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# Central Bank Digital Currency

## Is It a Good Idea?

A CBDC might make banking easier for you and me. It might also change how banks operate.

**BY DANIEL SANCHES**

Thanks to recent technological advances, central banks can issue a new type of money that travels through a network of computers around the globe and is exchanged with the click of a mouse or by using a mobile device. This central bank digital currency (CBDC) could change how people make payments and how financial firms operate. A CBDC is an efficient payment instrument for both domestic and international transactions, but it might prompt households and firms to shift funds away from bank deposits, increasing banks' funding cost and decreasing investment in the economy. This article examines a CBDC's potential benefits and trade-offs for society.

### Types of Money

In modern economies, a central bank such as the Federal Reserve issues two types of money: physical currency and reserves. Physical currency is the paper notes, such as the dollar bills, that most people use in their daily transactions. Reserves are a unit of account denominated in the country's own currency but issued only to select financial institutions, which can hold the reserves in accounts with the central bank.

Many central banks already issue reserves electronically. If a financial institution has an account with a central bank, it can sell assets (usually government bonds) to the central bank and receive a credit in its central bank account for the value of that transaction. Financial institutions and the central bank rarely use physical currency to settle these large-denomination financial transactions. Instead, they use computers. Thus, reserves are typically a virtual currency issued by the central bank and used for payments within a network of financial institutions. When a financial institution needs to make a payment to another financial institution, it usually transfers the amount electronically from its reserves with the central bank to the other institution's reserves.

Physical currency and reserves are both *outside money*–that is, money created outside the private sector. Outside money can be issued by a central bank, or it can take the form of an asset that has an intrinsic value, such as gold or silver. When the central bank buys government bonds from a financial institution, it pays

for them by increasing the reserve balances of that institution, which implies that the supply of outside money in the economy increases.

*Inside money*, such as bank deposits and checkable mutual fund accounts, is created by financial firms within the private sector. Unlike outside money, inside money is necessarily a claim on some private issuer. For instance, your checking account with a commercial bank is an asset for you but a liability for the bank. If you decide to withdraw the balance in your bank account, the bank must pay out currency. If the bank makes good on its promise to you, you no longer hold a claim on the bank.

If you want to make a payment to someone who holds an account at a different bank, you instruct your bank to transfer the balance in your account to that person's account. This can be done by check, wire transfer, or some other means. At the end of the business day, your bank is required to transfer reserves to the payee's bank for the value of that transaction. Alternatively, you can withdraw cash to make the payment yourself. So, in a typical daily transaction, the bank either pays currency directly to its depositor or transfers reserves to another financial institution. In other words, the bank must reduce its outside money holdings if a depositor makes a payment to someone outside the bank. Ricardo Lagos provides a useful summary of the types of money available to households and firms (Figure 1).

A CBDC is a new form of outside money designed to eventually replace physical currency. Because it is an electronic token, any individual or firm holding CBDC can make payments to all individuals and firms within the CBDC computer network. An important innovation associated with a CBDC is that if the network is sufficiently large, people can transfer balances without a commercial bank. For instance, you could use your CBDC balance to pay for a meal at your favorite restaurant or to order a new refrigerator from an online retailer. Your transaction is immediately settled via a transfer of electronic outside money to the seller.

Additionally, individuals or firms with an account at the central bank can receive interest payments proportional to their balances, so a CBDC account can earn interest just like a money market mutual fund account. In most advanced economies, financial institutions that are eligible to hold an account with the central bank already receive interest payments on their balances. In other words, some financial institutions have access to interest-bearing outside money. A CBDC would allow the central bank to pay interest to individuals and nonfinancial firms, too.

Initially, the central bank would issue a CBDC and stand ready to exchange it one-for-one with physical currency, which would be necessary to ensure that people and firms feel comfortable with the new payment instrument. Gradually, the central bank would retire physical currency from circulation until it is phased out.

