are several variants of this family of proposals: in some of them banks are transformed into credit institutions that raise their resources in the market. In others, banks issue deposits but only invest in a safe asset like public debt (narrow banking). In yet others, banks compete with Central Banks in the generation of deposits[8]. In most of them existing safety nets like Deposit Insurance and the role of the Central Bank as Lender of Last Resort (and even important aspects of present prudential regulation of banks) would probably be redundant and can therefore be eliminated or significantly reduced.

The goal of this family of proposals is a very relevant and ambitious one: to reduce and eventually eliminate banking crises. This would require profound changes in financial intermediation. In the most elaborated proposal (Barrdear and Kumhof (2016)) Central Banks issue deposits that do not necessarily crowd out banks' deposits. The latter would always have the possibility of paying interest[9] and providing transactional services (like transfers and direct debits)[10] which would make them more attractive to compensate the higher security of Central Bank deposits.

One drawback of this proposal is that it could facilitate bank runs in the case of rumors – founded or not – on the financial health of a bank or banking system. In such a situation depositors will move to the Central Bank with the speed of a click. This is the reason why this proposal is sometimes accompanied with the idea of limiting the convertibility between both types of deposits (see Kumhoff and Noon (2018)). But this implies another weakness, related to the establishment of capital controls and the related enforceability problems.

Furthermore, the drop in the money multiplier would probably imply, at least initially, a credit squeeze. Gradually new institutions will probably arise providing credit to households and companies, but probably at a higher cost. And in any case a transition problem seems difficult to avoid. Although the rewards of this option (taken at face value) in terms of eventual elimination of banking crisis are huge, the risks are very significant too.

It is important to acknowledge that currently banks are the safest place for individuals to place their savings. There are no other best options for the public and under this proposal it would become clear that individuals would have a safer option: the Central Bank. Therefore, to a greater or lesser extent, banks would stop collecting the savings of the economy in the form of deposits. The degree in which individuals would be more prone to do so would be in line with their risk profile as nowadays some individuals also opt for not placing all their savings in banks. Therefore, deposits in banks would be safer than savings placed in an investment fund but riskier than in a Central Bank. All in all, if the main objective of this option is to reduce banking crisis it is unclear whether it will achieve it (or if the concentration of risks would move to other parts of the financial system, namely investment funds and/or the Central Bank itself) and, in any case, it is very difficult to envisage a situation in which the Central Bank

8: See Kotlikoff (2010) and King (2016).
9: In option (iv) the account in the Central Bank may or may not pay interest. I opt for the latter to differentiate from variant (iii). But a combination of options (iii) and (iv) is possible, in which the pros and cons of both options would be exacerbated.
10: It is unlikely that Central Bank accounts would offer these transactional services.

concentrates knowledge, capacity, ability, resources to make better informed investment decisions than what banks do currently. In this scenario banks would not be at the epicenter of problems because banks basically would reduce their importance in intermediation and therefore banking crises would evolve to broader financial crises.

In this sense, it is important to analyse what the Central Bank would do with the proceedings of the deposits in this family of proposals. It can basically do four things:

- Lend to the government or buy public debt. This would open the way for monetary financing to the public sector, which is normally prohibited in the statute of modern independent Central Banks. And would lead to so called "fiscal dominance", in which monetary policy is subordinated to fiscal policy objectives.

- Lend to the private sector. It would require developing in the Central Banks an expertise that is far beyond their present capabilities, and more importantly, would imply a degree of interventionism difficult to reconcile with a market economy. This would be seen as a nationalization of credit as the Central Bank would act as a Public Bank.

- Acquire foreign exchange reserves (gold or positions in other currencies): it would hugely aggravate the inherent currency mismatch of any Central Bank balance sheet (a result of their liabilities being denominated in domestic currencies but part of their assets being in foreign currency) and expose it to the risk of losses as a result of foreign exchange volatility.

- Lend to banks or financial institutions. This would put the Central Bank in between the generation of deposits and the provision of credit. Depending on how this is done, the current implicit guarantee of banks deposits (which was one of the roots of the crisis and one of the problems that the recent regulatory reform is trying to fix) may become explicit, thus exacerbating moral hazard.

The main drawback of variant (iv), like in the case of variant (iii) – and even more in the combination of both, where the Central Bank offers interest bearing deposits to the general public – is that the resulting Central Bank is too powerful. As a result of the crisis, Central Banks are currently doing already too many things: monetary policy, financial stability, payments systems, banking supervision, consumer protection… and with the QE after the crisis they already intermediate an important part of interbank transactions. If they were also in charge of providing deposits -- and perhaps credit, or financing the public deficit, or holding a significant part of the nation's foreign assets -- it would be incompatible with their independence. The political economy aspects of the most disruptive variants of CBDCs should be analyzed in an extremely careful way before moving in that direction.

