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Is Central Bank Currency Fundamental to the Monetary System?

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Abstract

In this paper, we discuss whether the ability of individuals to convert commercial bank money (i.e., bank deposits) into central bank money is fundamentally important for the monetary system. This is a significant question since the use of cash—the only form of central bank money that the public currently has access to—is declining rapidly in many countries. The question is highly relevant to the discussion around whether central banks need to issue a retail central bank digital currency (CBDC). We conclude that depositors' need for control could be a reason why cash or a CBDC is essential, even in countries with strong measures safeguarding commercial bank money.

Topics: Bank notes; Digital Currencies and fintech; Financial services; Payment clearing and settlement systems
JEL codes: E, E4, E41, E42, E5

Résumé

Dans cette étude, nous cherchons à déterminer si la capacité des personnes à convertir la monnaie de banque commerciale, soit les dépôts bancaires, en monnaie de banque centrale revêt une importance fondamentale pour le système monétaire. Cette question est importante puisque l'utilisation de l'argent comptant – seule forme de monnaie de banque centrale actuellement accessible au public – diminue rapidement dans de nombreux pays. Elle entre certainement en ligne de compte dans le débat sur la question de savoir si les banques centrales doivent ou non émettre une monnaie numérique de banque centrale (MNBC) de détail. Nous concluons que le besoin de contrôle des déposants pourrait expliquer pourquoi les espèces ou une MNBC sont essentielles, même dans les pays dotés de mesures rigoureuses pour protéger la monnaie de banque commerciale.

Sujets : Billets de banque; Monnaies numériques et technologies financières; Services financiers; Systèmes de compensation et de règlement des paiements
Codes JEL : E, E4, E41, E42, E5

". . . you need as much public money as needed to anchor the trust in the currency."

– Cœuré (2019)

1. Introduction

Cash is often considered fundamental to the national monetary system. For instance, some theories of money suggest that a monetary system needs cash or some form of "outside money." Similarly, many authors assume that convertibility into cash—that is, the fact that you can convert your bank deposits into cash whenever you want—underlies both the store of value function and the acceptability of commercial bank money.[1] The convertibility function also allows one form of money to replicate the store of value and unit of account properties of another and therefore supports the "uniformity of money."[2]

However, the use of cash is declining in many countries, and cash is on the verge of becoming marginalized in Norway and Sweden. If this development continues, the general public will no longer have access to central bank money.

In this paper, we discuss whether central bank money that is available to all—for instance, cash—is fundamentally important for the national monetary system. Our focus is mostly on the need for convertibility between commercial bank money and publicly available central bank money. The question is very important for countries where cash is becoming marginalized. If convertibility is fundamental and physical cash is disappearing, central banks might have to issue a modern electronic version of cash—a central bank digital currency (CBDC).

Our discussion proceeds in three steps.

We start by looking at what the literature has to say about the issue. Essentially, this literature suggests the government has to take measures to ensure that money is safe and trustworthy. However, these studies do not say that the government (or the central bank) necessarily has to issue its own money but suggest that it can just as easily strengthen measures that safeguard private money.

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[1] Money comes in different varieties. The most common are "central bank money" and "commercial bank money." Central bank money is money issued by the central bank. It is a liability of the central bank and typically takes the form of physical cash and reserves. Anyone can hold cash, while mainly banks can hold reserves. In the future, the general public may also hold balances at the central bank. We follow standard terminology and call such balances, including electronically tokenized balances, retail central bank digital currencies (CBDC). Commercial bank money is money issued by commercial banks. It is a liability of a bank, and nowadays it takes the form of balances held at commercial banks, i.e., commercial bank deposits. Throughout the paper, we use the terms "deposits" and "commercial bank money" interchangeably.

[2] See, e.g., Andolfatto (2009, 14), who writes that "the demandability clause makes bank money more widely acceptable as a means of payment." Brunnermeier, James and Landau (2019, 26) presuppose that the safety of private money that is convertible into cash (or CBDC) is independent of the issuer. Brainard (2019, 3) writes, "Commercial bank money [...] is widely used in part because people are confident that they can convert it on demand to the liability of another commercial bank or the central bank, such as physical cash."

In the second step, we therefore look at the measures that countries have put in place to protect—and to signal the intent of protecting—commercial bank money. Many countries have instituted such measures and have proven willing to protect deposits and the payment system in times of crisis. In those countries, commercial bank money is safe—at least up to the amount of the deposit insurance.

In the third step, we look for other reasons why cash or a CBDC can be fundamental to the monetary system. We introduce a (novel) mechanism that may make cash or a CBDC fundamental even if commercial bank money is safe: people who do not trust commercial bank money may still choose to hold it as long as they can easily convert it into central bank money. This mechanism finds support in the psychology literature, where it has been documented that people are more willing to take risks if they feel they are in control. This mechanism may also offset some of the bank-run risk that many associate with a CBDC.