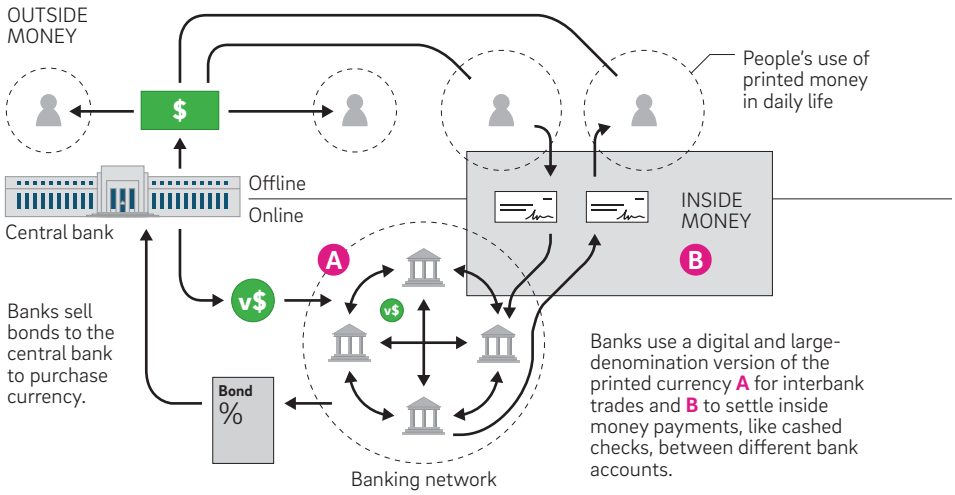
## CBDC as an Efficient Medium of Exchange

Consumers typically earn little or no interest on deposit accounts at commercial banks and may pay considerable fees for withdrawing cash from automated teller machines. Merchants pay substantial interchange fees for taking payments via debit and credit cards. These fees reflect both operational costs and profit margins for card-issuing financial firms.

A central bank could offer a CBDC at no cost to households and firms, which could then earn interest on the balances they hold at the central bank. Although the central bank would bear the nonnegligible costs of maintaining the digital transaction records, it might find it worthwhile to subsidize CBDC accounts, as they could serve as a valuable public good.[1]

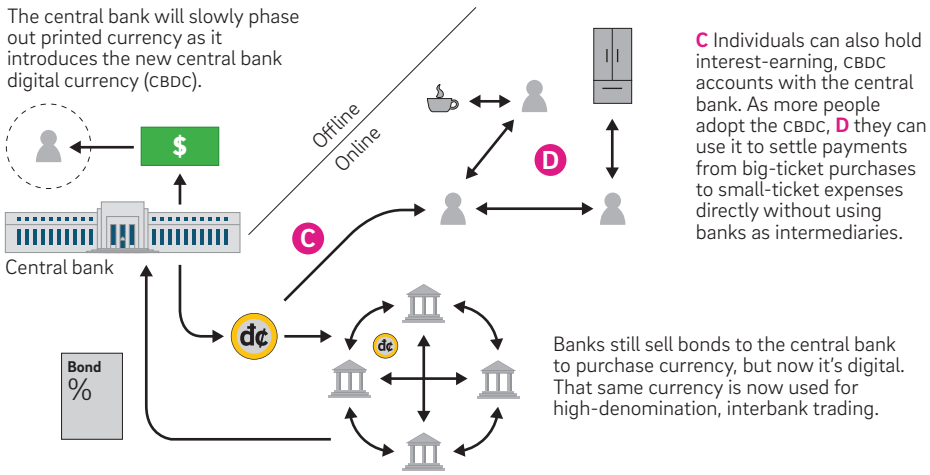
**FIGURE 1**

**With a Printed Currency: Outside vs. Inside Money**




**But with a Digital Currency...**

The central bank will slowly phase out printed currency as it introduces the new central bank digital currency (CBDC).



If a CBDC paid an interest rate in line with other risk-free assets, it could serve as an efficient payment instrument for all sorts of transactions.[2] A big reason why people hold bank deposits and other checkable accounts at financial institutions (even though they pay little or no interest) is because they make it easy for households and firms to make payments. Although consumers value these transaction services, they tend to economize on currency and bank deposits in their portfolio because there is an *opportunity cost* of holding money balances. That cost is the difference between the interest rate on a risk-free asset and the yield on money holdings. An efficient medium of exchange would drive this differential to zero.

When interest rates rise, households and firms tend to transfer some of their wealth from their noninterest-bearing checkable accounts to risk-free assets. By paying an interest rate in line with other risk-free assets in the economy, a CBDC would induce people *not* to transfer money to those risk-free (but illiquid) assets. In his classic 1969 article, Milton Friedman argued that in an economy in which money did not receive a rate of interest, as is now the case, people would hold too little wealth in the form of money. By encouraging people to hold more money as a proportion of their portfolio, a CBDC could make everyone better off.[3]

One advantage of a CBDC is that its network can include all households and firms in each country. By setting the interest rate on a CBDC equal to the risk-free rate, the central bank could then supply an efficient medium of exchange to all agents in the economy.

