RESERVE BANK
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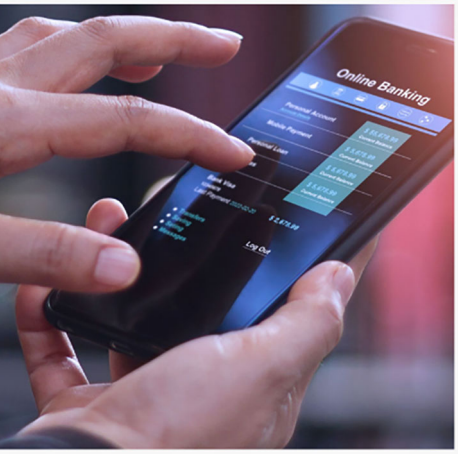
Australian Government
The Treasury

Central Bank Digital Currency and the Future of Digital Money in Australia

SEPTEMBER 2024



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Central Bank Digital Currency and the Future of Digital Money in Australia

September 2024

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Executive Summary

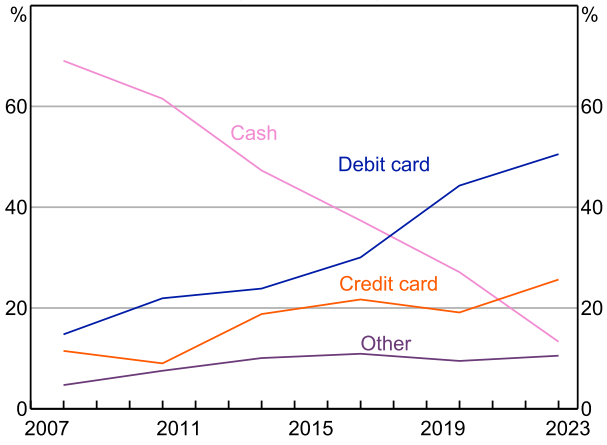
Ongoing changes in payment behaviour and the emergence of new payment technologies are reshaping the payments landscape in Australia and internationally. These changes raise key questions about whether available forms of money are fit for purpose in the digital age. In light of this the RBA and the Australian Treasury have been examining arguments for and against introducing a central bank digital currency (CBDC), as well as considering aspects of CBDC design.

The use of physical cash as a means of payment is at record lows in Australia following decades of steady decline (Graph 1). Consumers are instead making most of their payments using debit or credit cards, with an increasing share of transactions occurring online. Similar trends have been observed in many peer economies. Moreover, the emergence of new instruments – including CBDCs and stablecoins – have highlighted a range of new technologies that could define the monetary and payments landscape of the future. The central policy question is how Australia's monetary and payments arrangements should adapt to the evolution in preferences and technology in order to best serve the Australian economy.

Graph 1

Consumer Payment Methods

Share by number of payments



* 'Other' includes payment methods such as BPAY, cheque, gift/prepaid cards, internet/phone banking and other methods.

Source: RBA calculations, based on data from Colmar Brunton, Ipsos and Roy Morgan Research.

One possibility is for a CBDC to be issued in Australia as a digital form of money that has different functional capabilities to the two existing types of state-backed money: physical cash, which is available to the general public; and exchange settlement account (ESA) balances, which are a form of digital money only available to select financial institutions.

One form of CBDC – a 'retail CBDC' – could be designed for use in retail payments by the general public. This could include online payments and digital payment methods at the till, such as for buying a coffee. Depending on its design, a retail CBDC could have some similar features to physical cash. For instance, it could offer a degree of transaction privacy and offline capability (allowing it to be used during power

outages). It could also have many features common to regular cards or bank accounts, allowing balances to be transferred and payments to be made electronically. A retail CBDC would be a complement to, rather than substitute for, the physical cash that has circulated in the Australian economy for decades.

Another form of CBDC – a 'wholesale CBDC' – could be used in wholesale payments and settlements between financial institutions.[1] This could allow for greater functionality than is possible with today's ESAs that are the bedrock of wholesale market transactions in Australia. Yet another (though less potentially transformative) possibility is that the supporting infrastructure for ESAs is upgraded, to provide for more functionality than is currently available.

As a practical matter, a CBDC (retail or wholesale) would be issued by the RBA. However, the introduction of a retail CBDC for use among the general public would entail material changes to the financial arrangements of Australia. Because of this, the Australian Government would ultimately decide whether to introduce a retail CBDC and, if introduced, may have to enact enabling legislation and/or regulatory reforms. In the case of wholesale CBDC, the legal, regulatory and primary decision-making implications would depend on the design and scope of its use, including the extent of transformation enabled by these innovations in the clearing and settlement of wholesale market transactions. Irrespective, the Government, Treasury and RBA would closely consult ahead of any decision to issue a CBDC, should a public policy case for doing so emerge in the years ahead.

In addition to the range of possibilities for state-backed digital money, the private sector in Australia may respond to evolving payment preferences and technological developments by introducing new types of money in the years ahead, including in the form of Australian dollar stablecoins or tokenised bank deposits. These forms of money are likely to have overlapping functions, both with each other and with CBDC, so decisions about whether or how they should be part of Australia's future are interrelated with broader questions around the potential role of a CBDC. These new forms of money could potentially circulate in the absence of, or alongside, a CBDC.

It is against this background of wide-ranging possibilities for digital money that the RBA and Treasury have been exploring whether there is a public interest case to introduce a CBDC and, if so, in what form. For example, in 2023 the RBA temporarily issued a pilot CBDC as part of a project with industry that explored a variety of potential retail and wholesale use cases (RBA and DFCRC 2023). As many other jurisdictions have been exploring similar questions regarding the future of money, part of the research effort in Australia has also been directed to reviewing international research and collaborating with other central banks on projects of mutual interest.

This paper summarises RBA and Treasury research to date, including how it has informed our assessment on the future of CBDC in Australia, and sets out a roadmap for future analysis. Section 1 describes what a CBDC is.[2] Sections 2 and 3 examine potential benefits, costs and other considerations related to CBDC, covering some more complex technical issues. Section 4 outlines the forward work agenda for the RBA and Treasury.

