Retail Central Bank Digital Currency: Design Considerations, Rationales and Implications

Tony Richards, Chris Thompson and Cameron Dark[*]



Photo: alengo – Getty Images

Abstract

There has recently been increasing international focus on the possible issuance of central bank digital currencies (CBDC), or what might be considered a digital equivalent of banknotes. While the technical feasibility of such a new form of money is not yet established, this paper considers some issues around its possible design, the possible rationales for issuance, and the implications of issuance. Given the likely benefits and risks, at present there does not seem to be a strong public policy case for issuance in Australia. Nonetheless, it will be important to closely watch the experience of other jurisdictions that are considering implementing CBDC projects.

Introduction

Australian banknotes, which are a liability of the Reserve Bank, are a safe, accessible and widely accepted method of payment. But the use of cash for transactions has been declining over the past few decades in Australia as more people have switched to electronic payments such as cards. This trend has accelerated recently following the onset of the COVID-19 pandemic, as some consumers and businesses have sought to avoid using cash because of virus concerns. However, even though cash is being used less frequently for transactions, the amount of cash on issue has continued to grow, reflecting demand to hold cash for precautionary purposes and as a store of value. Trends in the use and holdings of cash in Australia have been documented in the Bank's three-yearly consumer payments surveys, the most recent of which was conducted in late 2019 (Caddy *et al* 2020).

With the ongoing decline in the use of cash for transactions, a number of technological developments – such as the emergence of distributed

ledger technology (DLT), blockchain and cryptocurrencies – as well as the broader digitalisation of the economy, have prompted interest in the possibility of central banks issuing a new digital form of cash, known as central bank digital currency (CBDC).[1] Many central banks are exploring the case for CBDC and the various policy and technical issues it would raise.

Consideration of a CBDC is particularly relevant to many aspects of the Reserve Bank's mandate and activities:

- The introduction of a CBDC would represent a change to a significant element of Australia's monetary system and could have effects on the structure of the financial system and financial stability, so it would be relevant to the Bank's responsibility for maintaining monetary and financial stability.
- A CBDC would also be relevant to the Bank's role as the issuer of banknotes in Australia. The *Reserve Bank Act 1959* stipulates, among other things, that Australian banknotes be printed by, or under the authority of, the Reserve Bank. The Bank's primary objective in carrying out this role is to maintain the capacity of Australian banknotes to provide a safe, secure and reliable means of payment and store of value.
- A CBDC would represent a major change to the payments system with implications for the Bank's payments system regulatory mandate. Under the *Payment Systems (Regulation) Act 1998*, the Bank's Payments System Board is required to determine the Bank's payment system policy in a way that will best contribute to controlling risk in the financial system and promoting competition and efficiency in the market for payment services, consistent with the overall stability of the financial system.
- The introduction of a CBDC could have major implications for the operation of the Reserve Bank Information and Transfer System (RITS), Australia's real-time gross settlement system. It could also be relevant to the Bank's role as provider of banking services to the Australian Government.

The Bank provided a first assessment of the issues around CBDC in late 2017 (Lowe 2017). This paper provides an update, focusing on a possible CBDC for general household use rather than a CBDC for wholesale settlement between banks and other wholesale market participants. It reviews some of the key concepts and issues associated with CBDC, including the various ways in which a CBDC could be designed, the problems it might address, the possible opportunities created and the potential consequences of issuance. It also reviews some of the work that other central banks have been doing on CBDC.

The main conclusion is that the public policy case for issuing a general purpose 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. Households and businesses are also well served by a modern, efficient and resilient payment system that has undergone significant innovation in recent years, including the introduction of the New Payments Platform, a new real-time, 24/7 and data-rich electronic payments system. However, consistent with its mandate to promote competition and efficiency in the payments system and contribute to the stability of the financial system, the Bank will continue to consider the case for a CBDC, including how it might be designed, the various policy implications and the future conditions in which significant demand for a CBDC might emerge.

What Is Meant by a Central Bank Digital Currency?