4. The evolution of Central Banks' balance sheets under the different options

In order to understand the design and potential evolution of Central Banks' balance sheets once a CBDC is set up there are two dimensions that need to be taken into consideration:

- The liabilities' side of the Central Bank balance sheet. And within this, two aspects: (a) who has access to the CBDC and (b) the convertibility of the CBDC with other types of "legal money"

  a) **Access to the CBDC**: For this we need to establish if the CBDC is universal (option (ii) and (iii) and (iv) or restricted (option (i)). Under option (i) the issuance of CBDC has no impact on monetary aggregates or in the Central Bank balance sheet. However, if it is universal and only banks and similar institutions have

access to the Central Bank (options (ii) and (iii)) -what the ECB refers to as value based CBDC- the implications are different from option (iv), in which the CBDC is also universal but everyone has an account at the Central Bank (account based CBDC). In the latter, as discussed below, the issuance of CBDC has a large effect on deposits, therefore on reserves at the Central Bank and ultimately has a more meaningful impact on the size of Central Banks' balance sheet.

b) **The convertibility of the CBDC to cash and reserves**. Once again this only applies to options (ii), (iii) and (iv). The base scenario is that the CBDC is as similar as possible to cash and therefore it is convertible to cash and or reserves on demand. Although the objective of creating a CBDC could be the introduction of another monetary policy tool (particularly under option (iii)) the non-convertibility of the CBDC into cash and reserves would raise several issues from which the most meaningful is that from an operational point of view it would be equivalent to the implementation of some sort of capital controls across CBDC, cash and reserves. Giving consideration to a scenario in which someone has CBDCs and can't convert it to cash and vice-versa limits the credibility of the Central Bank, limits the confidence on the different types of money, limits the stability of the monetary framework , raise several difficulties in terms of monetary policy implementation and control of monetary aggregates. The Bank of England in a paper by Kumhof and Noone (2018) contemplates a scenario in which the CBDC is universal, pays an adjustable interest rate and CBDC and reserves are distinct and not convertible into each other. The CBDC would be like a second policy tool. Although we acknowledge the potential benefits for the banking sector and for financial stability, as it would limit the possibility of bank runs (as the substitutability of CBDC and deposits would lose weight) , it would be a very unrealistic scenario, in light of the above mentioned problems. Therefore in this analysis, the CBDC is convertible to cash and vice-versa and the Central Bank controls the joint amount of both of them but not the breakdown among them.

Having this in mind it is important to distinguish the differences on CB balance sheet liabilities' side under the two main options. For simplicity we do not analyse the implications of option (iii) but they would be more similar to option (ii).

- Option (ii) (only banks have access to the CB, and the general public holds anonymous CBDCs in the form of tokens). The issuance of CBDC will increase the monetary base. Although it is likely that the amount of bank notes slightly decreases when the CBDC is set up, there is a slight fall in reserves held by commercial banks in the CB as some people will switch from bank deposits and hold directly CBDC), see table 1. At the same time, and assuming a constant supply of money, i.e. the amount of deposits, CBDC and cash remains constant (and therefore the fall in deposits is compensated by the increase in CBDC and part of the increase in CBDC reduces the amount of cash), the multiplier falls from 4 to 2,5. Along the same lines, the level of loans falls (assuming a banking sector that is just financed by deposits and that all its assets are loans). Given that the monetary base increases considerably and the multiplier falls, the capacity of CBs to influence money supply and the transmission of monetary policy diminishes.

- Option (iv) (everyone has access to an account at the CB). Assuming that the Central Bank maintains the monetary supply constant and that more people are willing to switch from deposits to CBDC (because they can access directly the CB and this is safer than holding their savings at commercial banks), the amount of CBDC has to increase further while the amount of deposits drops even more and accordingly the reserves of banks at the CB: the multiplier falls further in this scenario, emphasizing the effect commented in the prior scenario. In addition the size of the Central Bank's balance sheet increases further.