1 While it is possible that the group of eligible entities using a wholesale CBDC could eventually extend beyond financial institutions to include corporates, such a scenario is sufficiently far off, and would entail such a different set of issues, that we do not pursue it in this paper.

2 Section 1 borrows heavily from previous RBA publications, namely RBA (undated-a) and Richards, Thompson and Dark (2020).

Regarding retail CBDC, our key assessments and priorities are as follows:

- **There is no clear public interest case to issue retail CBDC in Australia as yet.** In the case of jurisdictions that have either issued a retail CBDC (exclusively emerging market economies) or indicated that issuance of a retail CBDC was distinctly possible in the next few years, the main motivations have less resonance in the Australian context, at least at present. This recognises that Australians are currently well served by a retail payments system that, by global standards, is efficient, innovative and safe. However, there are many potential benefits and costs to consider, and this assessment will be revisited as more information becomes available, including lessons from the experiences of other jurisdictions.
- By committing to a forward work plan covering the next three years, **the RBA and Treasury will work closely together in progressing understanding of key policy issues related to retail CBDC, and to support any future deliberation on related issues by the Australian Government**. This workplan will include soliciting a wider range of insights and perspectives on the merits of retail CBDC in Australia and will be informed by a structured public engagement process beginning in 2025. The RBA and Treasury will also establish industry and academic advisory forums from next year, and the RBA will build on last year's pilot exercise by conducting further experimentation and practical research.

Regarding wholesale CBDC, our key assessments and priorities are set out below:

- **Compared to retail CBDC, the potential benefits and use cases for a wholesale CBDC seem more tangible at this point.** Potential benefits could also be realised in a minimally disruptive way in a wholesale setting, building on key features of the monetary system that have served the Australian financial system well for decades.
- **The most compelling proposition in favour of CBDCs relates to increasing innovation and efficiency in wholesale markets, particularly 'tokenised' asset markets.**[3] This reflects the large size of existing markets that could conceivably be tokenised, and the potential for new markets to emerge in unison with tokenised assets and money. Authorities in a number of other economies have arrived at similar assessments (Di Iorio, Kosse and Mattei 2024). Key policy questions relate to how best to support tokenisation in wholesale markets, including the division of roles across the public and private sectors. One path, which incorporates a key role for the public sector, could include the issuance of a wholesale CBDC or upgrading existing infrastructure to support tokenised settlement using ESA balances. A second path, with private sector-led innovations in digital money and new forms of ledger development, might also yield considerable benefits in supporting tokenised markets. A third path could comprise a hybrid of official and private sector innovations in digital money and supporting infrastructure. These issues are the focus of an applied research agenda that is well underway in Australia and internationally.

As a result of these assessments, the future work program of the RBA and Treasury will prioritise CBDC initiatives in wholesale applications. This will include the RBA stepping up its experimental project work and wider engagement with industry, academia and peer central banks, while Treasury will support the Government in considering enhancements for regulatory sandbox arrangements and clarify the regulatory arrangements for stablecoins and other types of digital assets.

3 Tokenisation refers to the process of creating a digital representation (token) of an asset on a programmable platform.

1. What is CBDC?

1.1 Money as we know it

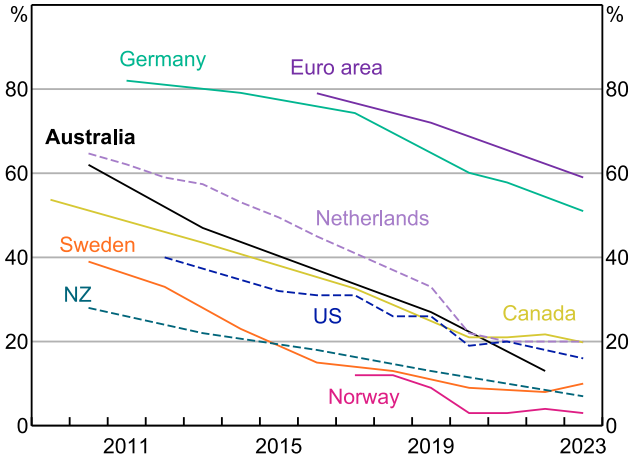
Throughout history and around the world, money has taken diverse forms – from cowrie shells, copper ingots, rum and gold coins, through to paper or polymer notes and digital bank records. The common feature between these different forms of money are the functions they perform, with each being trusted (at least for a period) as a reliable way to pay or be paid, a way to quote prices and a way to store value. These three attributes – a medium of exchange, a unit of account and a store of value – are the key attributes that make something 'money'.

Today in Australia, money exists in both physical and digital form. Physical money ('currency' or 'cash') consists of banknotes and coins. It can be held by anyone and is a bearer asset, meaning that no ownership information is recorded, and the holder of the instrument is presumed to be the owner. For example, payment with a banknote occurs when someone passes it to another person, without the involvement of a financial institution or any recording of the transaction on a ledger. In Australia, banknotes are issued by, and are a liability of, the RBA. As a method of payment, usage of banknotes and coins is at record lows after decades of steady decline in Australia, a trend that is also evident among most advanced economies (Graph 2).

Graph 2

Trends in Cash Payments*

Share of number of payments



* Observations are not directly comparable due to differing survey methods and inclusions across economies.

Sources: Bank of Canada; Colmar Brunton; De Nederlandsche Bank; Deutsche Bundesbank; European Central Bank; Federal Reserve Bank of San Francisco; Ipsos; Norges Bank; Roy Morgan Research; Sveriges Riksbank.

Most of the money in Australia exists in privately issued digital form, as deposits at commercial banks. Households and businesses that hold deposits at banks can exchange them for cash via withdrawals or can use them to make payments by transferring funds from their account to the account of a recipient using cards or other electronic payment systems. Deposits meet the definition of money because the

funds are a liquid store of value that is widely accepted by others as a means of payment. They are digital because the balances exist only as entries in digital ledgers or databases managed by the issuing bank (i.e. there is no physical form). They are a liability of commercial banks, not the RBA, and therefore carry some additional (albeit minimal) credit risk. In Australia, bank deposits are guaranteed up to $250,000 per account holder by the Australian Government under the Financial Claims Scheme administered by the Australian Prudential Regulation Authority (APRA). There are other measures in place to protect the safety of deposits as well, such as a comprehensive prudential oversight regime (see Turner 2011).