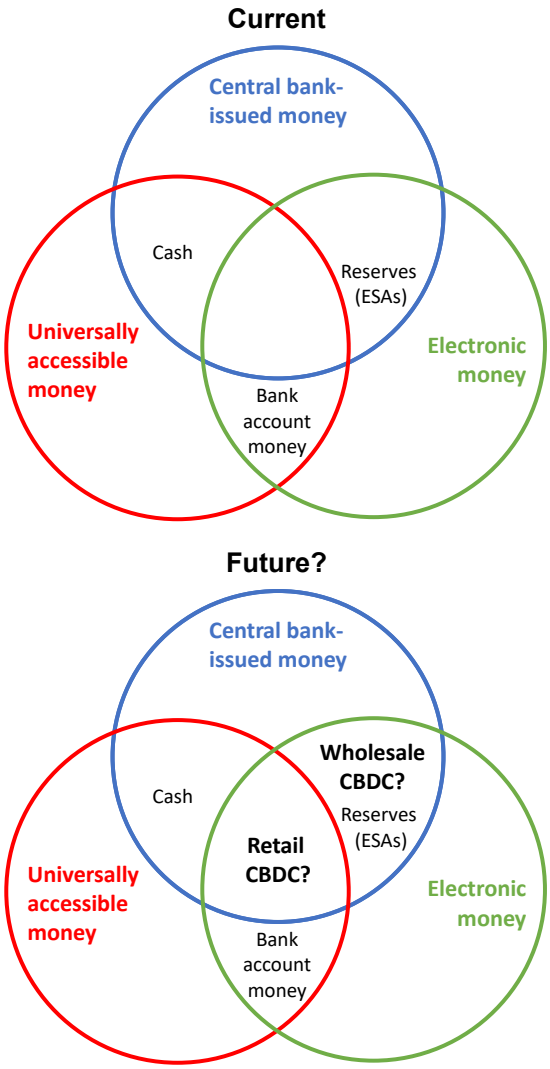
In economics, 'money' is generally considered to be something that has three major functions: it provides a medium of exchange (i.e. a way to make payments), a unit of account and a store of value. Historically, many different things have served as money, ranging from whale teeth, to large stone discs, precious metals, metallic coins and more recently paper and polymer banknotes (Reserve Bank of Australia 2020).

Today in Australia money exists in both physical and electronic (or digital) form (Figure 1).[2] Physical money (or 'currency', which we will generally refer to as 'cash') consists of banknotes and coins, which

can be held by anyone and are a bearer asset, meaning that no ownership information is recorded and the holder of the instrument is presumed to be the owner. 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. In Australia, banknotes are issued by, and are a liability of, the Reserve Bank and can therefore be called 'central bank money'. The total value of banknotes and coins in circulation is currently around $89 billion; as a ratio to annualised GDP, currency on issue in the June quarter was at the highest level seen in the period since the introduction of decimal currency in 1966.

As in most advanced economies, most of the money in Australia exists in digital form as deposit account balances recorded in electronic ledgers or databases. For example, in Australia, currency represents only 7 per cent of M1 and just 3.7 per cent of broad money.[3]

Figure 1: Different Forms of Money



The bulk of this digital money is in the form of deposits at commercial banks.[4] These deposits are a liability of commercial banks, not the Reserve Bank, and therefore carry some additional (though still low) credit risk compared with liabilities of the Reserve Bank. Individuals who hold deposits at banks can exchange them for cash via withdrawals or can make payments using those deposits by instructing their bank, via a number of different payment systems, to transfer their deposit balance to another individual or business. In Australia, deposits at authorised deposit-taking institutions (ADIs) are subject to depositor preference and covered up to $250,000 per account holder by the Australian Government's Financial Claims Scheme (FCS) (APRA 2020).

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, in exchange for providing the Reserve Bank with government securities or other high-quality assets. Banks can use their ESA balances to make payments to other ESA holders, including to settle transactions between their customers. They do so by instructing the Reserve Bank, which keeps the official ledger of account balances, to debit their ESA and credit the ESA of the intended recipient. 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.

While ESA balances are a form of digital money issued by the central bank, when we talk about CBDC in this paper we are referring to a new form that is more widely accessible than ESA balances. We can further distinguish between *retail* 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 this paper 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. It would likely also be specified to serve as legal tender. 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. These various design elements are discussed in the next section.

At this point, it is also useful to distinguish a retail CBDC from some other types of digital payment methods like e-money and cryptocurrencies. 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, the 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 are another type of digital asset. They have their own 'currency' unit and are not denominated in the currency of any sovereign issuer. The 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' (or computers) rather than relying on a central party to operate the system. Bitcoin is the most prominent implementation of a decentralised cryptocurrency protocol, but thousands of variations have emerged. 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 effectively rely on users' complete trust in 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 (e.g. Carstens 2018) have previously 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.

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 attempt 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. Where a stablecoin is denominated in a single currency and backed by high-quality assets in that currency, it may have many of the attributes of e-money. For example, a consortium, which includes Facebook, has launched the Libra Association with the goal of issuing 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. In Australia, to date, there has been essentially no issuance of stablecoins nor any use of them as a payment method.

How Might a Retail CBDC Be Designed?

This section describes a number of the key attributes that would need to be considered in the design of any CBDC system. While choices on these would be driven by the intended purposes of a CBDC, including how it might address various policy objectives such as accessibility, resilience, privacy and security, we discuss them first to give the reader a better sense of what a CBDC might look like.

What 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 facilitating access to and use of a CBDC. A one-tier CBDC system would be one where the central bank was responsible for all aspects of the system including issuance, account-keeping, transaction verification, and so on. Alternatively, in a two-tier or 'platform' system the central bank would develop the technology to issue CBDC to private sector entities with those entities then responsible for all customer-facing activities.[6]

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 was changing rapidly. This includes 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. Instead, it is likely that these would be done by private sector entities like banks or newer fintech firms; we will refer to all these entities as payment service providers (PSPs).[7]

Depending on the technology used (see below), PSPs 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. PSPs would likely also provide their customers with the ability to transact in and out of CBDC using existing payment systems. Subject to decisions about whether the CBDC was interest-bearing (see below) it is possible that there would be no interest rate spread available to PSPs. Hence, 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 the customer's 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 the keeping of a record of balances and transactions of all holders of the CBDC. Transactions would involve transferring CBDC balances from one account to another and would depend on the ability to verify that a payer had the authority to use the account and that they 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, and would effectively function as the digital equivalent of a banknote that could be transferred electronically from one holder to another. Such tokens would – like banknotes – 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.[8] 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 is a transaction. A possible implication of a token-based CBDC is that it would allow payments to occur without the involvement of a central party, which might be an advantage in an offline environment.