Table 1 The evolution of the monetary base and monetary supply and the multiplier with CBDC issuance

	Current situation and option (i)		Option (ii) and (iii)		Option (iv)
Deposits in banks (1)	100	-25	75	-50	50
Reserves at the Central Bank (2)	10		2.25		1.5
Loans	90		72.75		48.5
CBDC (3)	0	+35	35	+60	60
Currency in circulation (4)	20	-10	10	-10	10
Monetary Base (2+3+4)	30		47.25		71.5
Monetary Supply (1+3+4)	120		120		120
Multiplier	4.0		2.5		1.7
Size of the CB Balance Sheet	**30**		**47.25**		**71.5**

In summary, it is important to have in mind that although the issuance of CBDC per se would not change the mechanics of monetary policy implementation, the need to accommodate a higher or lower demand for CBDC versus bank deposits would have an impact on the size of the Central Bank balance sheet. As seen, despite the issuance of CBDC, in principle, always increasing the monetary base (even if the increase in CBDC is partially compensated by a decline in banknotes in circulation), it might decrease the monetary supply if deposits fall and banks are forced to reduce lending. Naturally, this could be compensated with a larger increase in the monetary base, i.e. the issuance of more CBDC, which would automatically translate into a larger balance sheet.

- The assets' side: When Central Banks issue CBDC they have to do it against some sort of assets (as highlighted in section 3 above). We will explore the evolution in terms of size and risks embedded in this issuance. Typically Central Banks hold government securities, other securities (with the QE CBs expanded significantly the amount and diversity of securities that they hold) and foreign exchange reserves (table 2).

Table 2 Balance sheet of a Central Bank

Assets	Liabilities
Foreign assets (net)	**Reserves held by commercial banks**
Public sector securities	**Cash in circulation**
Private sector securities	**Deposits from banks**
Lending to banks	**Equity**

In principle, and assuming that the issuance of a CBDC is not totally offset by a decline in banknotes in circulation, there will be an expansion of the balance sheet. The CB can purchase government securities. In this scenario (mostly associated with option (ii) where the decline in bank deposits would be more moderate, the Central Bank would not engage in liquidity or credit risks substantially different from the current situation (table 3). In any case, as mentioned before, the need to expand the Balance Sheet and not engage in credit risks, could open the way for monetary financing to the public sector (lending to the government).

Table 3 Expansion of the CB balance sheet in option (ii) (Assuming an expansion of securities)

Assets	Liabilities
Foreign assets (net)	**Reserves held by commercial banks**
Public sector securities increase	**Cash in circulation + CBDC**
Private sector securities	**Deposits from banks**
Lending to banks	**Equity**

However, if we are in option (iv), although the initial movement can be fairly similar, the need to accommodate the decline in money supply will lead to the need to expand significantly the monetary base, i.e. the issuance of CBDC and, therefore, the size of assets on balance sheet (table 4, expressed as stage 2).

In this alternative, and to compensate for the decline in bank deposits and the subsequent decline in loans, the Central Bank needs to finance the private sector. This can be done through the acquisition of private sector securities and/or lending to banks which in turn will lend to the private sector. Thus, under this option, the Central Bank balance sheet is likely to expand considerably.

Table 4 Expansion of the CB balance sheet in scenario D: (1) indicates initial phase and (2) second phase

Assets	Liabilities
Foreign assets (net)	**Reserves held by commercial banks fall (2)**
Public sector securities increase (1)	**Cash in circulation + CBDC (1) CBDC (2)**
Private sector securities increase (2)	**Deposits from banks**
Lending to banks increase (2)	**Equity**

The risks embedded in this activity for the Central Bank can be significant because it starts to engage in activities in which it has no experience or expertise. Currently, when Central Banks lend to banks these transactions are always secured. Under this option, in which commercial banks are less reliant on deposits and more reliant on Central Bank funding it is difficult to foresee banks' ability to generate sufficient collateral to get this secured funding from the CB and therefore the exposure of CB to banks will be most likely unsecured. The analysis of credit, maturity and liquidity risks would need to be developed at Central Banks completely changing the monetary and financial system landscape that we know today.

In summary, although at first sight it could seem that the Central Bank would have the option to choose the size of its balance sheet and the assets it wants to acquire to issue CBDC, this might get out of control under option (iv) when everyone is given an account at the Central Bank. In this scenario the Central Bank will have no other option than lending to banks and buying private sector securities to maintain the level of lending to the economy that will no longer be provided by commercial banks.

5. Fiat money, discretionary policies, cryptocurrencies and stablecoins

Fiat currency relies on the confidence on the Central Bank. Since the collapse of the gold standard in the 1930s and the move to floating rates in the 1970s Central Bank issued currency lacks any external anchor. Independent Central Banks in charge of price stability have been established in most countries to ensure that the money issuance does not take advantage of the lack of an anchor to inflate the economy according to the convenience of the government or the electoral cycle.