The RBA also issues digital money in the form of balances in ESAs that banks and a few other types of eligible financial entities can hold. ESAs enable banks and other financial institutions to settle obligations among themselves arising from their customer's payments and other financial market transactions. Banks use their ESA balances to settle these obligations by instructing the RBA, which keeps the official ledger of account balances, to debit their ESA and credit the ESA of the recipient bank. ESA balances are the main form of digital money issued by the RBA, and they cannot be held by individuals.[4]

The ongoing decline in the transactional use of cash, the emergence of new payments technologies, and the broader digitisation of economic activity raise questions about whether the forms of money that are currently available are fit for purpose in the digital age. Are they consistent with modern expectations for the reliability, safety, convenience and functionality of money? It is in this context that interest is growing in the possibility of central banks issuing new types of digital money, in the form of retail and/or wholesale CBDC. Likewise, there has also been interest in new types of privately issued digital money, such as stablecoins or tokenised deposits. As each of these forms of money are likely to have overlapping features and functions (Table 1), decisions about their future role in the economy are interrelated.

Table 1: Current and Potential Forms of Money in Australia

	Current forms			Potential forms			
	Physical cash	**Bank deposits**	**ESA balances**	**Retail CBDC**	**Wholesale CBDC**	**Regulated stablecoins**	**Tokenised bank deposits**
Issued by the RBA	✓	✗	✓	✓	✓	✗	✗
Accessible to all households and businesses	✓	✓	✗	✓	✗	✓	✓
Digital format	✗	✓	✓	✓	✓	✓	✓
Relies on advances in distributed ledger technologies	✗	✗	✗	?	?	✓	✓

1.2 Retail CBDC

Retail CBDC can be considered a digital version of cash issued by the central bank, which could complement physical currency and bank deposits. It would be available for use by all households and

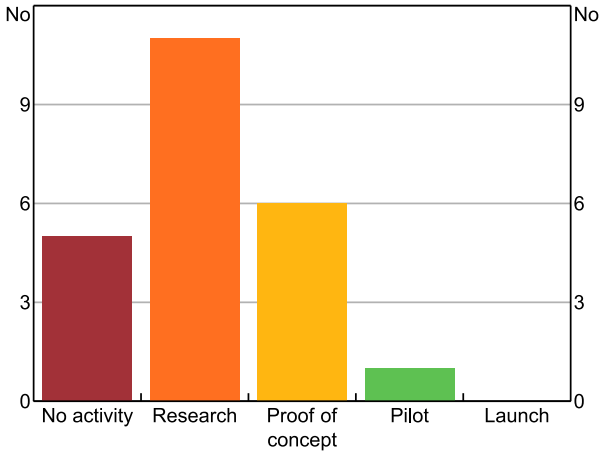
4 The RBA also provides accounts and banking services to some Australian Government departments and agencies as well as a range of overseas central banks.

businesses, and would be intended to serve as another widely accepted medium of exchange and store of value. Like cash and deposits, the unit of account (denomination) of a retail CBDC would be the sovereign currency (in Australia's case, the Australian dollar), and it would be convertible one-for-one with other forms of money (i.e. you could convert A$1 of CBDC for A$1 of cash or deposits).

Besides these core features, a CBDC would have other attributes that would reflect policy or design decisions to be made depending on its intended purpose (Box A). Many central banks are currently exploring the case for retail CBDC and the various policy and technical issues it could raise (Graph 3). A few jurisdictions have launched or are piloting retail CBDC, but no advanced economy has made the decision to launch a retail CBDC.

Graph 3

Retail CBDC Status in Advanced Economies*



* As of July 2024. Excludes projects that have been announced but are not yet live. Euro Area countries are combined.

Sources: cbdctracker.org; IMF.

Box A: Some design options for retail CBDC

Privacy settings. Available payment methods offer varying degrees of transaction privacy to users. For example, payments in cash provide a high level of privacy. Payments using deposits are less private because a record of the account holder's transactions is maintained by the bank or payment service provider, though that information is not generally available to others. The nature and degree of privacy would be a key design decision for any CBDC and there is already significant debate on this issue internationally. The trade-offs associated with different potential privacy settings are explored in Section 2.2.

Distribution model. This refers to the system through which a CBDC is made available to end users. In a 'single-tier' distribution system, the central bank would issue the retail CBDC directly to end users and would be responsible for all customer-facing activities, such as account-keeping and transaction verification. A much more likely alternative would be a 'two-tier' system, or 'platform' system, where the central bank operates the underlying CBDC infrastructure, but the CBDC is distributed to end users via private sector entities (like commercial banks), which are responsible for all customer-facing activities.

Policymakers in advanced economies have advocated for the two-tier model, the logic being that it leverages the existing capabilities of the private sector (central banks are unlikely to have a comparative advantage in providing customer-facing services), especially in an environment where technology

changes rapidly (Bank of England 2020; Wilkins 2023). Indeed, in Australia and internationally, the two-tier system has served the economy well for decades because it makes best use of the relative strengths of the official and private sectors in supporting national monetary arrangements (Jones 2023a). Some proposed CBDC designs do, however, have some features of a single-tier model. For example, in its research into a digital euro, the European Central Bank (ECB) is considering developing a digital wallet that people could use to store and transact in digital euro, with one of the key motivations being to ensure the CBDC could be used and accepted on a consistent basis throughout the euro area (ECB 2023). However, even in this scenario, private payment service providers would likely still be responsible for onboarding and verifying end users and performing any necessary measures to mitigate financial crime. Private payment service providers would also be able to develop competing wallet offerings of their own.

Offline capabilities. A CBDC could potentially allow 'offline' payments (at least temporarily), which would be useful in remote locations and offer resilience benefits when power and telecommunications networks are down. This is discussed further in Section 2.4.