In order to avoid misunderstandings, we would like to emphasize what we do not analyze in this paper:

- We do not analyze whether cash or a CBDC is needed to promote resilience and competition in the payment market.
- We do not evaluate whether central banks are necessary. We are only looking at the implications of lack of general public access to central bank money. We assume that banks can still hold reserves at the central bank. Thus, our analysis differs from the literature on completely private monetary systems.
- We do not analyze the physical aspect of cash.
- We do not discuss currency competition. Our focus is on monetary systems based on commercial bank money denominated in the same currency.
- We do not analyze whether a system with deposit insurance and implicit guarantees to the banking system is better than systems that have no need for deposit insurance, for instance, the Chicago plan.

We have structured the paper as follows. In Section 2, we look at what the literature has to say about our questions. In Section 3, we look at instituted measures that protect commercial bank money. In Section 4, we discuss reasons beyond safeguarding commercial bank money for why public access to central bank money might be fundamental. We summarize and conclude in Section 5.

2. The literature

In this section, we focus on studies that formulate and test theories about money in formal models. We are not aware of any empirical literature that casts light on our questions. Economic theory provides many models of money, but only some are useful for the analysis of our questions.

Within the New Keynesian class of models, money sometimes enters directly as an argument in the utility function. We often call these ”money-in-the-utility-function models” (see, e.g., Walsh 2010). These models are useful for studying monetary policy and other macroeconomic issues, but they are not useful for our question. This is because they do not distinguish between private and central bank money and they assume that money is accepted and used.

A somewhat older class of models uses a “cash-in-advance constraint” (see, e.g., Lucas and Stokey 1987). These models have two forms of money: cash and credit. A key assumption in the models is that agents need cash to buy certain goods. Thus, the public needs access to cash by assumption. However, these models also simply assume that agents trust and accept both forms of money.

The models that are useful with regard to our question are instead those that endogenously explain why a specific form of money is accepted and used. These are typically models where money is essential in the sense that it helps overcome some friction so that we can achieve higher welfare with a specific form of money than without. A common label for models with these features is “monetarist models” (see, e.g., Williamson and Wright 2010; Lagos, Rocheteau and Wright 2017).

These models point to two reasons why central banks may need to give the general public access to central bank money—that is, why they need to issue cash or a CBDC. Both reasons involve a lack of trust in private money:

1. Private credit, which can work as money, comes with credit risk. If this risk were too high, private credit would not work as money and the government would have to step in and offer safe money.
2. Private issuers of money may have incentives to issue more money than needed. This could create inflation that undermines the value of money. The government would therefore have to offer money that keeps its value.

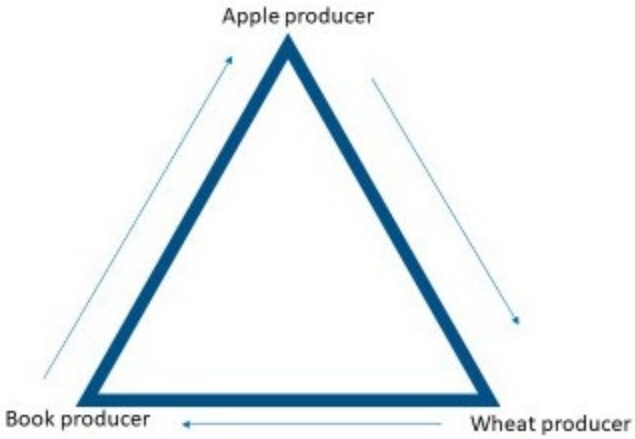
We will now take a closer look at the mechanisms behind the two reasons why we might need cash or a CBDC. We will also explain why public protection of private money can be an alternative to general public access to central bank money. The exposition below is intuitive, informal and quite cursory. Our aim is to portray the main arguments in a simple way.

Credit as money or the basis for money

If all agents in the economy could be trusted to honour all of their promises, then there would be no need for money. It would be sufficient to have a common bookkeeping system. However, in reality people cannot always be trusted to honour their promises, and bookkeeping is difficult when there are many agents. Therefore, we might need money in some form.

To explain how credit can work as money or can form the basis for money, we use Wicksell's Triangle. Suppose that an apple producer wants to consume wheat, a wheat producer wants to consume books and a book producer wants to consume apples. Obviously, if there is no money and none of them can be trusted to keep their promises, trades will be hard to achieve unless all of them can meet in the same place at the same time. However, do we need central bank money (or some other form of outside money) for trades to take place?