The debate on rules vs discretion of monetary policy has long ago been settled in favor of discretion. The instability of money demand led to the abandonment of monetary aggregates as objectives of monetary policy. Anchors defined in terms of nominal exchange rates were abandoned too in most countries as a result of the difficulties to deal with speculative attacks in a world of free capital movements. In a majority of countries monetary policy objectives are defined in terms of inflation targets. In practice this implies a high degree of discretion for Central Banks, since the link between interest rates and inflation is not a direct one. And the more objectives the Central Bank has the higher the room for policies that may depart – at least temporarily – from price stability, to reach other objectives like financial stability.

All this implies a challenge for independent Central Banks, whose role has been questioned in the political debate on grounds of their limited accountability. One may even argue that the recurrent financial crises have been to a certain extent a result of the asymmetric discretionary reaction of monetary policy to asset prices bubbles. For instance, the Fed reacted with aggressive easing when asset prices drop (in 1987, 1990, 1998 and most notably 2008), but did not increase rates so aggressively when asset prices escalated in the booming phase immediately before each of these episodes. This asymmetry arguably led to moral hazard and fueled the development of bubbles in the markets, whose players were confident that the authorities will “mop up after” (the so-called “Greenspan’s put”).

What has all this to do with cryptocurrencies? In a world of pure fiat money, the attractiveness of cryptocurrencies lies partly on their delinking from discretionary decisions of the authorities. The issuance of Bitcoin is based on an algorithm that is certainly not transparent, but in accordance with a preset rule. The external anchor provided by cryptocurrencies has some similarities with gold, and for this reason the emergence of cryptocurrencies reignited the longing for the gold standard. The main drawback of Bitcoin and the like for being an anchor lies in their extreme volatility.

To address this problem, recent initiatives have been developed to create “stablecoins”, a type of cryptoasset whose value is linked to an external anchor, be it a fiat currency or a commodity, collateralized or not, or an algorithm that manages the price controlling the quantity of the cryptocoin in circulation. Most of them are still in an experimental phase, but if they succeed they may turn out to be more serious competitors to Central Bank money than present cryptocurrencies.

It is interesting to observe that, one the one hand, markets are developing currencies that may challenge the role of Central Banks and lead to some type of external anchor to the international monetary system and, on the other, the authorities are analyzing (so far from a purely academic viewpoint) the issuance of account- based CBDCs that

would strengthen the role of Central Banks and confer them much more power than the considerable one they currently have. It seems that the debate is open to extreme forms of means of payment: one private and rules-based and the other public and discretional. We may witness in the future an interesting competition between both, first in the academic field and perhaps later in practice.

6. Some concluding remarks

- The emergence of cryptocurrencies is opening the way to Central Bank Digital Currencies. The competition of the former may be an incentive for Central Banks to issue a similar digital currency, but so far the size of the cryptocurrencies stock is far from being a threat for cash.

- Cryptocurrencies are not a threat for cash so far mainly because of their volatility, that prevents them to the used as money to the extent that they do not fulfill its role as means of payment and store of value. They also face a scalability problem. But the development of stablecoins may imply a bigger challenge for cash in the future.

- The different options of CBDCs analyzed here present a correlation in terms of risks and potential benefits: from the more modest proposals (limited to the wholesale payments systems), where risk and reward are both relatively small, to the most ambitious ones (accounts in the Central Bank for the whole population), where the ambitious aspiration of ending banking crises is confronted with a serious disruption of financial intermediation as we know it and the political economy problems of an excessive concentration of power in the Central Bank.

- The main dilemma for Central Banks lies in anonymity: to issue tokens (like present cryptocurrencies) or account-based CBDCs. For most Central Banks it is unacceptable to issue an opaque instrument that may be used for crime-related transactions. The only option is therefore account-based CBDCs, which implies a radical transformation of financial intermediation, with serious risks attached.

- The main drawback of account-based CBDCs is that they would imply extending the role of the Central Bank far beyond its present functions. It would need to either lend massively to banks (making explicit the implicit guarantee of banks) or become a mechanism for financing the public sector (breaking the present prohibition of monetary financing), or lend directly to the private sector (or a combination of the three). This is incompatible with the present paradigm of independent Central Banks with a specific mission of maintaining price stability. This is why most Central Banks that studied this topic apparently have decided not to go ahead.

- The Central Banks that are more seriously considering issuing CBDCs are those that face a reduction in the use of cash and its potential elimination due to the use of alternative means of payment like credit cards.

- The topic is in any case still under analysis and discussion. It one Central Bank decides to go ahead there may be pressure on others to follow.

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