Remuneration and transaction fees. While cash holdings do not earn any interest, a CBDC could in theory earn a rate of interest that might be adjusted over time. Decisions as to whether a CBDC would bear interest would depend on the purpose of the CBDC and the entities that could hold it. 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 (see, e.g., Bank of Canada 2020; ECB 2023). Likewise, policymakers will need to make decisions about whether users of CBDC (merchants and/or consumers) would be charged transaction fees associated with its use.

Underlying technology. A key decision in the development of a CBDC is the choice of underlying technology for issuing and recording the CBDC. A wide range of technology options are available, and these options continue to evolve. Distributed ledger technology (DLT) is a recent innovation for storing, updating and sharing databases among multiple parties that does not rely on a single entity to record and facilitate transactions. This technology has gained prominence in cryptocurrencies, such as Bitcoin (see Section 1.4), but is being applied in an increasing number of commercial, including financial sector, applications where it can offer benefits such as transparency, efficiency and resilience (including no single point of failure). Although retail CBDC prototypes and pilots today tend to use DLT, many of the features offered by these platforms may also be achievable using more traditional technologies. Furthermore, DLT presents a number of challenges related to complexity and scalability and an unclear regulatory and legal framework.

1.3 Wholesale CBDC

In addition to their work on retail CBDC, many central banks are also considering the merits of issuing a wholesale CBDC. This would be a digital form of money issued by the central bank that would only be able to be held by a limited range of entities for use in wholesale payment and settlement systems. As noted above, the RBA already issues digital money to eligible financial institutions for wholesale purposes in the form of ESA balances. A key difference between ESA balances and wholesale CBDC is

that the latter could use an entirely different form of technology that offers new capabilities and/or permits new types of transactions (see further Section 2.8).[5]

However, the distinction between wholesale and retail CBDC could become blurred. There are proposals to make wholesale CBDC available to a wider set of market participants than ESAs, and those are not yet clear on where that expansion should end. The larger the expansion in access, the more retail in nature the usage could become. Compounding this challenge is a possibility that wholesale CBDC could also be used as a one-for-one backing asset for privately issued forms of digital money issued for retail purposes (such as stablecoins, discussed below). In this case, a wholesale CBDC could effectively be held by retail users, albeit in an indirect way.

1.4 New forms of privately issued digital money

It is important to distinguish retail and wholesale CBDCs from cryptocurrencies, such as Bitcoin, which have gained prominence in recent years. A central feature of most cryptocurrencies is that they rely on cryptography and some form of DLT to record ownership and transactions on a digital ledger that is distributed (and synchronised) across multiple nodes (computers) rather than relying on a trusted central party to do so. A key difference from CBDCs is that cryptocurrencies have their own currency unit and are not denominated in the currency of any sovereign issuer. Most cryptocurrencies are also not 'issued' in the traditional sense of having an entity stand behind the obligations to holders. Instead, the value of many cryptocurrencies, like Bitcoin, relies entirely on holders' trust in the integrity of the software that controls the system and on the expectation that other users will continue to ascribe value to them.

While the term 'cryptocurrency' suggests they are a form of money, the consensus is that they do not provide the key attributes of money. As the RBA 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 volatile and so they are a poor store of value.

Besides cryptocurrencies, there are other types of digital assets that rely on DLT that may be more likely to function as forms of money:

- **One example is 'stablecoins'**. These are a type of digital asset 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), in an attempt to make them more attractive as a means of payment. Issuers of stablecoins employ different methods to minimise price volatility, such as backing them with high-quality assets. However, depending on the method used, stablecoins can still entail risks to holders. As such, efforts are underway internationally and in Australia to develop regulations that hold the safety of stablecoins to a high standard, particularly stablecoins with features designed to facilitate their widespread use as a means of payment (Dark *et al* 2022). Globally, the two largest stablecoins on issue are Tether and USD Coin, both of which aim to minimise price volatility against the US dollar, and at the time of writing have amounts on issue of around US$120 billion and US$35 billion, respectively. Issuance of Australian dollar denominated stablecoins has been relatively

5 There is no widely agreed definition of wholesale CBDC and its distinction from ESA balances, especially when entertaining the possibility of upgrading the technology that underlies ESAs. Use of the term 'wholesale CBDC' typically refers to a form of digital money issued by central banks with technological infrastructure that is entirely new, especially infrastructure that relates in some way to DLT. A wholesale CBDC would probably need to be built from the ground up, whereas improvements to the functionality of ESAs could probably be achieved via upgrades to existing infrastructure.

limited to date. However, a few Australian banks and payment providers are showing increased interest in issuing or supporting Australian dollar stablecoins. The CBDC pilot project completed in 2023 also highlighted a potential scenario where stablecoins backed by CBDC compete with digital forms of money issued by regulated financial institutions (RBA and DFCRC 2023).

- **Some banks are also exploring the possibility of issuing tokenised deposits**. The term tends to refer to a digital representation of bank deposits recorded on a DLT platform, where the holders have a claim over the issuing bank similar to a deposit holding.

Depending on how they are designed and regulated, stablecoins and tokenised deposits could be much like CBDC in that they would be safe forms of digital money. See Jones (2023b) for further discussion of tokenised forms of money.

2. The Potential Benefits of CBDC

The international research literature and public commentary raise a range of potential benefits of CBDC. This section summarises those benefits and our assessment of their relevance to the Australian setting. In some cases, the ability to realise a proposed benefit will depend on the chosen design features of the CBDC. Where the RBA and Treasury have strong presumptions about relevant design features, those are discussed here, but for the most part this section makes no assumptions about the design features that any Australian CBDC might have.

The section begins with arguments that apply more to retail CBDC, and then considers those that also apply to wholesale CBDC.

2.1 Offering more safety in digital money

As a liability of the RBA, a retail CBDC would be a form of money that has no credit risk (i.e. risk of loss arising from default of the issuer). Deposits in a bank account in Australia also have very low credit risk, reflecting a range of official measures in place to protect them – including deposit insurance, depositor preference, a robust regime for bank regulation and supervision (all described in Turner 2011) and the RBA's role as lender of last resort (see Jones 2023b). While some of these protections could also apply to regulated forms of privately issued digital money, such as tokenised deposits or stablecoins, some would not apply or offer quite the same level of protection as a retail CBDC. One of the value propositions of retail CBDC is therefore to provide improved safety over other forms of digital money. A central question for policymakers is how much Australians would value this difference.