Figure 1. Wicksell's Triangle



First, suppose that one of the agents, for instance the wheat producer, issues a credible IOU stating, "I owe you one kilo of wheat." The book producer then accepts this IOU as payment for a book, knowing they can hand it to the apple producer in exchange for an apple. The apple producer wants the IOU because it can be exchanged for a kilo of wheat. In this case, the IOU—which is in fact a credit given to the wheat producer—serves as money. Thus, in this situation there is no need for outside money. All welfare-enhancing trades take place using the IOU, and central bank money is not necessary. This simple example illustrates that measures that render the IOU trustworthy are sufficient and eliminate the need for cash or a CBDC.

An alternative to the IOU is to introduce a bank (see, e.g., Calvananti and Wallace 1999). The bank could issue a loan denominated in some unit of account to the wheat producer. The wheat producer could then use the borrowed money to buy books. The book producer accepts the money because they can use it to pay for apples. This is because the apple producer knows the wheat producer will accept the money, since the wheat producer needs it to pay back the loan. Thus, in this case all welfare-enhancing trades also take place using the money issued by the bank based on the credit. Therefore, central bank money is not necessary. This simple example illustrates that measures that safeguard credit repayment render bank credit trustworthy and useful.

In the examples above, agents trade only once. If agents make trades more than once and their previous behaviour (histories) can be observed, then trust in private money may arise endogenously. If agents want to trade repeatedly, they might prefer not to default in order to be able to trade in the future. The reason is that a previous default on an IOU or a credit can destroy future IOUs or credits. This illustrates that when people want to trade repeatedly, they—and thereby the money created inside the system—endogenously become trustworthy. However, the literature also shows that this mechanism is weakened in the presence of other frictions: for instance, the time it takes to verify whether an agent has honoured previous promises. Kocherlakota and Wallace (1998) and Mills (2007), for example, show that if there are lags in updating histories, contracts cannot be enforced. Their models reveal a need for outside money such as central bank money. However, and similarly to other models, an alternative would be for the government to put measures in place that enforce contracts.

In Sanches's (2016) model, banks themselves find it optimal to set up measures that protect deposits. In his model, there is no role for outside money at all. Thus, the private sector finds a solution that does not involve central bank money. Again, theory suggests that it is not essential that the general public has access to central bank money.

The examples above revolve around the need for money when people cannot meet in the same place: what the literature sometimes calls "separation in space." Other theories explain the need for money when there is "separation in time." Samuelson (1958) is a prominent example. Regarding our question, these studies, like those on separation in space, also show that public central bank money is not needed if instituted measures can provide sufficient trust in private money. Examples include measures that keep inflation in check and ensure sufficient enforcement or commitment to honour debt obligations.

The mechanisms explained above tend to suggest an "all-or-nothing" solution. Either central bank money is not needed and not used at all, or it is needed and agents use only central bank money. In reality, central bank money and commercial bank money co-exist and are in use simultaneously. In other theories and models in the monetarist literature, inside and outside money do co-exist. However, these theories are not relevant to our question, since they explain either why private money provides more flexibility than central bank money or why two types of money denominated in different currencies can co-exist and circulate in an economy.

For example, Bullard and Smith (2003) provide a model in which it can be welfare enhancing if private agents issue money in addition to the already-existing central bank money. This is because the amount of central bank money is fixed and independent of the needs of the economy. The model does not suggest that we need central bank money for private money to exist.

Another example is Kiyotaki and Wright (1989), whose paper forms the basis for much of the consequent literature. In their model, the two types of money that circulate have different properties: one type has a higher rate of return and the other is liquid. Also note that in

models where different money co-exists, they do not have one-to-one convertibility—and thus no uniformity of money. These models, and other similar ones, do not provide any mechanism whereby public access to central bank money (or outside money) is a necessary condition for private money. They do, however, highlight that the co-existence of two types of money implies that neither of them strictly dominates across all characteristics. Users trade off one characteristic dimension for another when making their portfolio choice of what monies to hold.

One of the most influential models of banking is Diamond-Dybvig's (1983). The model explains how banks can help the economy reach a first-best solution through their ability to create short-term liquidity. This model is not about money per se, but rather about the consequences of mismatching maturities in the banks' assets and liabilities. Nevertheless, an important conclusion from the model is that securing bank deposits through deposit insurance, or some other means, is crucial for the stability of the financial system.

What does all this say about our question? Basically, it says that central bank money that is available to all is needed if bank money is not trustworthy and therefore not accepted. A corollary is that the government and the central bank will have two options. They can issue central bank money that is available to the general public, or they can put measures in place that safeguard bank money. Therefore, the literature that argues credit works as money or forms the basis for money does not suggest that cash or a CBDC is fundamental to the monetary system. It suffices to have strong measures that protect commercial bank deposits. In a later section, we take a closer look at these.

The temptation of private issuers to over-issue

We now turn to the second mechanism in the monetarist models that may lead to the need for general public access to central bank money, namely, the temptation for agents to issue more money than needed. The assumption behind this is that money-issuing agents make a profit on money issuance similar to seigniorage or net interest rate margins. They therefore have incentives to over-issue money, which can result in money losing value.

