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# Monetary policy implications of central bank-issued digital currency

Galo Nuño



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This article analyses the concept of digital currency issuable by a central bank, highlighting its similarities to and differences from the two main liabilities on its balance sheet: cash and bank reserves. It also discusses the main reasons why some central banks are looking into the potential consequences of the introduction of this new instrument. Lastly, it considers different central bank digital currency alternatives and highlights some of the possible implications for monetary policy conduct and for financial stability.

The author of this article is Galo Nuño of the Directorate General Economics, Statistics and Research.

## Introduction

The decline in the use of cash in some countries owing to the growing popularisation of private digital means of payment (cards, mobile payments, etc.), combined with technological innovations and the development of the so-called “cryptocurrencies” (Bitcoin, Ethereum, etc.), has elicited debate on whether central banks – which already issue a public means of payment in the form of a physical instrument, namely banknotes – should adapt to this growing demand for digital payment services and issue their own digital currency. Some central banks, such as the Bank of England, the People’s Bank of China and the Riksbank (Bank of Sweden), have – strictly from a theoretical standpoint – considered this possibility.

Issuing a digital means of payment would entail extending the possibility – available at present to credit institutions and the public sector – of holding deposits at the central bank to all other economic agents: other non-bank, non-financial corporations and households. This possibility poses, in turn, several technical alternatives: whether the digital money should be remunerated (like the public’s deposits at banks) or not (like cash); and whether it should observe the anonymity that cash ensures or be in registered form (like bank deposits).

Advocates of a central bank digital currency (CBDC) claim it would both improve aspects of the functioning of the payment system and, potentially, the transmission of monetary policy.<sup>1</sup> Detractors, for their part, consider that the benefits for monetary policy transmission associated with CBDC are modest and that the technological risks and the risks to financial stability mean due caution is required.<sup>2</sup> As analysed below, the possible advantages and disadvantages of CBDC hinge crucially on the design choice, in particular on the two aforementioned aspects: potential anonymity and the possibility of this type of currency being remunerated.

This article analyses the concept of CBDC, highlighting its similarities to and differences from the two main central bank liabilities: banknotes and bank reserves. There is also discussion of the main reasons why some central banks are considering the possible introduction of this new instrument, along with some of the forms it may take. Lastly, the article analyses some of the potential implications for monetary policy conduct and for financial stability.<sup>3</sup>

## What is CBDC?

Central banks currently issue two main types of liability that may be classified as “money”: bank reserves and banknotes (see Table 1). Bank reserves are the deposits that a relatively small group of financial institutions (credit institutions) hold at the central bank, either for regulatory and monetary policy (required reserves) reasons, or for liquidity management purposes (excess reserves). The reserves have no physical format, but are solely accounting entries between the central bank and the commercial banks. They are restricted-access, registered and potentially remunerated digital assets.<sup>4</sup> In the Eurosystem, bank reserves (above the minimum obligatory reserves) are currently remunerated at the deposit facility rate, this being one of the main monetary policy instruments of the European Central Bank (ECB).

<sup>1</sup> See Bordo and Levin (2017).

<sup>2</sup> See Siciliani (2018) and BIS (2018a).

<sup>3</sup> Recently, the Bank for International Settlements (BIS) has published a report on cryptocurrencies that also analyses the possibility of CBDC [see BIS (2018b)].

<sup>4</sup> The central bank’s liabilities are assets for the rest of the agents in the economy.

	Reserves	Banknotes	CBDC
Format	Digital	Physical	Digital
Access	Restricted	Universal	Universal
Anonymity	Non-anonymous	Anonymous	Both possible
Remunerated	Yes	No	Both possible

SOURCE: Banco de España.

Banknotes, for their part, are physical, non-registered assets that can be used by any person to make payments anonymously, without even having to be a citizen of the area or region in which this currency is deemed to be legal tender. Naturally, banknotes are not remunerated. They are, therefore, physical, universal, anonymous and non-remunerated assets.<sup>5</sup>

CBDC is typically conceived as a deposit at the central bank available to households and firms.<sup>6</sup> Consequently, CBDC shares characteristics with banknotes and bank reserves. Regarding anonymity and remuneration, various possibilities are envisaged, which will be discussed below. This system may or may not be anonymous (as in the respective cases of banknotes and bank reserves). Likewise, CBDC may or may not be remunerated.