The available evidence on this is mixed. For example, most consumers in recent retail CBDC focus group consultations conducted for the ECB did not see a difference in the risk profile between central bank and commercial bank money (Kantar Public 2022), a view that Brainard (2022) suggests would also be true for the average US consumer. Evidence from a Dutch survey, however, shows that many consumers do see the risk difference and would value it (Bijlsma *et al* 2021). Cash holdings in advanced economies do tend to increase during times of economic uncertainty (Guttmann *et al* 2021), but it is unclear to what extent that owes to confidence derived from the physical nature of cash (i.e. consumers finding assurance in being able to touch and feel it), as opposed to its status as a risk-less claim on the central bank.

More recently, an RBA study by Fairweather *et al* (2024) conducted an experiment on this issue, using a technique designed explicitly for settings where the research objective is to value potential attributes of goods or services that do not yet exist or are not traded in markets. The results suggest that, at least for Australian consumers on average, the risk-less nature of a CBDC is unimportant. In particular, the study estimates that consumers on average would not be willing to pay anything for access to a retail CBDC account over a commercial bank account, holding all other features of those accounts constant.[6]

6 The authors use the willingness-to-pay metric not because the RBA has taken a position on whether retail CBDCs would or should have fees, but because the metric has an objective interpretation.

These results are consistent with the range of government measures already in place to protect bank deposits. They suggest that, for Australians to value a retail CBDC enough to justify issuance, the CBDC would probably need to deliver a value proposition other than safety. There are, however, some caveats that deserve consideration. For example, the study does not fully address a related question – raised during separate RBA liaison with the academic community – of whether Australians would be comfortable having no *choice* but to interact with (profit-seeking) commercial banks to make routine digital payments. This is a complex issue that will likely require engagement with the public to address.

2.2 Offering different payments privacy

One aspect of the debate over retail CBDC relates to its potential to provide privacy benefits over other forms of digital money, both existing and emerging. Some end users might prefer not to transact using these existing and emerging forms of digital money, for fear of leaving data trails that banks and payment providers, or even criminals, might exploit. By contrast, there is potential to design a retail CBDC that offers users full anonymity, at least for certain transaction types (an option being actively explored by the ECB: see ECB (2023)). Moreover, even for transaction types that do not permit full user anonymity, central banks would still not have the incentives banks may have to use the transaction data for commercial purposes.

To understand these potential privacy benefits of a retail CBDC, policymakers face two major questions:

1. To what extent would consumers value access to a retail CBDC that has different data-sharing arrangements than existing and emerging forms of digital payment offered by the private sector? This includes the possibility of having a retail CBDC offer full anonymity for at least some transaction types.
2. Would the most valued data-sharing arrangements for retail CBDC be consistent with other policy objectives, such as the detection and prevention of financial crime?

Regarding valuations of different data-sharing arrangements, respondents to public consultations on retail CBDC overseas have generally revealed strong preferences for payments anonymity (Bank of England 2021a; ECB 2021; RBNZ 2022). Though there has been no such consultation in Australia to date, other available survey evidence here tells a similar story. For example, two-thirds of respondents to the RBA's 2022 Consumer Payments Survey stated that they often or always consider privacy when deciding how to pay for things, and anonymity ranks as one of the most important reasons for using cash (Graph 4). A different survey, by the Office of the Australian Information Commissioner (2023), shows that Australians are generally more comfortable sharing data with government agencies than with financial institutions.

At the same time, the international literature commonly finds a paradox in privacy attitudes from surveys like these, observing that people who state strong preferences for privacy still consistently choose to forego it. For example, Acquisti, Taylor and Wagman (2016) explain that, while surveys repeatedly highlight privacy as a major concern for internet users, most consumers continue to use technologies that they know track their personal information, even when more private alternatives exist. These behavioural patterns make privacy a challenging area to study.

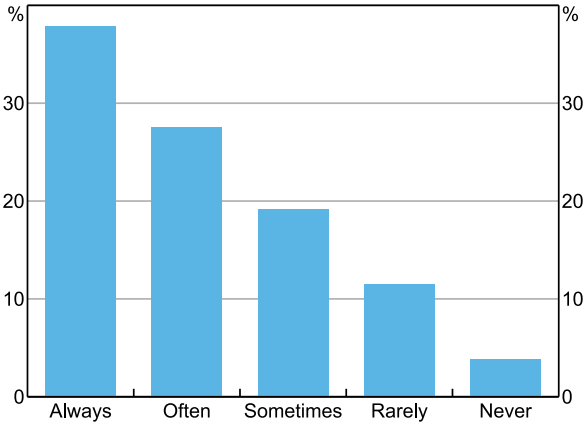
To help overcome some of these challenges, the RBA study by Fairweather *et al* (2024) also examined privacy preferences. The study results support earlier evidence that the average Australian consumer values transaction anonymity and, to the extent that transaction data are shared with other entities, the average consumer cares about who those entities are. For example, the study estimated that

Australian consumers are willing to pay an average of $5 per year more for access to a form of money that makes transaction data available to the RBA instead of a commercial bank, assuming that Australia's financial crime authority, AUSTRAC, can access transaction data in both cases. Aggregated over the adult population, this equates to around $100 million per year, a figure that would rise a little further if the account also offered anonymity for small transactions.[7] Though material, this is not a valuation that would easily overwhelm the range of other considerations relevant to the retail CBDC issuance decision.

Graph 4

How often do you consider privacy in your payment decisions?*

Estimated share of Australian adults



* The complete survey question: 'How often do you consider privacy when deciding whether to proceed with a transaction, or which payment method you will use?'

Source: RBA calculations, based on data from Ipsos.