The mechanism is quite intuitive. Suppose two types of money are available: central bank money and private money. Furthermore, suppose they are not necessarily convertible at par. If issuance of central bank money is under control and well managed, inflation in terms of central bank money remains in check and central bank money will keep its value. In this sense, central bank money is "good money." The mere existence of central bank money as a stable alternative, then, induces private money issuers to not over-issue, and private money becomes trustworthy. Thus, central bank money's role as a competitor, rather than its convertibility, lends credibility to private money. Also note that the problem of over-issuance disappears if the money issuers can be sufficiently monitored: that is, if instituted measures are strong enough (see, e.g., Cavalcanti-Wallace 1999; Gu, Mattesini and Wright 2013). Hayek (1990) suggests that competition among private money issuers is enough to render private money safe.

We nevertheless conclude that these models do not directly relate to our question, for two reasons:

1. Under current (real-world) regulation and monetary policy arrangements, credit demand restricts commercial banks' money creation. Credit demand, in turn, is determined by the central bank's monetary policy. Thus, under the current monetary policy regime, the risk that banks over-issue money to the extent that it leads to high inflation is not a matter for concern. However, over-issuance in the sense that banks may extend too much credit can still be a concern, for instance, if banks' capital requirements are too low. Our point here is only that banks cannot extend more credit than what is demanded at a given rate of interest.
2. In these models, the two forms of money do not have one-to-one convertibility. Thus, they are more about two different currencies than about a monetary system with commercial bank money denominated in the same currency as central bank money.

3. Measures that safeguard commercial bank money

What measures can safeguard commercial bank money? To what extent are they in place? Are they sufficient to render commercial bank money trustworthy? In this section, we consider these questions.

Laws, regulations and supervision

Legal frameworks and practices that support contract enforcement make loan defaults less likely. That reduces the vulnerability of banks and increases the safety of bank money. Similarly, regulatory frameworks for banks make bank money safer. The frameworks typically prescribe minimum capital levels, accounting standards, disclosure standards and so on. Regulation also describes what measures will be taken and what will happen if a commercial bank becomes insolvent or runs into illiquidity or other problems. Finally, supervision is supposed to ensure that the banks comply with regulations. Member countries of the Organisation for Economic Co-operation and Development (OECD) and many other countries have these measures in place.

Facility of lender of last resort

Commercial banks can run into illiquidity even in countries where strong laws, regulation and supervision are in place. Seen in isolation, this may undermine the trust in commercial bank money. For this reason central banks have the facility to act as lender of last resort, whereby banks that run into a temporary liquidity shortage can borrow from the central bank against

collateral. This facility makes commercial bank money safer and thereby more trustworthy. It is a key function of all central banks.[3]

A focus on depositors and the payment system

Banking resolution frameworks specify how authorities will handle insolvent and bankrupt banks. If these frameworks focus on saving depositors' money and keeping the payment system up and running, that makes commercial bank money safer and enhances trust in commercial bank money.

The current legal framework regarding bank resolution in the European Union (the Bank recovery resolution directive) states that responsible government agencies will make sure that when major banks are under resolution, their customers' accounts will remain open.

When it comes to banking resolution, it is worth noting that government finances and the strength of the balance sheet of the central bank may matter. To see why, consider an insolvent bank. The central bank, or some other relevant national authority, will have at least two options if it wants to save the funds of the depositors in such a bank:[4]

1. It can restore the bank's balance sheet by injecting necessary new capital.[5]
2. If there is another solvent bank, it can liquidate the insolvent bank, sell the bank's assets, add sufficient capital and move the deposits to that other solvent bank.

In the unlikely event that all banks are insolvent, the central bank—or other relevant authorities—can use option (1) for all banks, or option (1) for some banks and option (2) for the rest of the insolvent banks.

The capital that is injected through such operations can come from two sources: either the central bank's equity capital or capital from the government. If the government finances the operation, it needs to be able to raise enough capital. If capital from the central bank finances the recapitalization, the central bank's equity capital falls. The funds needed might even be larger than the central bank's equity. Thus, for such a large recapitalization to be possible, we must allow the central bank to operate with low or negative equity, or the government must be able to raise enough capital.

Theoretically, central banks can operate very well with negative equity. One reason is that a central bank cannot run into liquidity problems because it is legally entitled to pay its bills with the money it creates. If not through physical cash or a CBDC, it will pay by issuing bank

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[3] The lender-of-last-resort facility is dependent on the existence of neither cash nor a CBDC. As long as the central bank accepts a sufficiently wide set of collateral, it can bridge the bank's liquidity shortage by lending bank reserves. Central banks can create such credits "out of thin air."

[4] According to current legislation, a central bank within the European Union cannot bail out an insolvent bank. However, in real life it is often hard to separate between liquidity and solvency problems during a crisis. Furthermore, the central bank is part of the state and this section gives a theoretical exposition.