Another benefit of a CBDC is that it can be a safe asset for households and firms. The current banking system necessitates an elaborate system of bank regulation to prevent bank failures and bank runs. A government bankruptcy is less likely than a banking crisis. Certainly, there is much less probability of a run on a CBDC. As a result, a CBDC can promote financial stability in the banking system.

## Disintermediation in the Banking System

As we have seen, a CBDC is a new payment instrument that competes with all forms of inside money. If a central bank decides to launch a CBDC with the previously described properties, some households and firms will likely shift their funds from private financial institutions to an account at the central bank, a process economists call *disintermediation*.

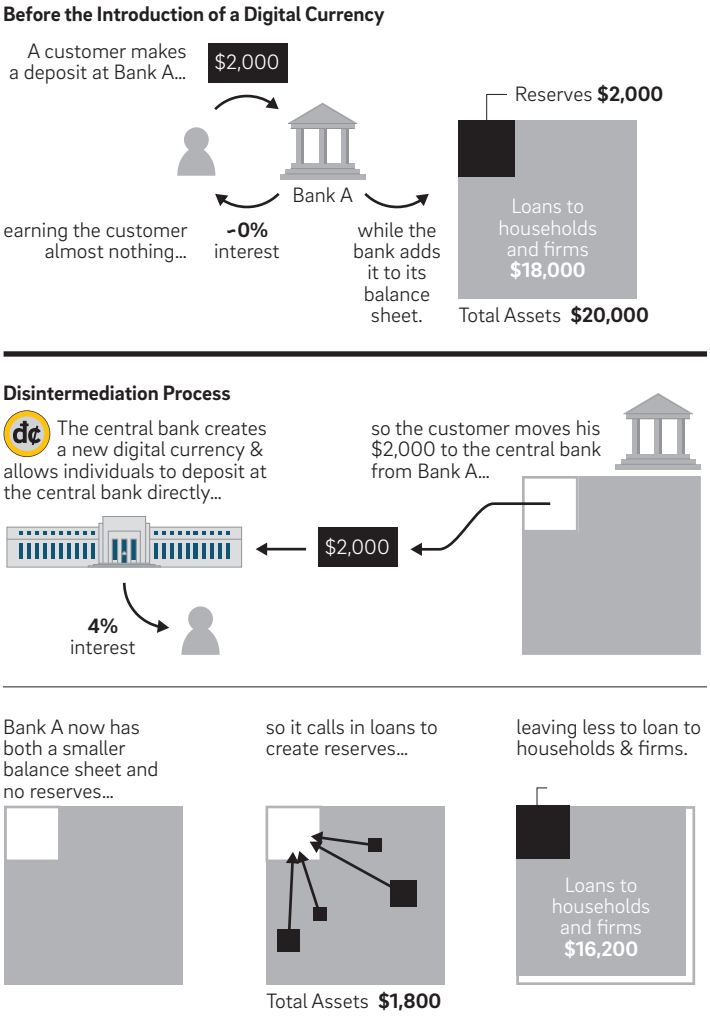
To better understand disintermediation, suppose that a central bank creates a CBDC overnight and offers to pay 4 percent per annum interest on its account balances. Right now, commercial banks in the U.S. offer a negligible, if not zero, interest rate on most retail customers' account balances. If commercial banks do not change their interest rate strategy in response to the introduction of a CBDC, many people and firms will likely transfer their balances to a CBDC account immediately. Because commercial banks issue deposits to finance loans to households and firms, they will have to contract their loan portfolio in response to a decline in deposits, leading to disintermediation in the banking system.

The exact amount of this disintermediation depends on many factors. For example, suppose that someone with a private-bank account worth $2,000 decides to shift their balance to the newly created CBDC. The private bank's deposits—and its reserves with the central bank—decline by $2,000. On the liability side of the central bank's balance sheet, reserves diminish by $2,000 and the CBDC rises by the same amount.

Now suppose that the private bank initially had $20,000 worth of assets, with $2,000 in reserves held in an account with the central bank and $18,000 in loans to firms and households. In other words, the private bank held 10 percent of its assets in reserves. After one of its depositors transfers $2,000 to the CBDC, the private bank ends up with no reserves at all. To return to the desired portfolio composition, it would have to call in $1,800 worth of loans, holding everything else constant (Figure 2). But this would happen only if the central bank does not issue new units of the CBDC to buy assets from the private bank.