CBDC also shares characteristics with private digital money, represented by accounting entries in agents' current accounts, which can be mobilised without the need for the use of banknotes, for instance through bank transfers or debit cards. The main difference is that CBDC is a public digital currency, issued by the central bank.

### What might warrant the issuance of CBDC?

The recent literature has indicated three main reasons why some central banks might consider the future introduction of CBDC:<sup>7</sup> i) the lesser demand for cash in some jurisdictions; ii) possible improvements in some aspects of the workings of the payment system, and iii) potential improvements in monetary policy transmission. Moreover, in many of the countries in which the introduction of the CBDC is being considered, regard is also had to other more general aspects of economic policy, such as combating tax fraud and money-laundering, and financial inclusion. Each of these reasons are analysed below in greater detail.

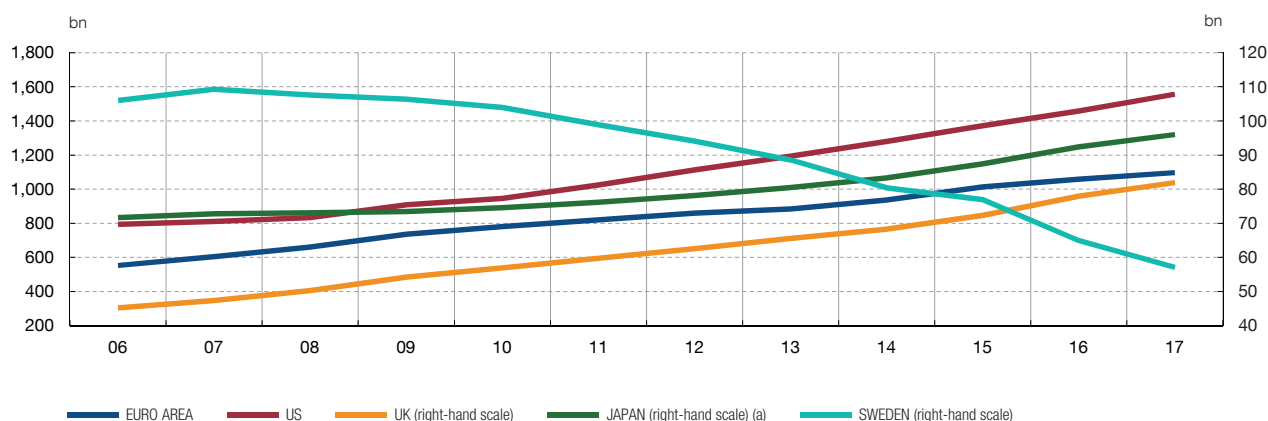
One reason for issuing CBDC might be the impact that a potential replacement of cash with digital means of payment might have on seigniorage, i.e. the profit the central bank obtains on the issuance of banknotes, whose production cost is small compared with their face value. Insofar as the central bank's profits are transferred to the Treasury, that would cause a decline in public sector revenue, potentially giving rise to tax increases or reductions in public spending. However, the amount of banknotes in circulation remains on a growing course in most economies, including the euro area (see Chart 1).<sup>8</sup> Accordingly, this reason does not appear currently to justify the issuance of CBDC in most advanced economies.

5 The concept of "universal" refers to the possibility of their use by whatsoever agent, i.e. the fact of not being confined to a certain type of agent, as in the case of bank reserves.

6 Although proposals for non-universal CBDC have been made, in that case we would be talking more about an increase in counterparties with access to central bank facilities than about digital currency. This is a relevant matter in terms of monetary policy conduct, but one too far removed from matters relating to the concept of CBDC discussed here.

7 See Bech and Garrat (2017).

8 Sweden is an exception to this broad pattern, since the bank notes in circulation there have been declining for a decade.



SOURCES: Bank of England, Bank of Sweden, Datastream and ECB.

a Japan: expressed in trillions.

Secondly, some studies conclude that the introduction of CBDC might improve certain aspects of the functioning of payment systems. Recent analyses estimate considerable gains in productivity associated with the introduction of CBDC.<sup>9</sup> However, it is not clear why these improvements should arise necessarily from the introduction of public digital currency and not from the extension and improvement of current private digital currency (transfer payments, etc.).