[5] Preferably, the central bank should also take ownership of the bank if the original equity capital has been wiped out by the losses.

reserves. The other reason is that, unlike other financial institutions, central banks are not legally forced to implement recovery measures or go into administration ("go bankrupt") when their equity is negative. And indeed, several central banks operate or have operated successfully with negative equity. The Czech National Bank and the central bank of Chile, for instance, have operated for years with negative equity without experiencing any ill effects on their reputations or operations.

There could nevertheless be a limit to how low the negative equity can become before the situation becomes unsustainable, for instance, because it gives the central bank incentives to embark on inflationary policies or simply because the central bank will lose its reputation or room to manoeuvre. Thus, we conclude that in countries with relatively low government debt, a well-run central bank and institutional arrangements that keep inflation in check, it is reasonable to believe that deposits in failed banks can be protected even in a systemic crisis.

Deposit insurance

Deposit insurance is a promise by the government to assure consumers that money held as deposits in commercial banks are safe, at least up to a certain amount. It is a powerful measure set up to communicate the authorities' intent to protect deposits. It enhances trust in commercial bank money, in particular in times of crisis.

Deposit insurance schemes are typically not fully funded. For instance, the US Federal Deposit Insurance Corporation (FDIC) web page states, "FDIC insurance is backed by the full faith and credit of the United States government." It does not state that the government has a designated account with money already earmarked for deposit insurance. Thus, if the crisis is sufficiently large, the scheme cannot provide full compensation for all deposits covered without additional funding. However, as explained above, the authorities can guarantee deposits even if a deposit insurance scheme is absent or underfunded.

Is commercial bank money safe enough?

In most advanced economies, all of the measures mentioned above are in place. Furthermore, during past financial crises, public authorities have proven willing and able to protect commercial bank deposits in many countries, including in the United States in 2008–09. In both Sweden and Norway, countries where cash seems to be disappearing, the governments have also proven willing and able to protect commercial bank deposits in times of systemic banking crises. The payment systems have been up and running without interruptions and no reductions have been applied to the value of commercial bank deposits.

Based on the discussion above, we can conclude that in countries with strong institutions and sound government finances and macroeconomic policies, commercial bank money is safe up to the limit of the deposit insurance guarantee—and in practice even above that. Thus, given this, and according to the theory described above, it seems that neither cash nor a CBDC are fundamental to the monetary systems in these countries. However, even if commercial bank money is safe, cash or a CBDC may be essential to the monetary system for other reasons.

4. Other reasons why public central bank money might be essential

In this section, we discuss two reasons beyond issues of the risks around bank money for why public access to central bank money might be essential. These are uniformity and control.

Uniformity of money

A key feature of the current monetary system is that funds deposited in different banks exchange at par. This makes money issued by different banks uniform and is sometimes referred to as the "uniformity of money."

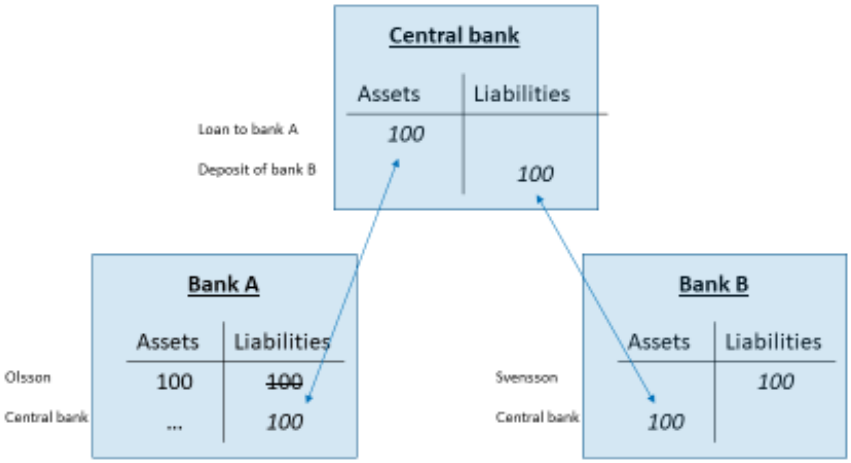
Cash is often considered fundamental to the uniformity of money. This is because when all commercial bank money is convertible into cash at par value, one commercial bank's money automatically becomes convertible into another commercial bank's money. Convertibility into a CBDC would support uniformity of money in the same way. Thus, if cash disappears, convertibility and the uniformity of money would be maintained by a CBDC.

However, cash or a CBDC are not the only mechanisms we can use to transfer money between individuals or to convert money issued by different commercial banks (or other money issuers) between them at par value. All commercial banks (and other money issuers) have access to central bank reserves, and all electronic payments are ultimately settled with central bank reserves. These facts are important parts of the mechanism to ensure the uniformity of money.