This example shows that the amount of loans generated from within the private sector will likely contract upon the introduction of a CBDC that pays a sufficiently attractive interest rate. If households and firms shift their funds to a CBDC, and if nothing else changes in the economy, intermediaries in the financial system must contract their balance sheets, which is why the creation of a CBDC can lead to a reduction in private-bank loans to households and firms.

**FIGURE 2**



Under normal conditions, central banks, unlike commercial banks and other private intermediaries, do not provide intermediation services—that is, they do not provide funding for private firms and households. Instead, the central bank typically just issues currency or reserves to buy short-term government securities. Although many central banks still hold other types of assets on their balance sheets as a legacy of the policy response to the 2007-2008 global financial crisis, most central banks say they will soon return to normal operational procedures.

However, a central bank could invest the funds it raises by issuing a CBDC in other assets, such as corporate bonds and mortgage-backed securities. In this case, disintermediation does not necessarily reduce the supply of credit in the economy.

This discussion shows that the effects of a CBDC on credit allocation, production, and consumption can vary depending on how the central bank behaves when launching a CBDC. Recent research examines the effects of a CBDC when the central bank sticks to its standard operational procedures, and when it instead engages in private intermediation following the creation of a CBDC.

## CBDC Without Central Bank Intermediation

Todd Keister[4] and I have studied the effects of the introduction of a CBDC in the context of a formal economic model. Throughout the analysis, we assume that the central bank follows the standard procedure of buying government bonds when it expands the supply of CBDC and selling government bonds when it contracts the supply. But we do not assume that the central bank is necessarily backing all of the CBDC supply with government bonds. For instance, the central bank could finance some of the CBDC interest payments by simply issuing more units of the CBDC. Finally, we assume it doesn't cost much for the central bank to issue a CBDC.

We then consider all effects associated with the introduction of a CBDC, including the reaction of private banks. We find that although a CBDC promotes efficient exchange, it crowds out private-bank deposits, raises private-banks' funding cost, and decreases investment. We show that despite these effects, a CBDC raises the welfare of households in the economy under certain conditions.

Once it introduces a CBDC, the central bank might raise the interest rate paid on balances held at the central bank to promote efficient exchange. As we have seen, the private banking system currently offers an interest rate on deposits lower than the interest rate on risk-free assets, which leads to inefficient exchange. Thus, in our analysis, the introduction of a CBDC is necessarily associated with a higher interest rate on CBDC balances than the interest rate on deposits prior to the introduction of a CBDC, given that the central bank's goal is to create a CBDC that provides an efficient medium of exchange to households and firms. To avoid losing funds to the central bank, private financial firms will likely then raise the interest rate on their deposits, too. A higher interest rate on deposits means a higher funding cost for private banks, which will likely charge more for their loans to borrowers.

Taking the costs of disintermediation into account, we find that households will, nonetheless, often benefit from the introduction of a CBDC. The benefits of introducing an efficient medium of exchange more than offset the increase in private banks' funding cost and associated decline in investment, resulting in larger output for the whole economy.

This is true when *investment frictions* are relatively small. Investment frictions take many forms. For example, borrowers may know more than the private bank about their future risks or actual revenues, so banks bear added costs to ensure repayment of the loan. Or, as in our model, private banks may be unable to capture a large enough share of the borrower's project payoffs.[5] Whatever the cause, investment frictions lead the private bank to demand a higher interest rate as compensation than would be required in the absence of frictions. Meanwhile, the bank will refuse to make some loans that would be profitable in the absence of investment frictions.

To maintain their spreads as their funding cost rises, private banks raise the interest rate they charge for loans, increasing the number of profitable projects they can no longer fund.[6] These profitable projects that are no longer funded—that is, projects that would have been funded despite the investment frictions—are the social cost of disintermediation.

For example, consider a local bank that accepts deposits from households and then loans some of that money to small businesses. Assume that all borrowers are equally likely to default. Finally, assume that the bank pays households 1 percent per annum on their deposits and charges borrowers 5 percent per annum on their loans. In this case, the bank spread is 4 percent, which generates earnings to cover the bank's operational costs and create a profit margin for the bank's owners. If the bank's funding cost increases to 2 percent as a result of the introduction of a CBDC that pays an interest rate of 2 percent per annum, then the bank will end up charging borrowers 6 percent on their loans to maintain a bank spread of 4 percent. Consequently, all projects that earned a rate of return for the borrower of between 5 and 6 percent per annum are no longer profitable for the borrower, so those borrowers will no longer apply for these loans. Assuming that they have no other ready source of funds, these projects will not get done.

