



Speech

## Retail Central Bank Digital Currency: Design Considerations and Rationales

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### Introduction

Thank you for the invitation to speak at the UWA Blockchain and Cryptocurrency Conference. It is great that you have been able to run the conference this year, even with the challenges raised by the pandemic. The downside from a virtual conference is the loss of the interesting conversations that occur in the coffee breaks, lunches and dinners. But the upside is that it is now possible to attend more such events when they are available online and travel is not required.

Strictly speaking, I will not be speaking today about blockchains or cryptocurrencies. But the issue I will be covering is very much related to the broad topic of the conference. In particular, technological developments such as the emergence of distributed ledger technology (DLT), blockchain and cryptocurrencies – plus the ongoing digitalisation of the economy and the declining use of cash – are prompting interest in the possibility of central banks issuing a new digital form of cash, known as central bank digital currency or CBDC. Many central banks are exploring the case for CBDC and considering the various policy and technical issues it would raise.

Today I'm going to talk about some of the issues in this area, summarising a recent article on CBDC in the Reserve Bank's September Bulletin. [\[1\]](#) I am going to focus on the payments aspects of a CBDC, rather than the implications and risks for the broader financial system.

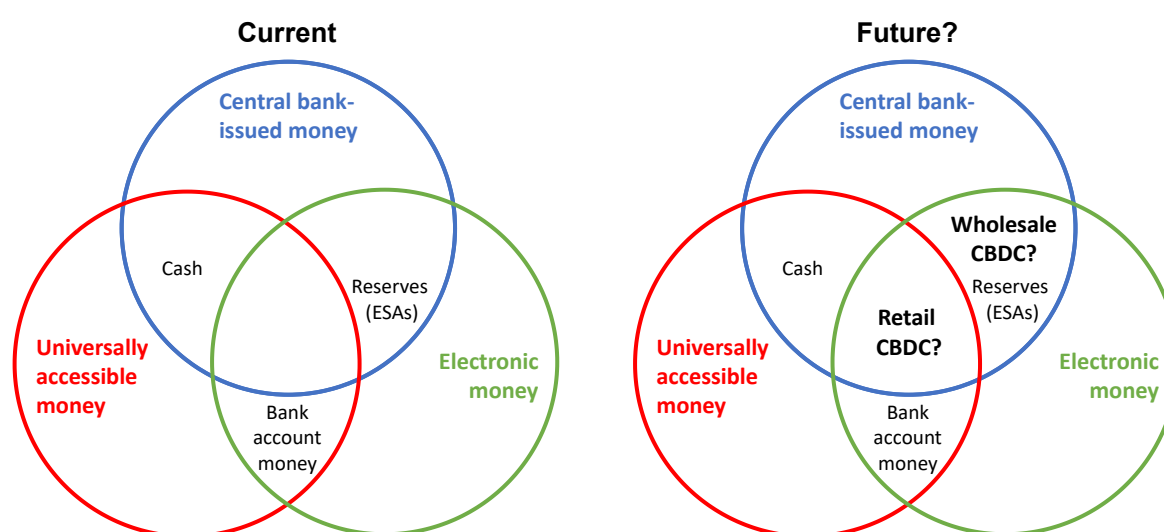
To foreshadow the conclusions, the Reserve Bank's view is that the public policy case for issuing a general purpose or retail CBDC in Australia is still to be made. Even though the use of cash for transactions is declining, cash is still widely available and accepted as a means of payment. In addition, Australian households and businesses are well served by a modern, efficient and resilient payments system that has undergone significant innovation in recent years, including the

introduction of the New Payments Platform, which is a real-time, 24/7 and data-rich electronic payments system. However, consistent with the Bank's mandate to promote competition and efficiency in the payments system and contribute to the stability of the financial system, we will be continuing to consider the case for a CBDC, including how it might be designed, the potential benefits and policy implications, and the conditions in which significant demand for a CBDC might emerge.

## What Is Meant by a Central Bank Digital Currency?

Today in Australia money exists in both physical and electronic (or digital) forms (Figure 1). [\[2\]](#)

Figure 1: Different Forms of Money



Physical money (or 'currency' or 'cash') consists of banknotes and coins. Payment with a banknote occurs when someone passes the banknote to another person, resulting in a transfer of ownership, but without the involvement of a financial institution or any recording of the transaction or ownership on a ledger. Banknotes are issued by, and are a liability of, the Reserve Bank and can therefore be called 'central bank money'.