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 entity that had issued the tokens, allowing the creation of 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 possible to design it so that the CBDC could also be used to make remote (or online) payments. In this way it would function in much the same way as 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 noted above, it may be possible to design a CBDC system in such a way that it could be used (at least temporarily) 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. However, there would still be a periodic need for power and network connectivity to reload or redeem CBDC balances against commercial bank deposits (and to recharge any batteries). As noted above, an offline mode might be easier to implement with a token-based system than an account-based system.

Would a CBDC bear interest?

While cash earns a zero rate of interest, a CBDC could earn a rate of interest that might be adjusted over time. Decisions as to whether the CBDC would bear interest could depend on the purpose of the CBDC and the technologies and entities involved. For example, 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. 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.[9]

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

Existing payment methods have a range of privacy levels. Cash offers a high degree of privacy – it is a bearer-instrument that does not require the services of an intermediary when passed from one person to the next and there is no record of who has held a banknote. Accounts at regulated financial institutions also typically provide a high degree of privacy; while there is a record of an individual's transactions and holdings, that information is not generally available to others. At the other extreme, some payment methods may provide only quite limited privacy. For example, a user may have authorised an e-money wallet provider to use their transaction data for marketing purposes and there are some payment services (for example Venmo in the United States) where users are able to post details of their payments to be visible to their contacts on social media.

In principle, a significant degree of anonymity might be feasible for a token-based CBDC, potentially even equivalent to that of cash. Alternatively, an account-based CBDC would not allow complete privacy or anonymity; transaction data would be visible to the institutions providing account-keeping and transaction services, to the relevant authorities and potentially others. An intermediate degree of privacy might also be

possible. For example, the European Central Bank (2019) has experimented with the concept of a CBDC with elements of programmable money, by which individuals could be allotted a certain amount of 'anonymity vouchers' that could be used for small transactions, with larger transactions still visible to financial intermediaries and the authorities, including those responsible for AML and CTF.

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. Most central banks and other observers have, however, 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. While a retail CBDC would presumably be designed with universal access in mind, there may be a case to restrict access to domestic residents, and possibly to impose limits on holdings if a CBDC raised concerns about the possible effects on financial stability or the structure of the financial system (see below). On the other hand, temporary access for tourists and foreign visitors could be important if one of the rationales for introduction was to promote competition in the domestic payments system. In addition, allowing foreigners to hold CBDC could facilitate a safe and efficient mechanism for domestic residents to make payments abroad, thereby supporting remittances and international commerce.

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.[10]

As discussed by the Bank of England (2020), the use of DLT for a CBDC could provide benefits in terms of enhanced resilience and availability. However, the overall benefits of decentralisation might not be all that large. In particular, in a retail context, the unavailability of a payment system 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.

Use of DLT could have a negative effect on aspects such as performance, privacy and security (BOE 2020). 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 is the primary contributor to the performance issues of public blockchains such as Bitcoin. The 'proof-of-work' consensus and resulting competition between 'miners' in systems like Bitcoin is inefficient and characterised by low throughput (Dark *et al* 2019). 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 PSPs or other regulated entities, and with a consensus mechanism that could achieve immediate, final and irrevocable settlement, probably with some degree of centralisation.

Would cash be withdrawn?

This can be thought of as a 'design' decision, though it is one relating more to the broader payments system and monetary system than to the design of a CBDC itself.

Any decision to introduce a CBDC would raise the question of whether physical notes and coins would continue to be issued or would be

withdrawn from circulation over a period of time. On the one hand, there may be resilience and accessibility benefits from retaining physical cash for as long as people want to continue using it. However, it would be costly for the economy to maintain systems to support two different types of central bank currency. So, if the CBDC had met most of the use cases of cash – including any objectives regarding privacy for legitimate transactions – and the use of cash had fallen significantly, there might be an argument for removing cash (including to ensure that it was not facilitating illegal transactions).

Why Introduce a Retail CBDC?

A number of reasons have been advanced for why central banks should consider CBDC issuance. The weight that is placed on these different reasons differs across jurisdictions and depends on factors such as the state of development and structure of the retail payments system and the degree of financial inclusion. This section reviews the main motivations that have been advanced for CBDC and discusses how relevant they might be in an Australian context.

Responding to the decline of cash

Many of the suggested rationales for CBDC have to do with the declining role of cash and the prospect of a significant reduction in the availability of cash deposit and withdrawal services, and the growing reliance of the economy on electronic payment services provided by the private sector.