To see why, consider the example in Figure 2: bank A has given Mr. Olsson a loan of $100, so that he has $100 in his deposit account at bank A but also a debt of $100. Mr. Olson wants to use the loan to buy a house from Ms. Svensson, who has a deposit account at bank B. To settle the payment, bank A will borrow $100 in reserves from the central bank (or use $100 that it already has deposited at the central bank). This money will then be transferred to bank B's account at the central bank. Bank B will then credit Ms. Svensson's account at bank B with $100. Thus, in this case parity and convertibility between bank A's and bank B's money are maintained even though only the commercial banks, and not the general public (Mr. Olsson and Ms. Svensson), have access to central bank money.

Nothing in the example prevents bank B from crediting Ms. Svensson's account with only $80. Also, in this case parity would be maintained. The difference from above is that now bank B has charged Ms. Svensson a fee of $20. The $20 will appear on bank B's balance sheet as increased capital. This would be no different from a case where bank B charged a fee of 20 percent to customers depositing cash at bank accounts at the bank. It makes no difference for this argument if bank A charges the fee.

Figure 2. Settlement of a payment at the central bank



The mechanism outlined above describes how payments work in normal times when people are fully informed and have complete trust in the overall system. However, which parts of the mechanism are essential to restore uniformity in the case of a disequilibrium?

Suppose again that Mr. Olsson owes Ms. Svensson $100 but that Ms. Svensson believes bank A is close to failure. If Ms. Svensson is fully informed about deposit insurance, resolution programs and other aspects of the financial system and trusts that the government has the will and resources to ensure the safe and continuous functioning of the payment system, then she will accept Mr. Olsson's payment as described above without any problem. However, if Ms. Svensson is not fully informed about the financial safety net or does not fully trust the capacity of the government to solve the problem, then she might make demands that threaten uniformity.

In this scenario, Mr. Olsson has three options to pay off his debt to Ms. Svensson:

1. go to the bank, withdraw cash (or CBDC) and deliver it to Ms. Svensson;
2. write a cheque[6]; or
3. send money via, for instance, Swish in Sweden or Electronic Funds Transfer (EFT) in Canada. [7]

Since Ms. Svensson does not trust bank A, she might prefer option (1), because this puts the risk on Mr. Olsson of obtaining the cash from bank A to settle the debt. She is unlikely to accept option (2) because she knows it could take days for the cheque to clear and for her to be certain she had her money. If she trusts that the payment in option (3) is close enough to

[6] Cheques are still in use, although they have declined significantly in Canada and many other countries.

[7] Swish is a real-time instantaneous payment system, while EFT in Canada can be very fast but it is not guaranteed to be instantaneous.

instantaneous and that it carries little risk, then she may accept that method. Ms. Svensson will likely accept $100 cash to settle the debt. But if Mr. Olsson chooses to write a cheque, Ms. Svensson may demand he add a premium to compensate her for the risk during the clearing period. Even if Mr. Olsson pays using option (3), some perceived greater risk might lead Ms. Svensson to demand a premium to compensate her for the risk. But the closer this electronic payment method is to the instantaneous settlement finality of cash, the lower the perceived risk will be of accepting a payment from Bank A.

The uniformity of money will only be broken if enough people begin to demand a premium from customers of riskier banks when using non-cash payment methods as described above. While cash, or a CBDC, does have a role to play in helping to ensure the uniformity of money, this role will diminish with the following:

- growth in the perceived and actual strength of the financial safety net,
- increased understanding of the safety net and financial system,
- greater confidence in the government's ability and willingness to quickly address systemic problems, and
- availability of payment alternatives that are instantaneous and fully understood to be so.

All of these components are important to the uniformity of money. Weakness in any of them could leave some role for cash or CBDC to help ensure the uniformity of different types of money. The importance of this role will depend on the national context. Even if cash or a CBDC is not needed for uniformity under normal circumstances, it could still be significant in extreme crises.

The importance of cash or a CBDC for control

Even if commercial bank money is safe, people might not believe it is. One reason could be that they see a risk that the measures instituted to support commercial bank money will be weakened in the future, in particular in times of stress. Other reasons could be that people are not aware of these measures or that they find it hard to assess how safe they can make commercial bank money. A case in point is that in Sweden only 52 percent of the population is aware of the existing deposit insurance guarantee (Riksgälden 2017). However, the declining use of cash seems to be at odds with distrust in commercial bank money. If people do not trust commercial banks, why do they not hold cash?

In this subsection, we provide a possible explanation for why cash or a CBDC may be fundamental even though people do not hold cash or hold it to a limited extent. The explanation builds on research on decision making in the presence of risk in the domain of psychology.