The first point to make in any discussion about a possible new form of electronic or digital money is that most money in Australia already exists in digital form. [\[3\]](#) The bulk of this digital money is in the form of deposits recorded in electronic ledgers at commercial banks (and other authorised deposit-taking institutions or ADIs). These deposits are a liability of ADIs, not the Reserve Bank. However, deposits at ADIs are subject to depositor preference and are covered up to \$250,000 per account holder by the Australian Government's Financial Claims Scheme (FCS). [\[4\]](#) These deposits can be referred to as 'commercial bank money'.

The Reserve Bank also issues digital money in the form of balances in Exchange Settlement Accounts (ESAs) that banks and a few other types of entities can hold. Banks can use their ESA balances to make payments to other ESA holders, including to settle transactions between their customers.

Currently, however, individuals do not have direct access to central bank digital money. If they want to hold central bank money (i.e. a form of money that is issued directly by the Reserve Bank), individuals need to hold banknotes.

When we talk about CBDC we are referring to a new form of digital money issued by the central bank that would be more widely accessible than ESA balances. And we can distinguish between retail (or general purpose) CBDC, which would be like a digital version of cash that is essentially universally accessible, and a wholesale CBDC, which would be accessible only to a more limited range of participants (but probably including some that do not have access to ESAs presently).

The focus of my talk today is on retail CBDC, a form of CBDC that could be considered a digital alternative to cash that could be a widely accepted medium of exchange and a store of value. Like cash and central bank deposits, the unit of account of the CBDC would be the sovereign currency (i.e. the Australian dollar), and the CBDC would be convertible at par (i.e. one for one) with other forms of money. Besides these core features, a CBDC would also have a number of other attributes that would be policy or design decisions to be made depending on its intended purpose and the underlying technologies used to implement it.

But before I discuss some possible design elements of a CBDC, it might be useful to distinguish a retail CBDC from three other types of digital payment methods or private money.

E-money (also known as stored-value facilities) is a form of electronically stored monetary value that can be used to make payments. [\[5\]](#) This encompasses a wide variety of facilities, including prepaid cards and digital wallets like PayPal; in China, it would include the heavily used Alipay and WeChat Pay mobile wallet services. E-money facilities are similar in some ways to bank deposits, though they are issued by non-banks and are typically covered by a different regulatory framework than banks. While the user interface and technology employed for a CBDC could be similar to that for e-money, a key difference is that e-money is not issued by a central bank and, therefore, presents some credit risk to the user.

Cryptocurrencies or crypto-assets have their own 'currency' unit and are not denominated in the currency of any sovereign issuer. A distinguishing feature of most cryptocurrencies is that they utilise DLT and cryptography to store digital 'coin' ownership records and transactions in a digital ledger that is distributed (and synchronised) across a number of 'nodes' rather than relying on a central party to operate the system. While a CBDC could also – though need not – be designed to use DLT, a key difference is that cryptocurrencies are not issued by a central bank; indeed, they are not issued by any entity and users must effectively rely on the software protocol that controls the system. While the term 'cryptocurrency' may suggest that they are a form of money, the consensus is that existing cryptocurrencies do not provide the key attributes of money. As the Bank and many others have noted, they are rarely used or accepted as a means of payment, they are not commonly used as a unit of account, and their prices can be quite volatile and so they are a poor store of value.

Third, in recent years, a number of so-called 'stablecoins' have emerged as a type of cryptocurrency designed to minimise price volatility against a widely used unit of account (such as the US dollar) or a common store of value (such as gold), to make them more attractive as a means of payment. One

way their promoters seek to maintain a stable value is by holding assets that back the coins on issue. For example, the Libra Association consortium, which includes Facebook, intends to issue stablecoins that would be fully backed by high-quality assets. However, it remains to be seen if it will gain regulatory approval and become operational.

## How Might a Retail CBDC Be Designed?

Because most central banks are only in the early stages of considering issuing retail CBDCs, the attributes and design features of a possible CBDC are very much yet to be determined. However, I think it may be helpful to give you a sense of some of the possible choices here, before addressing the question of what problems a CBDC might solve.

### Roles for the central bank and the private sector

A key question in the design of a CBDC would be the respective roles of the central bank and the private sector in providing households with access to the CBDC. A one-tier CBDC system would be one where the central bank was responsible for all aspects including issuance, account-keeping, transaction verification and so on. [\[6\]](#) Alternatively, in a two-tier or 'platform' system the central bank would issue CBDC through private-sector entities, with those entities then responsible for all customer-facing activities.