Some arguments for CBDC include the following:

- 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]
- 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 CBDC 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.
- Because cash currently functions as a back-up payment method for in-person payments when electronic payment systems are down, if cash were to disappear then the payments system may become less resilient. A CBDC could function as an alternative back-up payment method.
- 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. This reflects the tendency for a small number of players to dominate industries such as payments, where there are strong network effects and economies of scale and scope. Decreased competition could result in higher prices for payments services, and eventually in reduced innovation and poorer services. Introduction of a CBDC could provide a source of competition in the payments market that might mitigate the dominance of large private providers.

While these arguments point to some problems that could emerge from a further decline in the role of cash, issuance of a CBDC may not be a complete solution to the identified problems or there may be alternative responses other than a CBDC.

- 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 deposit insurance (or equivalent arrangements) provides adequate protection. For example, in Australia, deposits with ADIs are subject to depositor preference and covered by the Australian Government's FCS. Nevertheless, even with deposit insurance, there is evidence that some people still convert their bank deposits to cash during periods of increased uncertainty. This occurred during the 2008–09 global financial crisis and has been apparent recently during the COVID-19 pandemic. However, it is unclear if such episodes represent a changing view about the risk of banks or just a desire to keep some non-electronic payment method on hand in case there is greater risk of service interruptions at such times.

- The proposition that a simple device with a well-designed user experience and accessibility features could make it easier for some cash users to transition to electronic payments, while still meeting all needs in terms of security, is yet to be proven.[12] Of course, if it is possible to provide easy access to payments using a CBDC, it would equally be possible for a similar user experience to be applied to payment services using e-money or commercial bank money; as noted above, the user experience for a CBDC might well be largely designed and provided by private sector entities.
- Payment services using a CBDC could potentially be provided with a high degree of resilience if such resilience was built into the systems of the central bank and PSPs. 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 PSPs. 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 at least some CBDC use cases.
- As in many other industries, regulation may be an alternative to public sector provision of goods or services. The Reserve Bank has a mandate and regulatory powers to promote competition and efficiency and to control risk in the payments system. It has used its formal regulatory powers in the past to address competition and efficiency concerns in the card payments market. Concerning resilience, the Bank and the Australian Prudential Regulation Authority are currently working with the payments industry on an initiative to require improved disclosure of outages, with the aim of raising the focus on resilience within individual financial institutions. Accordingly, to the extent that the decline of cash heightens concerns about competition or risk in the payments system, the use of regulatory powers may be an alternative to the introduction of a CBDC. It should also be noted that the user-facing aspects of a CBDC system would presumably still rely heavily on the private sector, so competition and resilience concerns could still arise even in the presence of a CBDC.
- Finally, it should be noted that an alternative response to the risk of declining access to cash services is for the central bank to work with entities in the cash distribution chain to remove frictions and improve efficiency, with the goal of prolonging the feasibility of a viable cash system.[13] Indeed, the Reserve Bank has recently been discussing ways to help sustain access to cash services with the major banks, cash-in-transit companies and ATM providers.

Responding to the emergence of stablecoins and cryptocurrencies

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:

- Widespread substitution away from the domestic currency could threaten a country's monetary sovereignty and reduce the ability of

the central bank to influence domestic monetary conditions (including via changes to the structure of interest rates and the exchange rate) 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 either 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.[14] 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.

- An additional 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. However, this would not, for example, preclude adoption of a global stablecoin for specific use cases, such as cross-border payments, particularly if it was lower cost and offered a better user experience than existing services.
- It should also be noted that significant adoption of a stablecoin denominated in the domestic currency should not raise any concerns regarding monetary sovereignty. For example, 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, stablecoins marketed in Australia would be subject to any required standards – existing or still to be established – regarding privacy as well as in other areas such as data usage, competition, KYC, and screening for AML and CTF purposes.

Providing stimulus for payments innovation

Given that much discussion of CBDC has focused on its use in a DLT environment, some proponents have argued for the introduction of CBDC to facilitate some of the payment innovations that are associated with DLT and blockchain. The focus here has been on enabling programmable or 'smart' money using the smart contract functionality of DLT. This could include making payments conditional on various events or characteristics, facilitating 'atomic' (i.e. all or nothing) transactions such as delivery-versus-payment, automatically triggering the immediate payment of taxes associated with particular transactions, and so on.

As discussed by the Bank of England (2020), to the extent that such capabilities were enabled with CBDC, they would presumably be provided as some form of overlay services by different PSPs rather than being part of the core functionality of the CBDC. The Bank of England also notes that smart contract functionality can be decoupled from DLT, and implemented on other types of ledgers, including centralised databases. This points to the possibility that many of the innovations that have been highlighted by DLT over the past decade might also prove to be feasible using existing payment instruments. For example, it might be possible to use the real-time nature of the New Payments Platform (NPP) and various types of

escrow arrangements to facilitate atomic transactions involving tokenised assets.[15]

What Effects Could a CBDC Have on the Financial System and Financial Stability?