The third reason is the potential improvement in monetary policy transmission.<sup>10</sup> Firstly, if CBDC were remunerated, its interest rate would become a key instrument for implementing conventional monetary policy, since it would affect household and corporate saving and investment decisions, either directly (through the remuneration of funds deposited at the central bank) or indirectly (by setting a lower bound on the remuneration of bank deposits). That would enable monetary policy transmission to be decoupled in part from banks' financial situation, which might prove particularly important during financial crises.

Further, if cash were eliminated, that would see the disappearance of the main reason justifying the existence of the so-called zero lower bound, which refers to the difficulty financial institutions face in setting negative remunerations on retail bank deposits, since in that case agents might withdraw their funds and save through the accumulation of banknotes.<sup>11</sup> That sets a limit on the possible expansionary stance of monetary policy in an environment of low interest rates. Conversely, in the case of an economy without physical banknotes, the CBDC interest rate would mark the floor on interest rates. That would break the current asymmetry in monetary policy due to the existence of the zero lower bound, allowing, in principle, bigger cuts in nominal rates if necessary.<sup>12</sup>

9 See Barrdear and Kumhof (2016).

10 See, for example, Haldane (2015), Rogoff (2017), Bordo and Levin (2017) or Meaning *et al.* (2018).

11 Actually, the costs associated with banknote storage (space, security, etc.) mean that these rates may be slightly below zero, but they cannot be arbitrarily negative.

12 By "asymmetry of monetary policy" we understand the fact that the central bank may increase interest rates by as much it wishes to combat inflationary pressures, but it cannot reduce them far below zero if there are deflationary pressures.

In addition, the CBDC might be conducive to other economic policy goals, such as combating financial exclusion and tax fraud.<sup>13</sup> In the case of the fight against tax fraud and money-laundering, it should be highlighted that the CBDC can play a significant role provided that holdings thereof are not anonymous, i.e. when the central bank maintains an active register of all transactions in the economy. Nonetheless, the attainment of such an objective would further require that the use of cash be eliminated so as to prevent it from being the vehicle used for illegal activities. However, in addition to the various and numerous challenges that a hypothetical introduction of non-anonymous public money would entail, the progressive replacement of banknotes by non-anonymous CBDC would not – far from it – mark an end to such activities. Illicit activities would still have alternative assets for such ends, such as other countries' currencies, gold or cryptocurrencies themselves.

The emergence of cryptocurrencies has caused some concern among certain analysts, inasmuch as the digital currencies become accepted and ultimately crowd out legal tender. Where this is the case, central banks would lose some control over monetary policy transmission to the real economy, which might entail serious consequences in respect of price stability.<sup>14</sup>

At present, however, this reason is a very weak one for justifying the issuance of public digital currency, given that the market value of cryptocurrencies is tiny compared with the monetary aggregates in the euro area or in the United States, and their use as a means of exchange is very limited. This is due, among other matters, to the fact that, as explained in Box 1, while cryptocurrencies were originally conceived as alternative means of exchange, the forceful volatility frequently characterising their valuations makes them rather inappropriate as a unit of currency or a store of value.<sup>15</sup>

#### Anonymous or non-anonymous money

The possibility of setting CBDC in place through registered deposits would entail a change compared with the current use of cash, which is anonymous. Although registered money can offer certain advantages to society (in areas such as combating tax evasion or money-laundering), it would also involve a loss of individual privacy.

Beyond the attendant sociological considerations, it is important to bear in mind that the decision to introduce public, non-anonymous digital currency would oblige the central bank to invest significantly in infrastructure that were equivalent or even superior to that currently deployed by electronic means of payment operators. Specifically, the central bank would have to validate each transaction in the economy at each point in time, ensuring the safety of the system against multifarious threats.

In the case of anonymous public currency, while the investment in infrastructure might be less, other technological problems arise. Anonymous CBDC might require adapting the current decentralised validation technology used by cryptocurrencies to a legal tender currency. This poses two challenges. First, it adds costs associated with this system whose calibration is a priori uncertain. Second, the system must be robust to cyber-attacks

<sup>13</sup> In the case of household financial inclusion, recent studies show how the use of CBDC would be beneficial to low-income households, which usually depend more on cash. See, for example, He *et al.* (2017).

<sup>14</sup> See, for example, Bordo and Levin (2017) or FernándezVillaverde and Saches (2016), who show how in an economy without public money there may be problems of price level indeterminacy, which would be resolved with the introduction of CBDC.