We assume that investment frictions are relatively small, so we expect to see a relatively small decline in the supply of loans following an increase in the private bank's funding cost. Because we also calculate, upon the introduction of a CBDC, large benefits from this more efficient medium of exchange, we conclude that a CBDC benefits society. Although it can lead to disintermediation, a CBDC is worthwhile.

## CBDC with Central Bank Intermediation

In a recently published paper, Markus Brunnermeier and Dirk Niepelt identified the conditions under which a shift of funds from private-bank deposits to a CBDC does not change the aggregate portfolio of loans and securities for the whole economy. The authors allow the bank to engage in private financial intermediation when issuing a CBDC. For instance, the central bank could issue a CBDC to buy privately issued loans, such as mortgages and commercial loans, from private financial institutions if doing so is part of its intervention strategy.

Their analysis assumes that the central bank and private-sector financial institutions are equally adept at identifying investment opportunities and monitoring loans, which is unlikely in the real world. They found that the introduction of a CBDC might not crowd out the supply of loans to firms and households, which they would use to finance private investment, if the central bank is willing to engage in private financial intermediation.

Jesus Fernandez-Villaverde, Linda Schilling, Harald Uhlig, and I have considered a framework in which the central bank, unlike private financial institutions, cannot identify investment opportunities and monitor loans. We believe this is a better approximation of the real world, given that both investment and commercial banks invest considerably in the selection, screening, and monitoring of their borrowers, which requires both sophisticated software and highly qualified analysts.

Surprisingly, we found that even though the central bank can't identify all investment opportunities, it can introduce a CBDC without disintermediation. If the central bank is willing to engage in private financial intermediation when issuing a CBDC, it can redeposit part of the funds raised from CBDC depositors with investment banks. These banks can identify profitable long-term investment opportunities, which will provide the central bank with revenue to finance the interest payments on a CBDC. The result is that the supply of loans in the economy does not change following the creation of a CBDC.

However, this does not account for the benefits of a socially efficient medium of exchange. These analyses focused on the role of banks as providers of intermediation services, and the conditions under which a CBDC, when combined with changes in the central bank's operational procedures, does not crowd out private investment. We did not examine the role of banks as providers of liquidity services through demand deposit accounts that are used as a medium of exchange.

As we have seen, commercial banks pay negligible if any interest on checking accounts, and high-yielding accounts offered by investment banks are not always checkable. The Keister–Sanches study, on the other hand, considered the benefits of a CBDC designed to serve as an efficient medium of exchange, even if it shifts the supply of credit because the central bank does not engage in financial intermediation.

## Conclusions

Central banks are investigating a CBDC's benefits and trade-offs for society. Although a CBDC can crowd out private-bank deposits and increase private banks' funding cost, it can also promote efficient exchange and improve the allocation of resources in the economy. Although the initial set of papers analyzing the effects of a CBDC focused on some key elements, there are many other aspects of the monetary system that require additional research, such as the impact of a CBDC on the framework for the implementation of interest-rate policy for business-cycle adjustments.

As we have seen, discussions of the merits of a CBDC have led economists to rethink the central bank's role in the provision of liquidity and intermediation services. The rise of new technologies and competition from the private sector will likely result in a fundamental change in central banking. Many scholars, including myself, think that this will be the greatest debate of our time in the field of money and banking.

## Notes

**1** Michael Bordo and Andrew Levin have argued that a CBDC could be implemented via accounts held directly at the central bank or via specially designated accounts at supervised commercial banks, which would hold the corresponding amount of funds in segregated reserve accounts at the central bank.

**2** A risk-free asset is a security that has a certain future return. For instance, Treasury securities are considered a risk-free asset because the U.S. government guarantees all future payments.

**3** See my 2012 *Business Review* article for a detailed discussion of the properties of efficient media of exchange.

**4** Todd Keister is a professor of economics at Rutgers University. Previously, he was an assistant vice president at the Federal Reserve Bank of New York.

**5** In the contracting literature, some project payoffs may be nonpledgeable for a number of reasons. For example, to keep a manager of a firm properly motivated, the manager may need to receive a sufficiently high compensation. But this means the firm can't pledge the manager's future compensation to the bank.

**6** The spread is the difference between how much interest a bank pays to its depositors–also known as its funding cost–and how much interest it collects from its borrowers.

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