While the approach used by Fairweather *et al* (2024) has advantages over standard surveys on privacy, it also has shortcomings in this application. For example, the study estimated privacy valuations at a particular point in time, which was soon after highly publicised data breaches at private companies Medibank and Optus. Those breaches could have temporarily elevated privacy concerns. Still, at this point, there is a substantial body of evidence supporting the idea that transaction anonymity would be valued by users of retail CBDC, and offering some degree of anonymity could be a material element of a retail CBDC value proposition.

As for whether transaction anonymity would be a feasible option for a retail CBDC, the main tension for policymakers is with government objectives to detect and prevent financial crime. Cash already allows anonymous transactions, but applying the same anonymity to a more mobile, digital form of money like retail CBDC could substantially weaken existing barriers to illicit activity. Other jurisdictions have sought to manage this tension by proposing anonymity for retail CBDC transactions in circumstances where the risk of illicit activity is lower. For example, in the European Union, the European Commission's legislative proposal for a digital euro envisages allowing anonymity for small transactions conducted offline (European Commission 2023). Ultimately, policy decisions in this area will need to balance the relative importance of these competing objectives.

7 Fairweather *et al* (2024) estimate that the Australian consumer is willing to pay a *further* $5 (aggregated to another $100 million) for full anonymity. They assume that partial anonymity would deliver some of this estimated extra benefit.

Similarly, there is an open question about whether accommodating preferences to share data with the RBA instead of commercial banks would be possible under a two-tier model of retail CBDC distribution. CBDCs issued under that model would likely involve commercial entities having access to transaction data. Further work is required to understand the privacy possibilities under different issuance models.

2.3 Maintaining the uniformity of money

Policymakers from several jurisdictions have raised the possibility that the availability of physical currency and people's familiarity with it plays a significant role in maintaining the 'uniformity of money', meaning that bank deposits (and cash) are all interchangeable with each other at par (i.e. one-for-one). Merchants do not charge differential prices based on which bank a customer's payment is coming from, for example. This is a fundamental aspect of a currency serving as an effective 'unit of account' as it helps consumers to be clear on how much of their money is needed for the payment of a particular good or service, and saves merchants from wasting resources quoting multiple prices and updating price differences regularly.

Different mechanisms have been proposed for how physical money might perform this role. Most of them centre on the idea that people's acceptance of bank deposits as a form of money is underpinned by their ability to exchange those deposits on demand for physical currency at face value (see, e.g., RBNZ 2021). With the possibility of cash use declining further, and more economic activity being conducted digitally, some have argued that a retail CBDC might soon be needed to preserve the uniformity of money (Bank of England 2021b; RBNZ 2021; Panetta 2022; Ingves *et al* 2022; Rivadeneyra, Hendry and García 2024). This argument for retail CBDC is often described as the 'anchoring' role of government-issued money, although that term often also captures issues other than uniformity of money that are covered in Sections 2.5 and 2.7 of this paper.

Whether physical cash currently performs this role in preserving the uniformity of money – and whether retail CBDC would be needed to in future – is not yet clear, because it has not been tested in advanced economies like Australia that already have other measures in place to support the uniformity of money. For example, the vast majority of the interbank obligations arising from transactions in Australia are settled using funds in ESAs, which are a form of government-issued money. This means that payments between different commercial bank accounts are ultimately settled by a transfer of ESA balances irrespective of which commercial banks are sending the payments.[8] As noted in Section 2.1, there are also various government measures in place to make bank deposits safe. This supports public confidence in the ability of commercial banks to honour their commitments to transfer value when customers direct them to.

At the same time, it is difficult to rule out all of the mechanisms that generate concerns about losing the uniformity of money if a retail CBDC was not introduced. In particular:

- Even in their name, bank account 'deposits' imply the safekeeping of cash. If cash becomes a less prominent form of money and is not accompanied by the issuance of a retail CBDC, people might not have the same degree of trust in bank account balances as a store of value.
- Relatedly, it is not certain that people would be as willing to hold bank deposits without the sense of control and assurance they might get from knowing they can withdraw them into cash at any time. Some researchers have argued that people would not be as willing to hold bank deposits,

8 Exceptions can arise when the account receiving payment, and the account sending payment, are with the same bank. In this case, the transaction can be settled without any movement of ESA balances.

but the existing evidence in support of this view is not strong (mostly it comes from Langer (1975), which has been challenged by Filippin and Crosetto (2016)). In any case, if it is the physical nature of cash that currently brings people a sense of control, then a digital form of money like a retail CBDC would not necessarily help; a retail CBDC could only help if it is the attribute of being government-issued that matters.

Given the low likelihood of fully resolving these uncertainties, and the high stakes involved, arguably a unique value proposition of retail CBDC is to provide insurance against possible challenges to the uniformity of money. Some policymakers in Sweden, for example, are sympathetic to this view (Armelius, Claussen and Hendry 2020).

2.4 Safeguarding monetary sovereignty

One source of policymaker interest in retail CBDC is the possibility that, without one, a foreign CBDC or some alternate form of foreign digital money could emerge with such appealing features that domestic consumers start using it regularly for domestic transactions, irrespective of the currency risk they would incur (Lagarde and Panetta 2022; Bank of Canada 2020; Bank of England and HM Treasury 2023). Large-scale currency substitution of this kind could be problematic, because the interest rates over which a central bank has influence (i.e. the ones that apply to borrowing and lending in the national currency) would become less relevant to the pursuit of the central bank's economic welfare objectives.[9] In the CBDC literature, these currency substitution outcomes are often described as a loss of 'monetary sovereignty' (see, e.g., Brooks 2021).

Whether issuing a retail CBDC is a sensible response for managing this risk in Australia depends on the likelihood of large-scale currency substitution in the absence of the retail CBDC and, if it is likely, whether introducing a domestic retail CBDC would be effective in stemming the substitution. To form views on these issues, it is useful to consider scenarios that could, at least in principle, trigger currency substitution. As previously noted by Jones (2022), the history of currency substitution indicates it is more likely to occur in economies where institutions and the rule of law are weak, and residents (and foreign investors) have good reason to question the integrity of the domestic currency – conditions not apparent in Australia. A broader range of considerations do not, in our assessment, present a compelling case for the issuance of retail CBDC in Australia (Box B). Similar points have been made by Börestam and Pedersen (2024), in their assessment of the likelihood of currency substitution in Sweden should the ECB issue a digital euro.