<sup>15</sup> It is not clear that CBDC could compete with the current cryptocurrencies. The main attractiveness of the latter for many investors is precisely the fact that their supply is not subject to any central bank discretionality. Hence, the argument on cryptocurrency competition seems insufficient to warrant the introduction of CBDC.

and fraud. That may prove complicated, based as it is on a relatively unconsolidated technology such as that of the cryptocurrencies.

### Implications for monetary policy transmission and financial stability

As earlier stated, the introduction of CBDC might have significant effects on monetary policy transmission. In this respect, the hypothetical scenario most closely in line with the current design would be the introduction of non-remunerated CBDC.<sup>16</sup> Here, the remuneration of commercial banks' reserves at the central bank would continue to mark the floor for short-term interest rates in the interbank market, a key variable in the transmission of monetary policy decisions.

Remunerated CBDC would be something more of a novelty. Confining ourselves to the case where such remuneration were never higher than that on bank reserves, the latter would continue to be the floor for short-term interbank yields. However, given that the CBDC is an alternative to current accounts as a store of value and a means of payment, the remuneration thereon would indeed be an effective floor for the rates at which the different economic agents with access to CBDC lent funds to banks. For example, giving access to CBDC to non-bank financial institutions would set an effective floor to broadly defined money market rates. Likewise, the remuneration on CBDC would establish a lower bound for the interest rates on households' and firms' deposits. Thus, changes in the CBDC rate would affect agents' spending and saving decisions, either directly through the remuneration of funds deposited at the central bank, or indirectly through their effect on the remuneration of deposits at commercial banks. In turn, changes in banks' funding costs have a bearing on the interest rates at which banks lend to the real economy. In short, the remunerated CBDC scenario would afford the central bank greater control over the general financial conditions in the economy and, therefore, over aggregate demand.

Beyond its effects on monetary policy transmission, the pressure that remunerated CBDC would exert on the returns on bank deposits might have implications for the profitability and size of the banking sector. In the case of a sufficiently low CBDC interest rate relative to the rates on bank reserves, banks could offer deposit rates above the CBDC rate, thereby avoiding the loss of deposits, and at the same time maintain the profitability of its funds. At the opposite extreme, a CBDC interest rate at the same level as that on bank reserves would force banks to raise the remuneration on their deposits above the CBDC rate. This, in addition to reducing their net interest margins, might lead to a reduction in the supply of credit and raise the cost thereof, likewise leading in all probability to a contraction in the banking sector's intermediation capacity.

Lastly, even if non-remunerated, the introduction of CBDC might affect financial stability, since in the face of a financial crisis central bank money could be perceived as safer than the deposits at commercial banks. Accordingly, depositors – especially wholesalers whose deposits are not covered by State guarantees – might be tempted to withdraw their funds from banks to their accounts in CBDC, thereby fuelling potential bank panic and, therefore, exacerbating the financial crisis.<sup>17</sup>

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<sup>16</sup> The analysis focuses hereafter on the case of *positive* interest rates on bank reserves, i.e. once the current situation of (slightly) negative interest rates has normalised. The scenario of negative rates (and the possibility of introducing CBDC with likewise *negative* remuneration) poses additional complexities that lie beyond the scope of this article.

<sup>17</sup> One means of minimising this risk in the case of CBDC remunerated below the rate on reserves would be to impose a penalty (negative) CBDC rate in the event of financial crises, to discourage mass fund withdrawals.

## Conclusions

As discussed in this article, one argument that might be considered when assessing the introduction of CBDC is that related to the improvement in monetary policy conduct by means of a better control of the market returns that savers and borrowers face. Also, the possibility of eliminating the restrictions associated with the zero-interest-rate bound is theoretically attractive, especially in an environment of low interest rates as at present.<sup>18</sup> However, the attendant uncertainties and risks are significant and oblige central banks to be cautious in this respect.

One initial risk associated with the introduction of CBDC pertains to technology. The case of non-anonymous CBDC based on a similar technology to that for the current electronic means of payment involves substantial costs in terms of infrastructure and of operating requirements and regulatory demands. The case of anonymous CBDC might require adapting the cryptocurrency technology to a relatively different environment. A failure in either of the two scenarios, whether accidental or further to a cyber-attack, might cause considerable harm to the economy as a whole.

The second risk is that of financial stability. The introduction of a new risk-free asset (especially if remunerated) would necessarily affect the profitability of the banking sector and might encourage depositors to withdraw funds (assigning them to their current accounts at the central bank), particularly during bouts of banking panic, making such bouts potentially more likely and intense. A priori, it is difficult to estimate quantitatively the effect of these considerations on the stability of the financial sector and on bank lending in general, as there is no previous experience.