If a CBDC were to be introduced and adopted widely, it could represent a significant change to the structure of the financial system. While some of the demand for CBDC might come from switching out of cash, there might also be switching out of bank deposits. In the extreme, many households and businesses might decide they no longer wished to use deposit accounts at commercial banks (though, as discussed earlier, banks might well still provide some payment and account-servicing functions for the CBDC). These end users would instead keep their liquid funds in CBDC and use those to make payments.

Currently, commercial banks source about 60 per cent of their funding from deposits, with about two-thirds of that being at-call deposits. If banks were to experience an outflow of deposits, they would have to fund more of their lending in capital markets or from equity. The loss of deposit funding and greater reliance on other funding sources could result in some increase in banks' cost of funds and result in a reduction in the size of their balance sheets and in the amount of financial intermediation. Of course, this would depend on any changes to the structure of the central bank's assets resulting from the increase in its balance sheet, for example, whether it invested in government securities as opposed to lending funds back to banks or buying their securities.

Furthermore, the existence of a CBDC could raise challenges during times of stress in financial markets. Currently, if households or businesses become wary about their deposits in a particular bank, they are able to withdraw their funds by a transfer to an account at another bank (or by withdrawing cash at branches or ATMs). However, currently it is not really feasible for depositors to seek to withdraw deposits en masse from the banking system as there are practical limits to what can be withdrawn via ATMs and branches. However, in the presence of a CBDC, a run on the banking system as a whole would become feasible; if depositors had concerns about the entire financial system, they could seek to make large-scale transfers of commercial bank deposits into CBDC.[16]

Of course, this bank-run scenario is highly unlikely. In Australia, the FCS is likely to provide a significant level of assurance to households (though not necessarily to businesses). Furthermore, the Reserve Bank is able to provide liquidity, with appropriate collateral, to solvent but illiquid ADIs. Nevertheless, it does point to a possible risk from the introduction of a CBDC. One control that has been proposed would be to place limits on the amount of CBDC that could be held by any individual.[17]

What Effects Could a CBDC Have on Monetary Policy?

The implementation of a CBDC could have implications for the central bank's balance sheet. To the extent that there was significant demand for CBDC at the expense of commercial bank deposits (as opposed to cash), household claims on the central bank would rise and the central bank's overall balance sheet would expand. A larger balance sheet need not have any significant implications for the operation of monetary policy, though changes to the composition of the central bank's assets may have implications for the risk profile of its balance sheet and the functioning of financial markets.

Furthermore, a simple change in the nature of currency on issue – from issuance of CBDC and an equivalent decline in the amount of cash in circulation – need not pose any challenges for the implementation of monetary policy. The reason is that monetary policy is not implemented through banknotes and coins, but rather through the quantity of ESA balances and the level of interest rates in the money market. Hence, there would be no need for any changes to the way monetary policy is implemented, and the Australian dollar would remain a store of value, medium of exchange and unit of account, even in the absence of physical cash.[18]

How Much Demand Could There Be for a CBDC?

A project to launch a CBDC would be a major, multi-year project for the central bank, the payments industry, their technology partners, and a wide range of stakeholders in the public and private sectors. It would be costly in financial terms and quite risky from both a financial and technology perspective. The question of how much demand there would be for a CBDC, and whether it would be large enough to justify the work that would be required to launch a CBDC, would be very important.

As noted earlier, in Australia, currency in the form of banknotes and coins represents only 3.7 per cent of broad money. Instead, households and businesses hold the vast majority of their money in the form of commercial bank deposits, which come with a range of flexible electronic payment methods attached and often earn interest. Consistent with developments in a number of other countries, the services associated with bank deposits are being enhanced by the real-time, round-the-clock functionality that is being enabled by the NPP. For many end users, the existing ability to make and receive payments from an interest-bearing account in real time with continuous availability may imply little demand if CBDC was introduced as a new payment method in addition to bank deposits and cash.

However, any conclusions about the likely demand for CBDC are highly speculative. The Bank's most recent consumer payments survey sheds light on why some households might experience inconvenience or hardship if cash were no longer available, with the most cited reason being privacy or security concerns (Delaney, McClure and Finlay 2020). However, it does not really shed light on what proportion of cash users might want to switch to using CBDC nor what proportion of existing users of commercial bank electronic payments might switch to electronic payments based on a CBDC. More targeted research may be able to yield stronger evidence on these questions and issues such as whether households view the FCS as making their deposits as safe as cash (or any future CBDC) and the extent to which the ongoing growth in demand for cash is related to the anonymity that it offers (but which presumably would not be fully replicated in a CBDC). We are not aware of any firm evidence from other countries on these or similar issues, although the Bank of Canada (2020) has recently noted that 'Initial public response through focus groups imply there could be a basic level of demand for a CBDC but that it may not be substantial at this time.'

What Are Other Central Banks Doing?[19]

A survey conducted in late 2019 of 66 central banks by the Bank for International Settlements showed that most were doing some type of work on CBDCs, either retail or wholesale (Boar, Holden and Wadsworth 2020). However, around 70 per cent of central banks saw themselves as unlikely to issue either a retail or wholesale CBDC in the foreseeable future.