The need for control

Research in the field of psychology has demonstrated that control or perceived control is very important for a person's willingness to engage in a risky activity. If people think they have more control over the outcome of an activity, then they are more likely to participate in that activity. Conversely, they are less likely to participate in activities over which they have no control.

Evidence also shows that control can be broken down into control over the outcome of an event and choice about whether to participate in an event or activity. People are more willing to take risk if they believe they have some control over the outcome. Interestingly, however, when people have control over participation, they will tend to avoid risk. This seems to be because of anticipated regret. To avoid a bad outcome from an activity they chose to participate in, people will sometimes decide to not participate at all. However, once the decision to participate has been made, people feel more comfortable taking risk when they believe they can have some effect on the outcome.

Bracha and Weber's (2012) discussion of financial panics provides an example. They describe how investors gain a feeling of control through their belief that if they understand how financial markets work, they can predict market behaviour. They argue that "events that destroy this sense of predictability and perceived control trigger panics, the feeling that crucial control has been lost and that the future is unpredictable, and hence, dangerous. Resulting behavior, including a retreat to safe and familiar options, aims to minimize exposure to such danger until a new model of how things work has been established" (Bracha and Weber 2012, 4).

How cash or a CBDC could support a sense of control

Access to cash or a CBDC can give people who distrust banks a sense of control. When individuals always have the option of converting their commercial bank money into cash or a CBDC, they are more in control of the outcome in the event of a banking crisis. Thus, even when people choose not to hold cash or CBDC, its mere availability may be necessary for some people to be willing to hold commercial bank money. Cash or a CBDC is especially useful for this because it is a method of exiting the entire banking system, not just a single bank. Agents may see this as particularly important.

As noted above, the literature also suggests that people will tend to avoid risk if they have control over participation. In our setting, this would mean that people who start out with cash might not want to put it in bank accounts. However, in advanced economies where income and transfers are payed in the form of commercial bank money, people start out with commercial bank money, not cash. Furthermore, in practice, interest payments, down payments, rents and most payments for big-ticket items have to be paid using commercial bank money—and people therefore simply have to hold it.

In practice, we see that in most circumstances people are willing to use commercial bank money to complete their transactions. This willingness may be due to the fact that instituted measures support bank money, as described above, and that this money can be converted into cash. However, the need for convertibility into cash or a CBDC may be particularly important in times of stress.

Access to cash or a CBDC in times of crisis

In a crisis, when mistrust in the banking system is at its highest, people become worried about the safety of their savings in banks. The easier it is for them to withdraw their money, the more in control they will feel about their financial well-being, which means they will be less likely to reduce their economic activity in terms of investment and consumption.

Roadblocks (e.g., withdrawal suspensions, banking holidays and quantity limits) designed to protect banks and stop a bank run will all take control away from the individual. This will exacerbate their loss of confidence and the resulting economic downturn. Being able to withdraw their money from the bank may not completely keep people from losing confidence, but it does give individuals a certain amount of control and will reduce the damaging psychological effects of the crisis. Obviously, the central bank will still need to provide liquidity measures or act as lender of last resort to solvent but illiquid banks in crisis.

When individuals always have the option of using cash or a CBDC to get their money out of a financial institution, they are more in control of the outcome during a crisis. Cash or a CBDC is especially useful for this because it is not only a mechanism to exit a bank in trouble but also a method of exiting the entire banking system, which is particularly important during a system-wide financial crisis. The existence of cash or a CBDC thus serves as another line of defence to help maintain confidence in the banking system.

In discussions about CBDCs, it is often argued that a CBDC leads to a higher risk of runs on banks in times of stress, as it presumably would be easier to convert bank money into CBDC than into cash. However, the arguments above suggest that there may be offsetting effects—since depositors know that bank money can be moved quickly and easily into CBDC—that might make them less prone to run from banks in trouble.

Today, in most advanced economies, the share of cash is very small compared with bank deposits. The amount of cash available would definitely not be enough to cover demand should all depositors want to withdraw their money in the form of cash. There is therefore a risk that convertibility would have to be suspended in case of a bank run. As emphasized by the Diamond-Dybvig (1983) model, congestion effects may reinforce this problem and intensify a run into cash. If the ability to convert commercial bank money into central bank money is important for control, as argued above, a CBDC would be a preferable option to cash since the central bank can instantly create large amounts of CBDC.

5. Summary and conclusions

In this paper, we discussed whether the ability of individuals to convert commercial bank money into central bank money is fundamentally important for the monetary system. This is a significant question because cash, the only form of central bank money that the public currently has access to, is becoming marginalized in some countries. The question is highly relevant to the discussion about whether central banks need to issue a retail CBDC.

Theory suggests that commercial bank money is sufficient if it is safe. We have argued that instituted measures like deposit insurance, lender of last resort, regulations and supervision, together with sound government finances and macroeconomic policies, make commercial bank money safe up to the limit of the deposit insurance guarantee—and often beyond. Thus, to begin with, neither cash nor a CBDC seems fundamental to the monetary systems in countries with these measures in place.