Box B: Currency substitution scenarios

Scenario 1: Persistently high inflation degrades the usefulness of the domestic currency for making payments and storing wealth, and the new foreign currency option is more accessible to Australians than previous options. Though the history of currency substitution globally shows that high domestic inflation is the most common cause, this scenario is unlikely in countries like Australia, which have independent central banks with a track record of successful inflation targeting. Moreover, even if inflation were high enough to cause Australians to adopt a foreign currency, issuing a domestic retail CBDC would not be a helpful response; the retail CBDC would suffer from the same inflation problem because it would be denominated in the same Australian dollars that are losing purchasing power.

9 Another issue is that foreign currency substitution could reduce the frequency with which the Australian dollar is used as the denomination for a range of international transactions. This could reduce the liquidity of the Australian dollar and thus raise international borrowing costs for governments and businesses in Australia.

Scenario 2: Using a new form of foreign currency allows Australians to access a valuable commercial platform. For example, a ubiquitous e-commerce or social media platform might permit participation on the platform only if a user makes and accepts payments in the platform's preferred (non-AUD) currency (see Brunnermeier, James and Landau 2019). Issuing a retail CBDC could be a useful response in this case, but only if it increases the chance that domestic currency is accepted within the network. Acceptance is not guaranteed, because a commercial network may be financially incentivised to enforce sole use of its own digital money, even when functionally similar forms exist in the domestic currency. For these reasons, regulation that forces the platform to allow some form of the domestic currency could be a better alternative to retail CBDC in this scenario, if not an important complement to one.

Scenario 3: The new form of foreign currency offers superior payments functionality than is available using the domestic currency. A non-AUD stablecoin or foreign CBDC could, for example, allow consumers to access digital money capabilities that are not available with existing forms of domestic money. The RBA conducted a pilot CBDC project in 2023 to explore use cases for a CBDC in Australia, which revealed little interest in retail applications (RBA and DFCRC 2023). That evidence suggests that the likelihood of this scenario is low, but it cannot be ruled out altogether. In any case, if consumer interest in these new payment technologies were to grow, it is not yet clear whether issuing a retail CBDC would be the most attractive policy option to preserve monetary sovereignty. Australian banks could upgrade the functionality of transaction deposits in response, potentially with tokenised deposits. The most sensible policy response might then be to ensure there is support for innovation and regulatory clarity around how that could safely occur.

2.5 Improving payment system resilience

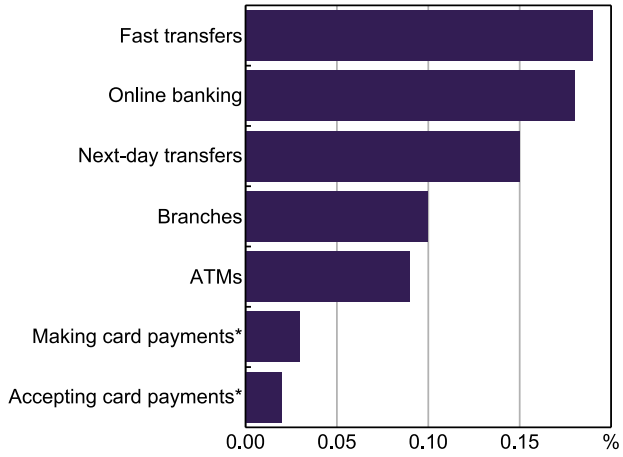
A safe, competitive and efficient payments system is essential to support the day-to-day operation of the Australian economy. A key priority of the Australian Government and the RBA is to promote a safe and resilient payment system (RBA 2023; Treasury 2023). Indeed, as the reliance on electronic payments increases and use of cash declines, the reliability of retail payment services becomes more important.

In Australia, there are a variety of electronic retail payment methods available, which allows for some resilience in the system. The availability of these systems for end users is generally high, with card payments in particular having low levels of downtimes or outages per year (Graph 5). However, payment services such as online banking and fast payments, which have grown in popularity in recent years, are comparably less reliable for households and businesses (RBA 2023). Cash can also serve as an alternative for transactions if electronic payments fail. Access to cash and cash acceptance systems, however, often depend on the same infrastructure as electronic payments. This means that widespread outages that affect electronic payment methods – such as natural disasters, cyber-attacks or major geopolitical events – may also impact the ability to withdraw and/or accept cash. As such, improving the resilience of the payment system has been the focus of ongoing policy work at the RBA (RBA 2023).

Graph 5

Duration of Retail Payment Outages

Percentage of planned available hours, September quarter 2021 to March quarter 2024



* Outages in making card payments prevent card holders from making payments to anyone. Outages in accepting card payments prevent businesses from receiving payments from anyone.

Source: RBA.

As an alternative digital payment method, a retail CBDC could potentially enhance payment system resilience, for example, if it was designed so as not to share the same infrastructure as other payment systems. This would minimise risks that accessibility and reliability of the retail CBDC is affected by outages to other payment methods.

The resilience benefits from a retail CBDC would be further enhanced if it could be used to make payments offline, which would ensure it can still process payments in an electricity or telecommunications outage that impairs the functioning of other digital payments and ATMs. A related consideration – particularly in sparsely populated countries like Australia – is the potential to improve the accessibility of digital payments for people living in remote communities that have poor or inconsistent access to internet and power. There is now a burgeoning literature investigating the technological feasibility of a retail CBDC with capabilities for offline payments (BIS Innovation Hub 2023a).