There is a strong presumption that any issuance of CBDC in a market economy like Australia would be via a two-tier system. There are a wide range of customer-facing activities where the central bank is unlikely to have a comparative advantage, especially in an environment where technology will be changing rapidly. Instead, it is likely that private-sector payment service providers like banks or fintech firms would be responsible for distribution to households, account-keeping services, customer verification such as know-your-customer (KYC) and anti-money laundering and counter-terrorism financing (AML/CTF) checks, transaction verification, provisioning of any mobile devices and so on.

Depending on the technology used, payment service providers might be responsible for maintaining separate records (sub-ledgers) of their customers' CBDC holdings or they might access a consolidated record of holdings, possibly held at the central bank or alternatively in some form of distributed ledger. These firms would also provide their customers with the ability to transact in and out of CBDC using existing payment systems.

So a key point to make, and one which will be relevant for many of the points to follow, is that there would most likely be a very significant role for the private sector in any retail CBDC. And there would also have to be some incentive for them to participate. One can only speculate here, but the business model for service providers could potentially involve charging account-keeping fees or transaction fees, or providing CBDC payment services for free together with other paid financial services or in return for using customers' data.

### Account-based or token-based?

Broadly speaking, a retail CBDC could be structured as an 'account-based' or a 'token-based' system, or some combination of the two.

An account-based system would require a record of balances and transactions of all holders of the CBDC. Transactions would involve transferring CBDC balances from one account to another following verification that a payer had the authority to use the account and had a sufficient balance in their account. Because the balance in a retail CBDC account would be a claim on the central bank, this model can be thought of as the equivalent of every citizen being offered a deposit account with the central bank, even though the central bank might not be responsible for user-facing and account-servicing functions.

By contrast, a token-based CBDC system would involve a type of digital token issued by and representing a claim on the central bank. Tokens would function as the digital equivalent of a banknote that could be transferred electronically from one holder to another. Like banknotes, such tokens would be bearer instruments, meaning that whoever 'holds' the tokens at a given point in time would be presumed to own them, rather than there being a record of account balances. Transactions in token-based CBDC might only depend on the ability to verify the authenticity of the token (to avoid counterfeits) rather than establishing the account holder's identity. [\[7\]](#) CBDC tokens could be stored on devices, such as mobile phones or some kind of chip-based card, and move from one device to another when there was a transaction. A token-based CBDC could allow payments to occur without the involvement of a central party, which might be an advantage in an offline environment where there is no connection to payment service providers.

Rather than a pure token-based or account-based system, a hybrid system would also be possible. This could involve both device-to-device token transfers between users and also some ongoing or periodic communication between devices and the central system that had issued the tokens. This would allow a record of transactions and balances corresponding to those devices. This would enable the detection of counterfeiting of tokens and potentially also the restoration of value in the event that an individual lost their device. It would also permit some degree of traceability of CBDC by relevant authorities.

## **Decisions regarding in-person, online and offline usability**

If a retail CBDC was being designed as a replacement for physical cash then, at a minimum, it would need to facilitate in-person payments – for example between two individuals or from an individual to a merchant in the retail environment. But, being an electronic system, it would presumably be designed so that it could also be used to make remote (or online) payments. In this way it would function in much the same way as credit and debit cards currently do.

As a form of electronic payment system, CBDC might be constrained by the availability of electricity and telecommunications systems, in contrast to physical cash, which is 'always on' for exchange purposes. However, as I just noted, it may be possible to design a CBDC system so that it could be used in an offline mode, which would be useful in remote locations and offer resilience benefits when power and telecommunications networks were down. For example, it might be possible for CBDC stored on a mobile device or some other small, battery-powered user-access device to be securely transferred to another device via wireless technologies even in the absence of power and telecommunications.

## Would a CBDC use blockchain or distributed ledger technology?

While Bitcoin and other cryptocurrencies are based on DLT, this would not necessarily be the case for a CBDC. [\[8\]](#)

The use of DLT could potentially provide benefits in terms of enhanced resilience and availability, although the overall benefits of decentralisation might not be all that large. In particular, in a retail context the unavailability of existing payment systems is most often related to problems at an individual service provider or to localised network or power interruptions, not an interruption to the centralised infrastructure, which is generally built to be highly resilient.