The jurisdictions which reported that they were likely or very likely to issue a CBDC over the next three years were all emerging market economies; in addition, 90 per cent of those likely or very likely to do so over the medium term were emerging markets. Indeed, a few emerging market economies have proceeded to conduct pilot studies of CBDCs, including the central banks of The Bahamas, Cambodia, Ecuador, Ukraine and the Eastern Caribbean. In most cases, the desire to improve financial inclusion has been cited as a major rationale for the central bank's work.

Given the complexity of the issues and some of the concerns discussed above, central banks in most advanced economies are proceeding cautiously and many have suggested that the case for CBDC issuance is not yet established. For example, the Federal Reserve has indicated that it is conducting research into CBDCs but that there are a number of issues that would have to be addressed before deciding to issue a CBDC. It has noted that 'Some of the motivations for a CBDC cited by other jurisdictions, such as rapidly declining cash use, weak financial institutions, and underdeveloped payment systems, are not shared by the United States. … We have a robust and diverse banking system that provides important services, along with

a widely available and expanding variety of digital payment options.' (Brainard 2020)

The two advanced economies that appear to have proceeded furthest in exploring the case for retail CBDC issuance are Sweden and Canada.

Sweden's Riksbank has been considering the issues around a possible retail CBDC (the e-krona) for several years and announced in February that it is undertaking a DLT-based pilot to develop a technical solution for a CBDC that could serve as a complement to cash (Riksbank 2020). The Riksbank's work is driven largely by Sweden's rapid shift to electronic payments and the growing difficulty that some households and businesses face in continuing to use cash. It has expressed concern about resilience, competition, innovation and data integrity in the payments system in the event that households no longer had access to central bank money. Sweden has not taken a decision on issuing a CBDC, how it might be designed or what technology might be used. The main purpose of the pilot is for the Riksbank to increase its knowledge of a retail CBDC.

The Bank of Canada has an extensive CBDC work program underway and provided an update on this work in February (Bank of Canada 2020). It stated that, based on its research to date, there is currently no compelling case to issue a CBDC. It noted that the existing payments system provides Canadians with payment options that they can use with confidence and that offer a high degree of resilience and privacy. Nevertheless, it plans to 'build the capacity to issue' a retail CBDC in case it became desirable, including in circumstances where banknotes could no longer be used for everyday transactions or where Canada's monetary sovereignty was being threatened by the adoption of some private-sector digital currency or another CBDC. It will be consulting with stakeholders about their payment needs and working over the next several years on the technological options for a CBDC.

More broadly, a number of central banks have been actively researching the possible use cases, design and implications of a *wholesale* form of CBDC. This would be a type of CBDC that would be accessible by banks and possibly other market participants that could be used for the settlement of transactions in wholesale markets, such as purchases of financial assets or large-value payments. A number of central banks, often in collaboration with other market participants, have built proofs-of-concept for wholesale CBDC using DLT, exploring its potential use in domestic interbank and cross-border payments and securities settlement, among other use cases. Many of these experiments have sought to explore the potential benefits of embedding a wholesale CBDC in a DLT platform along with tokenised financial assets, focusing on the programmability and automation capabilities provided by smart contracts. However, given the current capabilities, performance and resilience of most existing (centralised) wholesale payment and securities settlement systems, the benefits of a potential wholesale CBDC have not always been obvious.

Where to from Here?

In late 2017, the Governor gave a speech on the possible issuance of a retail or wholesale CBDC and outlined a series of working hypotheses on the Reserve Bank's thinking (Lowe 2017). He indicated that the Bank had no plans to issue a retail CBDC. The Bank expected the ongoing shift to electronic payments would continue, largely through products offered by the banking system rather than non-bank e-money providers or cryptocurrencies, though there would remain a place for banknotes in the payments system. In principle, it would be possible for a retail CBDC to exist side by side with commercial bank deposits and the electronic payment systems operated by the private sector. If a CBDC were issued, it would most likely be via a two-tier model, where the ultimate claim was on the central bank but the distribution and customer-facing aspects would be handled by private sector entities. The Bank did not consider that the case for issuing this new form of money had been established, though it would continue to consider the pros and cons of doing so.

The Bank's views on a retail CBDC remain very much in line with the working hypotheses outlined in 2017, though it recognises that circumstances could

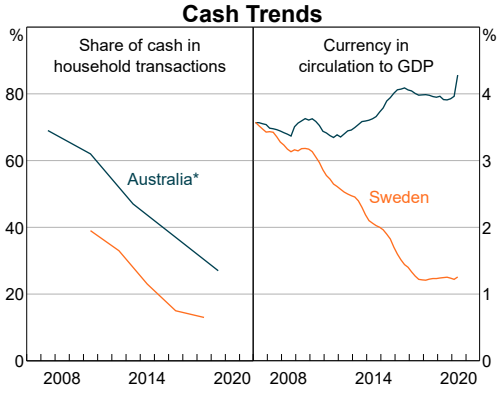
change so it will be important to keep an open mind. Any decision to introduce a retail CBDC could have economy-wide effects and would presumably require legislative change. Accordingly, the Bank stands ready to engage with the full range of stakeholders on the issue. In the meantime, the Bank has a commitment to providing high-quality banknotes, and ensuring reasonable access to them, for as long as Australians wish to keep using them.