Consequently, the most reasonable path for central banks to pursue is a watch-and-wait approach, analysing technological progress and its potential applications in the areas under their remit and avoiding potential risks to their operating and monetary frameworks.

30.7.2018.

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<sup>18</sup> See Galesi *et al.* (2017).

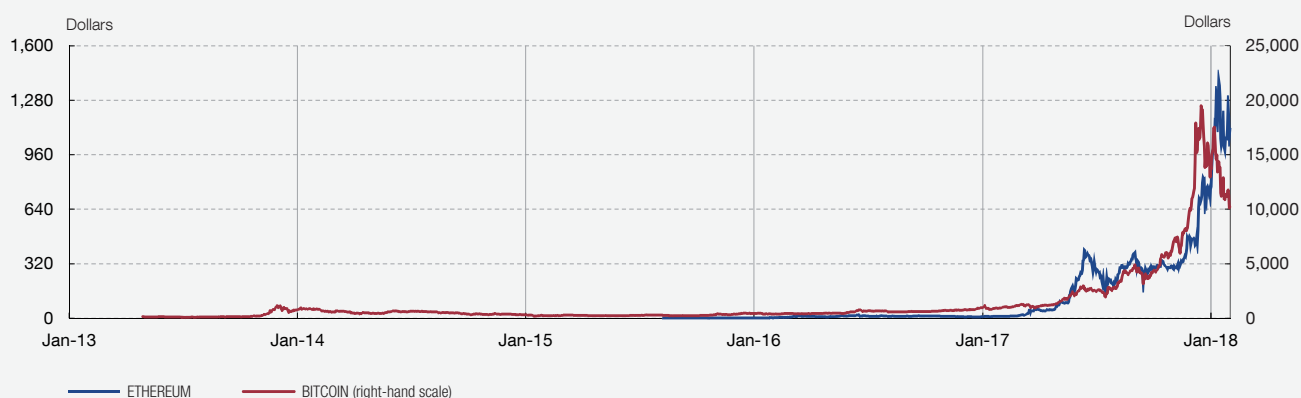
Cryptocurrencies emerged in 2009 with the creation of *Bitcoin*. Essentially, *Bitcoin* is a method for individuals to carry out transfers without the need for a central entity accrediting the movement of funds. That is to say, if individual A wishes to transfer funds to B, under conventional transfer arrangements it is necessary for an external institution C to accredit the fact that A has the funds at the outset of the transaction and that it is B who disposes of the funds at the end of the transaction. Accordingly, C must maintain in real time a ledger in which it records all transactions. *Bitcoin* introduced a distributed ledger algorithm whereby the accounting entries and the validation of the transactions are made in real time by the other nodes of the *Bitcoin* network. These nodes perform the aforementioned validation through complex mathematical algorithms in exchange for which they receive new *Bitcoins* as compensation, in what is known as “*Bitcoin* mining”. In this way, *Bitcoin* offers an alternative means for mobilising funds among economic agents.

Along with this algorithm, *Bitcoin* is novel in a second respect. Instead of being an algorithm designed to transfer legal-

currency-denominated funds, the amounts to be transferred are denominated in the virtual currency itself, the *Bitcoin*, which has no fixed parity with existing legal currencies. Instead, and to prevent the need for creating a central entity entrusted with issuing *Bitcoins*, the algorithm only allows the issuance of *Bitcoins* as remuneration for mining activities, at a rate that diminishes in proportion to the total volume created. In this way, the supply of *Bitcoins* remains limited and cannot be discretionally altered.

This limited supply of *Bitcoins* has prompted a progressive change in its valuation from its creation as a means of exchange to its current situation as an investment product, evidencing high price volatility. Investors invest in *Bitcoins* in the same way that they can invest in gold or in diamonds, which are assets with a limited supply and not subject to the actions of governments or of central banks. That has led to an explosion in the price of *Bitcoins* and to great volatility, as can be seen in Chart 1. Other cryptocurrencies, like *Ethereum*, which have improved on certain aspects of *Bitcoin*, such as validation time maintaining the same structure, have also followed a similar price pattern.

Chart 1  
CRYPTOCURRENCY PRICES



SOURCES: Coinmarketcap.com, etherscan.io and ECB.