In addition, use of DLT could have a negative effect on aspects such as performance, privacy and security. In a DLT-based system, each update of the ledger must be shared between nodes operating on the network, with the nodes coming to agreement on the state of the ledger through a consensus mechanism. The process of sharing information and finding consensus through 'proof of work' is the primary contributor to the well-known performance issues of public blockchains such as Bitcoin. Accordingly, it seems unlikely that there would be any serious consideration of public blockchain platforms for a CBDC. Instead, any DLT system considered for a CBDC would likely be permissioned, with access limited to payment service providers or other regulated entities, and with a consensus mechanism that could achieve immediate, final and irrevocable settlement, probably with some degree of centralisation.

## What degree of anonymity and privacy would apply and who could hold CBDC?

Clearly, the degree of privacy or anonymity would be a key design decision for any CBDC and it is likely that there would be significant debate on this issue. However, most central banks and other observers have noted that the potential for anonymous digital currency to facilitate shadow economy and illegal transactions makes it highly unlikely that any CBDC would be designed to fully match the levels of anonymity and privacy currently available with physical cash.

A related issue is the question of who would be allowed to hold the CBDC and how much they could hold. Unlike physical cash, where it is not feasible to control who can hold it and how much they could hold, it would be possible to control these with a CBDC. For example, in an account-based model, users would likely be required to verify their identity with their service provider before opening an account, just as currently occurs with deposit accounts at financial institutions. In addition, while a retail CBDC would presumably be designed with universal access in mind, there may be arguments for imposing limits on holdings if a CBDC raised concerns about possible effects on financial stability or the structure of the financial system.

## Would a CBDC bear interest?

While cash earns a zero rate of interest, a CBDC could earn a rate of interest, and the rate might be adjusted over time. Decisions as to whether the CBDC would bear interest would depend on the purpose of the CBDC and the technologies and entities involved. Most discussions around retail CBDC envisage it being introduced primarily as a method of payment similar to cash, with the presumption



that it would not bear interest. For example, the Bank of Canada (2020) has been explicit in indicating its expectation that a CBDC would not bear interest. [\[9\]](#)

## Why Introduce a Retail CBDC? What Payments Problems Might a CBDC Solve?

With that background on the possible attributes of a CBDC, I will now turn to some of the potential rationales for issuance. It may be useful to divide the rationales into three groups.

- The rationales that appear to be relevant to some central banks that are most advanced in pilots or prototypes of CBDCs
- Some possible rationales for issuance that are related to the ongoing declining use of cash
- Rationales that are related to the emergence of alternative payment methods including stablecoins.

### Rationales in some foreign jurisdictions

A few small countries appear to have taken decisions to explore or adopt retail CBDCs to improve financial inclusion. These are countries – the Bahamas is an example – where there is still heavy use of cash and a significant proportion of the population do not have bank accounts and access to digital payments. In these cases, the introduction of a CBDC can be thought of as helping to fill gaps that the private sector has been unable to meet.

Of course, such examples are not relevant to Australia, where almost all households have transaction accounts, including debit cards that allow both point-of-sale and online purchases. Following the launch of the New Payments Platform in 2018, these accounts typically also provide the ability to make online, real-time, account-to-account transfers where the funds are available to the recipient within a couple of seconds.

China is a different case. Its DC/EP (digital currency/electronic payment) project is reportedly well advanced and involves a two-tier model where the CBDC would be issued by the People's Bank of China and then distributed by commercial banks or other payment service providers. One important rationale for the CBDC there may be to promote a larger role for central bank money as an alternative to the very successful e-money services of the large private-sector wallet providers.

### Rationales related to the decline of cash

In the event that there was a significant reduction in the availability of cash deposit and withdrawal services, households that are heavy users of cash may not be willing or able to transition away from cash and might face challenges in making payments. Proponents of CBDCs have suggested that a retail CBDC that was accessed by a simple device with a well-designed user experience could potentially meet the payment needs of these people who still rely on cash. However, this proposition is yet to be established and if it does prove possible to provide easy access to payments using a CBDC, it would presumably equally be possible for a similar user experience to be applied to

payment services using commercial bank money or e-money; as I noted earlier, the user experience for a CBDC might well be largely designed and provided by private-sector entities.

Another possible rationale for a CBDC is to improve the resilience of the payments system, given that cash currently functions as a back-up payment method for in-person payments when electronic payment systems are down. However, for a CBDC to provide a significant improvement in resilience for the payments system as a whole, payment services based on a CBDC would have to be provided to end users via different platforms and technologies to those currently used by banks and other providers. To be fully resilient a CBDC would also need to operate (at least temporarily) in the absence of functioning electricity and telecommunications networks; as discussed above, this could be feasible for some CBDC models.