The Bank's view is that there is currently no strong public policy case to introduce a CBDC for retail use. This reflects a number of factors:

- While the use of cash in transactions has been falling gradually, demand for Australian banknotes continues to increase and has indeed risen significantly since the onset of the COVID-19 pandemic. Although there were indications that some merchants had stopped accepting cash in the early stages of the pandemic, acceptance of cash at the point of sale remains very high, and households have good access to cash withdrawal and deposit services. So concerns about the declining role of cash are less pressing than in some other countries, most notably Sweden, where a retail CBDC is being considered more actively (Graph 1). Nevertheless, a continued decline in the use of cash for transactions in Australia could lead to the withdrawal of cash services in ways that may create challenges for people who still need or want to use cash. The Bank will be looking to work with banks, ATM providers and cash-in-transit companies to promote improvements in the efficiency of the cash distribution system so that cash can remain a viable payment option for as long as people want to use it.
- Australia's electronic payments system compares favourably with those in many other countries. Households and businesses have access to a range of safe, convenient and low-cost payment services from commercial banks and other providers. The NPP represents a major upgrade to the payments system, allowing real-time, data-rich, easily addressed account-to-account payments that can be made on a 24/7 basis. Growth of transactions through the NPP has been strong compared with fast payment systems implemented in other countries. Looking ahead, the Bank will continue to work with the payments industry where it has policy concerns or sees a case for coordinated investment to fill gaps in the services available to households and businesses. We expect that the quality of payment services provided to end users will continue to improve, with the private sector able to deal with many of the shortcomings in the payments system that have been highlighted by proponents of a retail CBDC.
- Regulation remains an option for dealing with any concerns associated with private-sector provision of payment services. The Bank has a clear mandate to promote competition and efficiency and to control risk and well-defined powers to set standards and impose access regimes where policy concerns cannot be addressed by the payments industry. Together with other regulators, the Bank expects to be able to deal with any policy concerns around the possible emergence of stablecoins.
- It would be a major decision to implement a retail CBDC. The introduction of a CBDC would be a very substantial and costly project in terms of its design, build and subsequent operation, especially given growing cybersecurity threats and the rate at which technology is changing. Indeed, it remains to be seen if a CBDC that

Graph 1

Cash Trends



* The last observation for the share of cash in transactions in Australia is for October/November 2019; some rough figuring by Reserve Bank staff suggests a share of around 20 per cent in mid 2020

Sources: Colmar Brunton; Ipsos; RBA; Roy Morgan Research; Statistics Sweden; Sveriges Riksbank

would meet all requirements, especially in terms of resilience to fraud and cybersecurity risks, is feasible. Furthermore, it is possible that there might be only very limited demand from households to hold and use CBDC. Given the Bank's current assessment of the likely benefits and risks, there may be benefits to waiting and to closely watching the experiences of other jurisdictions that are considering implementing CBDC projects.

Separate to its work monitoring the case for a retail CBDC, the Bank is conducting research on the technological and policy implications of a wholesale CBDC. This work is taking place in the Bank's in-house Innovation Lab and included the development in 2019 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. The Bank plans to publish information on the results of this research in due course.

Footnotes

[*] The authors are from Payments Policy Department.

[1] Committee on Payments and Market Infrastructures and Markets Committee (2018) provides an overview of many of the issues in this area.

[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] 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] Deposits are created when banks extend loans (and the loan proceeds are deposited at the same or another bank). See Doherty, Jackman and Perry (2018) for a discussion of the role of banks in the creation of money. Note also that references to 'commercial banks' in this paper should be taken as referring to all types of authorised deposit-taking institutions.

[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,* and 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] A variant of the two-tier model would be what the International Monetary Fund has called a synthetic CBDC (sCBDC) (see Adrian and Mancini-Griffoli 2019). Here, sCBDC providers would be able to hold deposits at the central bank to back their sCBDC issuance. However, the claims of sCBDC holders would be on the private sector provider and not the central bank, so would carry some degree of risk and there would be no guarantee that different sCBDCs would be exchangeable at par. Hence, sCBDCs are perhaps best viewed as domestic currency stablecoins, albeit with high-quality asset backing.

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

[8] 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.

[9] 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] As DLT is an emerging technology with no deployments at the scale that would be required for a retail CBDC, it would be important for assumptions around performance, privacy and security to be thoroughly tested when selecting a DLT platform.

[11] See Ingves (2018) for example.

[12] See Miedema *et al* (2020) for a discussion of some of the attributes of a device that could provide easy access to payments using a CBDC (and presumably also to payments based on commercial bank money or e-money).

[13] Alternatively, facing the prospect of declining cash services, some jurisdictions, such as Sweden, have introduced legislative requirements for banks to continue to provide a specified minimum level of cash services.