We discussed two other potential reasons why cash or a CBDC might be fundamental.

The first is the role of convertibility of bank deposits into cash or a CBDC for the uniformity of money. We argue that the uniformity of money can be maintained without cash or a CBDC if:

- institutions are strong,
- the government has the ability and willingness to quickly address systemic problems, and
- payment alternatives are instantaneous and fully understood to be so.

Weakness in any of these components may leave some role for cash or a CBDC to help ensure the uniformity of different types of money.

The second reason is the role of convertibility of commercial bank money into central bank money in giving a sense of control to economic agents that mistrust banks. Research has shown that individuals who feel they are in control are more willing to take risks. Thus, in this sense, one of the roles of cash, and potentially of CBDC, may be to promote a sense of control for individuals. Furthermore, by extension this will support individuals' trust and confidence in their financial well-being and the financial sector.

Our overall conclusion is that the question of whether general public access to central bank money in the form of cash or a CBDC is fundamental to the monetary system is a judgment call and depends on the national context. In the two countries that are now experiencing the most rapid decrease in cash, Sweden and Norway, the governments have a proven record of protecting commercial bank money in times of crisis. People therefore have good reasons to believe their commercial bank money is safe should a new crisis come along. However, the perceived control provided by the ability to convert commercial bank money into cash or a CBDC may still be needed to make people willing to hold the former. We find that more research into this mechanism is needed before we can draw any definite conclusions.

References

Andolfatto, D. 2009. "What Is Money? How Is It Created and Destroyed?" Mimeo.

Bracha, A. and E. U. Weber. 2012. "A Psychological Perspective of Financial Panic." Federal Reserve Bank of Boston Public Policy Discussion Paper 12-7.

Brainard, L. 2019. "Digital Currencies, Stablecoins, and the Evolving Payments Landscape." Speech at the conference The Future of Money in the Digital Age, sponsored by the Peterson Institute for International Economics and Princeton University's Bendheim Center for Finance, Washington, D.C., October 16.

Brunnermier, M. K., H. James and J-P. Landau. 2019. "The Digitalization of Money." NBER Working Paper No. 26300.

Bullard, J. and B. D. Smith. 2003. "The Value of Inside and Outside Money." *Journal of Monetary Economics* 50 (2): 389–417.

Cavalcanti, R. and N. Wallace. 1999. "Inside and Outside Money as Alternative Media of Exchange." *Journal of Money, Credit and Banking* 31 (2): 443–457.

Cœuré, B. 2019. Benoît Coeuré: Interview with Bloomberg. Central Bankers' Speeches, Bank for International Settlements, October 17.

Diamond, D. and P. Dybvig. 1983. "Bank Runs, Deposit Insurance, and Liquidity." *Journal of Political Economy* 91 (3): 401–419.

Gu, C., F. Mattesini and R. Wright. 2013. "Banking: A New Monetarist Approach." *Review of Economic Studies* 80 (2): 636–662.

Hayek, F. A. 1990. *Denationalisation of Money: An Analysis of the Theory and Practice of Concurrent Currencies*. Third edition. London: The Institute of Economic Affairs.

Kiyotaki, N. and R. Wright. 1989. "On Money as a Medium of Exchange." *Journal of Political Economy* 97 (4): 927–954.

Kocherlakota, N. and N. Wallace. 1998. "Incomplete Record-Keeping and Optimal Payment Arrangements." *Journal of Economic Theory* 81 (2): 272–289.

Lagos, R., G. Rocheteau and R. Wright. 2017. "Liquidity: A New Monetarist Perspective." *Journal of Economic Literature* 55 (2): 371–440.

Lucas, R. E. Jr. and N. L. Stokey. 1987. "Money and Interest in a Cash-in-Advance Economy." *Econometrica* 55 (3): 491–514.

Mills, D. C. Jr. 2007. "A Model in Which Outside and Inside Money Are Essential." *Macroeconomic Dynamics* 11 (3): 347–366.

Riksgälden. 2017. "Uppföljning kännedom och kunskap om insättningsgarantin 2017." Memo at Riksgälden, Swedish National Debt Office.

Samuelson, P. A. 1958. "An Exact Consumption-Loan Model of Interest with or without the Social Contrivance of Money." *Journal of Political Economy* 66 (6): 467–482.

Sanches, D. 2016. "On the Inherent Instability of Private Money." *Review of Economic Dynamics* 20 (April): 198–214.

Walsh, C. E. 2010. *Monetary Theory and Policy*. Cambridge, MA: MIT Press.

Williamson, S. and R. Wright. 2010. "New Monetarist Economics: Methods." Federal Reserve Bank of Minneapolis Research Department Staff Report 442.