Another suggested rationale for CBDC is that as cash usage declines, there could be decreasing competition in the payment services market, leading to growing market power for large banks, international payments schemes, and possibly also technology companies. Decreased competition could result in higher prices for payments services, and possibly also in reduced innovation and poorer services. It is argued that introduction of a CBDC could provide a source of competition in the payments market that might mitigate the dominance of large private providers.

As in many other industries, regulation may be an alternative to public sector provision of goods or services to deal with competition (or resilience or accessibility) concerns in payments. The Reserve Bank has a mandate and regulatory powers to promote competition and efficiency and to control risk in the payments system. The Bank has used its formal regulatory powers in the past to address competition and efficiency concerns in the card payments market. Accordingly, to the extent that the decline of cash heightens concerns about competition or risk in the payments system, the use of regulation may be an alternative to the introduction of a CBDC. [\[10\]](#)

A final rationale related to the declining role of cash is that for a century or more, central banks in most countries have provided a safe, default-free and free-to-use form of money for use by households. If cash was no longer widely available, some proponents of CBDC argue that central banks should provide a new form of central bank money so that households have an alternative to commercial bank or private money that is subject to default risk. They have also noted that the provision of central bank money (both currency and settlement balances) supports confidence in the use of commercial bank money and in the financial system more broadly. These have been some of the main rationales for the work that Sweden's Riksbank is doing to explore issuing an e-krona. [\[11\]](#)

There are reasonable arguments for and against as to whether this factor builds a strong case for issuance of a CBDC. However, the fact that households are increasingly moving away from using central bank money (cash) in their day-to-day transactions (reflecting a growing preference for electronic payments) may indicate that most households in normal times do not feel strongly about any possible increase in risk from holding commercial bank money. If so, it may in turn reflect a perception that depositor preference and the Australian Government's FCS (or equivalent arrangements in other countries) provide adequate protections for commercial bank money.

## **Potential issues from the growth of other payment methods**



The emergence of cryptocurrencies like Bitcoin and the prospect of issuance of stablecoins have prompted some to call for central banks to introduce CBDCs as a precautionary or defensive measure. There are two major concerns here.

The first is that widespread substitution away from the domestic currency could threaten a country's monetary sovereignty, reducing the ability of the central bank to influence domestic monetary conditions and to act as the lender of last resort if required. In principle, this could result from a shift to a cryptocurrency like Bitcoin or a stablecoin denominated in some other currency. It could also result from more standard 'dollarisation' and the use of another sovereign currency in either traditional or CBDC form. [\[12\]](#) The argument is that, by providing households and businesses with access to a digital form of the domestic currency, it may be possible to reduce the likelihood of a shift to other forms of money.

A second concern where technology companies are involved is that such companies may have very large user bases (perhaps via their social media services) and could encourage rapid adoption of stablecoins despite the privacy concerns associated with their collection, commercialisation and occasional misuse of user data. It is argued that central banks should provide CBDCs so that individuals have the option of using an alternative electronic form of money with greater privacy around any collection and usage of their payments-related data.

However, it may be that concerns about loss of monetary sovereignty are overstated and concerns about data privacy can be addressed in other ways.

Traditionally, concerns about dollarisation and loss of monetary sovereignty have been confined to failed states or economies with histories of inflation or confiscation of financial assets. In countries with well-functioning financial and payment systems and a history of low inflation, like Australia, the risk of widespread adoption of money denominated in some other currency seems very low.

It should also be noted that significant adoption of a stablecoin denominated in the domestic currency would not necessarily raise any concerns regarding monetary sovereignty. Furthermore, if a stablecoin denominated in Australian dollars was marketed in Australia, it is likely that it would be subject to significant regulation in terms of safety and soundness, potentially including a requirement that issuance was fully backed by government securities or other very highly rated AUD-denominated assets. Similarly, any stablecoins marketed in Australia would be subject to any required standards regarding privacy as well as in other areas such as data usage, competition, KYC, and screening for AML and CTF purposes.

## The Way Ahead

The Reserve Bank and our Payments System Board have been closely watching developments in this broad area for a number of years. Bank staff are in regular contact with our counterparts in other central banks and also with private sector entities with an interest in CBDC. Based on the considerations I have summarised today, the Bank's view is that no strong public policy case has yet emerged for the introduction of a CBDC for general use. Australian households and businesses have access to payment services that have been upgraded significantly in recent years and meet most of

their current needs. It is not obvious that a CBDC would be a solution to any particular problems or that there would currently be significant demand for one.