[14] 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'.

[15] Here a 'tokenised asset' refers to a digital token on a DLT platform that represents ownership of an underlying asset (such as a bond). The token can be transferred from one participant to another on the distributed ledger, representing the transfer of ownership of the underlying asset.

[16] While this points to risks to financial stability from sudden shifts into CBDC, some observers have noted that a significant permanent shift of deposits from commercial banks into CBDC could imply less maturity mismatch in banks, and possibly a safer financial system.

[17] Of course, this points to a curious aspect of possible CBDC issuance, namely that the public sector would be simultaneously introducing a new asset while putting limits on holdings of it. An alternative control in the case of an interest-bearing CBDC would be for holdings above a certain amount to yield a lower (or zero) rate of interest, though it is not clear if this would be a significant deterrent to a bank run in the case of serious stress in the financial system.

[18] Proponents of CBDC have, however, noted that if a CBDC attracted an interest rate that was linked to the policy rate it could strengthen the effects of monetary policy because policy would then have an influence on a broader range of interest rates in the economy.

[19] Given that there is only limited information available about work by the People's Bank of China (PBOC) on a retail CBDC, this section does not cover that work. However, available reports indicate that a pilot is well advanced and involves a two-tier model where the CBDC would be issued by the PBOC and then distributed by commercial banks or other payment providers. The primary rationale for the PBOC's CBDC may be to promote a bigger role for central bank money as an alternative to the e-money provided by the large private sector wallet providers (most notably Alipay and WeChat Pay).

References

Adrian T and T Mancini-Griffoli (2019), 'The Rise of Digital Money', IMF FinTech Notes No 19/001.

APRA (Australian Prudential Regulation Authority) (2020), 'About the Financial Claims Scheme', Available at <https://www.apra.gov.au/about-financial-claims-scheme>.

Armelius H, G Guibourg, A Levin and G Söderberg (2020), 'The rationale for issuing e-krona in the digital era', Sveriges Riksbank Economic Review No 2, pp 6–18.

Bank of Canada (2020), 'Contingency Planning for a Central Bank Digital Currency', February.

Bank of England (2020), 'Central Bank Digital Currency: Opportunities, Challenges and Design', Discussion Paper, March.

Bech M and R Garrett (2017), 'Central bank cryptocurrencies', BIS Quarterly Review, September 2017, pp 55–70.

Bjerg O (2017), 'Designing New Money: The Policy Trilemma of Central Bank Digital Currency', Copenhagen Business School, CBS, MPP Working Paper.

Boar C, H Holden and A Wadsworth (2020), 'Impending arrival – a sequel to the survey on central bank digital currency', BIS Papers No 107.

Bordo M and A Levin (2017), 'Central Bank Digital Currency and the Future of Monetary Policy', NBER Working Paper No 23711.

Brainard L (2020), 'The Digitalization of Payments and Currency: Some Issues for Consideration', Speech at the Symposium on the Future of Payments, Stanford, California, 5 February.

Caddy J, L Delaney, C Fisher and C Noone (2020), 'Consumer Payment Behaviour in Australia', RBA *Bulletin*, March, viewed 26 August 2020. Available at <https://www.rba.gov.au/publications/bulletin/2020/mar/consumer-payment-behaviour-in-australia.html>.

Carstens A (2018), 'Money in the digital age: what role for central banks?', Lecture at the House of Finance, Goethe University, Frankfurt, 6 February.

Committee on Payments and Market Infrastructures and Markets Committee (2018), 'Central bank digital currencies', March.

Dark C, D Emery, J Ma and C Noone (2019), 'Cryptocurrency: Ten Years On', RBA *Bulletin*, June, viewed 26 August 2020. Available at <https://www.rba.gov.au/publications/bulletin/2019/jun/cryptocurrency-ten-years-on.html>.

Delaney L, N McClure and R Finlay (2020), 'Cash Use in Australia: Results from the 2019 Consumer Payments Survey', RBA *Bulletin*, June, viewed 26 August 2020. Available at <https://www.rba.gov.au/publications/bulletin/2020/jun/cash-use-in-australia-results-from-the-2019-consumer-payments-survey.html>.

Doherty E, B Jackman and E Perry (2018), 'Money in the Australian Economy', RBA *Bulletin*, September, viewed 26 August 2020. Available at <https://www.rba.gov.au/publications/bulletin/2018/sep/money-in-the-australian-economy.html>.

European Central Bank (2019), 'Exploring anonymity in central bank digital currencies', December.

Ingves S (2018), 'The e-krona and the payments of the future', Stockholm, 6 November.

Lowe P (2017), 'An eAUD?', Address to the 2017 Australian Payment Summit, Sydney, 13 December.

Miedema J, C Minwalla, M Warren and D Shah (2020), 'Designing a CBDC for universal access', Bank of Canada Staff Analytical Note 2020-10.

Reserve Bank of Australia (2020), 'What is Money?', Reserve Bank of Australia site.

Sveriges Riksbank (2020), 'The Riksbank's e-krona pilot', February.