However, the Bank has an open mind and will continue to monitor developments in this area. Globally, there are around 180 sovereign currencies. If some jurisdictions do move towards full implementations of CBDC, there will be many central banks like us who will be closely watching their experience. If it turns out there are significant benefits, we will be able to be fast followers, avoiding any early mis-steps and taking full advantage of the inevitable technology learnings.

In the meantime, separate to our work monitoring the case for a retail CBDC, the Bank is conducting research on the technological and policy implications of a potential wholesale CBDC. This work is taking place in the Bank's in-house Innovation Lab. Earlier work included the development of a limited proof-of-concept of a DLT-based interbank payment system using a tokenised form of CBDC backed by ESA balances. Currently, the Bank is collaborating with a number of external parties on a project to extend this proof-of-concept to incorporate tokenised financial assets to explore the implications of delivery-versus-payment settlement on a distributed-ledger platform as well as other programmability features of tokenised CBDC and financial assets. This is interesting research and we will be providing further information on it in due course.

Thank you again for the opportunity to speak at the conference. I would now be happy to participate in the discussion.

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## Endnotes

[1] See Richards, Thompson and Dark (2020).

[2] This figure draws on Bjerg (2017). See Bech and Garrett (2017) for further discussion of the different types of money, including a four-way taxonomy called the 'money flower', which adds an extra dimension based on whether types of money are transferable peer to peer (as opposed to requiring a central intermediary).

[3] For example, in Australia, currency represents only 7 per cent of M1 and just 3.8 per cent of broad money. M1 is defined as holdings of notes and coins by the private non-bank sector plus transaction deposits at authorised deposit-taking institutions (ADIs) from the private non-ADI sector. Broad money includes M1, all other deposits at ADIs (including negotiable certificates of deposits) from the private non-ADI sector plus other borrowings from the private sector by all financial intermediaries.

[4] See APRA (2020).

[5] In Australia, e-money facilities are known as purchased payment facilities (PPFs) and are regulated by the Reserve Bank under the Payment Systems (Regulation) Act 1998, or by APRA under the Banking Act 1959 where they are over a certain size, are deemed to be 'widely available' and have deposit-like features.

[6] Of course, the central bank would also need to work with private sector partners in designing and implementing the initial issuance of a CBDC, particularly with regard to technology and cybersecurity issues.

[7] A CBDC issued in this form would most likely be subject to other restrictions (e.g. transaction limits or limits on holdings) to ensure it supported compliance with AML/CTF rules and other initiatives aimed at addressing the black economy.

[8] See, for example, Bank of England (2020).

[9] However, some proponents of CBDC have envisaged it more as an asset or store of value that would bear interest and compete with commercial bank deposits. And some academic discussions have noted that a CBDC that could have either a positive or negative interest rate could improve the effectiveness of monetary policy, by increasing the pass-through from the central bank's policy rate to the broader structure of interest rates in the financial system. Some academics (for example, Bordo and Levin (2017)) have suggested this could be particularly useful in alleviating the 'zero lower bound' constraint to monetary policy, though for this to be fully effective it would rely on the removal of physical cash from circulation or some method of devaluation of cash relative to electronic money, otherwise a negative interest rate on CBDC could be avoided by a shift to cash. For the avoidance of doubt, the Reserve Bank is committed to ensuring adequate access to cash services, given that cash is still used heavily by some segments of the population, and has publicly stated that negative interest rates are very unlikely.

[10] It should also be noted here that the user-facing aspects of a CBDC system would presumably still rely heavily on the private sector, so competition and other concerns could still arise even in the presence of a CBDC.

[11] See Ingves (2018), for example.

[12] Concerns along these lines have been expressed in both Sweden and Canada. For example, Armelius et al (2020, p 7) note that 'Sweden is a small, open, and highly digitalized economy with its own national currency that is not commonly used in international trade. Consequently, the Swedish krona may be particularly vulnerable to the advent of currencies such as stablecoins issued by private multinational enterprises'. The Bank of Canada (2020) has indicated that a CBDC could be beneficial or necessary if 'one or more alternative digital currencies – likely issued by private sector entities – were to become widely used as an alternative to the Canadian dollar as a method of payment, store of value and unit of account'. It also referred to the possibility of a scenario where 'a CBDC issued by a foreign central bank had extensive cross-border use in Canada'.

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