At this point, our understanding is that technological feasibility has only been established for an 'intermittent offline' retail CBDC, which would be effective for overcoming short-term disruptions, but does not allow funds received to be re-spent until connectivity is re-established. In Australia, card payment terminals at merchants are already capable of accepting payments offline and processing the transaction when connectivity is re-established (see, e.g., Adyen 2024; Westpac 2024). But these fallback options leave the merchant or their financial institution exposed to settlement risk if the resumption of connectivity reveals a customer had insufficient funds. Partly for this reason, some financial institutions have prioritised offering merchants other redundancy features, such as secondary SIM cards, which give the merchant other options before assuming settlement risk for offline transactions. By contrast, it would be possible to design a retail CBDC with intermittent offline capability that does not expose payees to settlement risk and is available for peer-to-peer payments as well as for merchant payments.

More useful still would be a technological solution offering 'extended offline' capability, whereby settlement occurs instantly, and funds received can be re-spent before internet connectivity is re-established. However, extended offline capability is an emerging area of research and existing solutions

all involve major compromises (see, e.g., ECB 2023). One of the main challenges is that the longer a device can function offline, the more vulnerable it is to tampering and use for fraud. For example, offline wallets cannot receive security patches and updated lists of blacklisted wallets. One potential work around, if these challenges cannot be fully resolved, is to impose stricter holding or transaction limits on accounts that are offline for extended periods. This would discourage counterfeiting by making it uneconomical, but it would have the drawback of impairing the utility of the offline retail CBDC (BIS Innovation Hub 2023b).

Assuming that these issues can be overcome, there would still be challenges in ensuring an offline retail CBDC could be useful in disaster scenarios. For example, transaction capabilities could not be sustained for extended periods of time without electrical power, which might also be down in disaster scenarios. Distributing financial aid would be difficult without internet connectivity.

Given these challenges, most policymakers overseas are currently not proposing to include extended offline functionality in any initial rollout of retail CBDC, especially as cash would continue to circulate as an option for offline payments. The ECB looks to be an exception and is planning to develop comprehensive offline retail CBDC capability (ECB 2024a). The RBA and Treasury will continue to explore technological and legislative advances in this area closely.

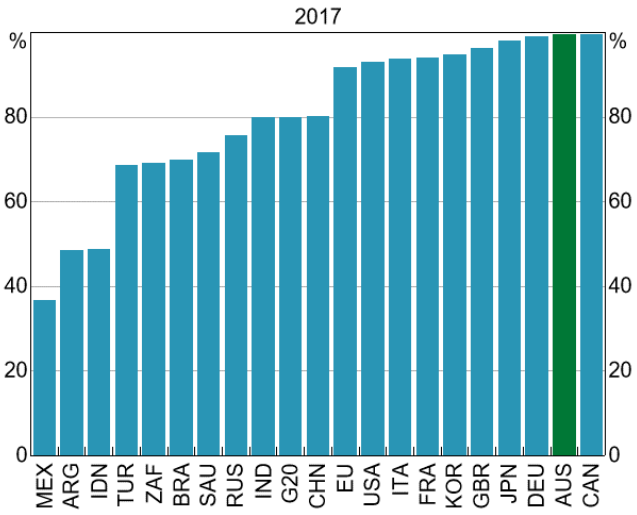
2.6 Improving financial inclusion

With economic activity increasingly moving online, access to digital money is becoming more important for people to be able to meet basic needs. A policy question is how to ensure access to digital money for everyone. Arguably, issuing a retail CBDC could be useful for improving access, both for people that currently do not have bank accounts (the 'unbanked'), and for people that do have accounts but struggle to use the digital transaction functionality the account offers (see, e.g., BIS 2021; Ingves *et al* 2022; OECD 2023; ECB 2023; Zamora-Pérez, Marini and Honkkila 2024). This section briefly explores these ideas.

There are several reasons why some people do not have bank accounts. These include, among others, a lack of documentation relating to personal identity or financial history, a distrust of privately provided financial services, and minimum account balance requirements (Zamora-Pérez *et al* 2024). A retail CBDC could help to overcome some of these barriers – such as by having identity requirements that depend on desired account characteristics – and this has been one of the primary motivations for exploring retail CBDC in economies with large unbanked populations. Typically, these are emerging economies or those with underdeveloped financial systems. The issues are less pertinent in Australia, which has one of the smallest unbanked populations in the world (Graph 6). Still, more work needs to be done to understand whether the people that are unbanked in Australia face access challenges that a retail CBDC could solve.

Graph 6

Bank Account Penetration in the G20*



* Percentage of the population aged 15 years and above with a bank account.

Sources: RBA; World Bank.

For people that do have bank accounts, there are still several potential impediments to using the digital functionality the accounts offer. For example, Livermore and Mulqueeney (2023) report that some Australians continue to rely on cash because of poor internet access, low confidence with digital modes of transacting, or difficulty using digital payment methods due to personal disability. As discussed in Section 2.5, a retail CBDC with offline functionality could help with challenges relating to poor internet access. A retail CBDC could also be designed to cater for groups that have difficulty using digital forms of money, including people with certain disabilities. This too is an area that requires further work.

2.7 Improving domestic payments efficiency

A major source of international interest in retail CBDCs is a view that the infrastructure could be designed to offer improved transaction efficiency relative to existing methods of payment. These efficiencies could take the form of faster transaction speeds, lower transaction costs, or some other enhancements that reduce frictions in common payment scenarios. Related to this idea is a view that a retail CBDC could improve the efficiency of existing modes of payment, through the effects of competition.

In general, these arguments are most prominent in emerging economies that have less well-developed private payment systems and/or a heavy reliance on cash (Ree 2021; Bank of Jamaica 2020). The arguments are less pertinent for Australia, where there has already been substantial innovation in payment systems and a high penetration of digital modes of payment over recent decades. For example, card-based retail payments are very convenient for consumers, with most transactions now made using contactless physical cards or with digital wallets on mobile phones (Nguyen and Watson 2023). In addition, Australians already have access to a fast account-to-account digital payments system, in the form of the New Payments Platform (NPP). The NPP enables retail payments to be processed and settled in near real time, 24 hours per day, every day of the year (see Rush and Louw 2018).

Of the opportunities that do exist in Australia to further improve payments efficiency, one of the more promising is in the reduction of payment costs. The RBA has longstanding card payment regulations –

rules that limit interchange fees and that allow merchants to surcharge card payments and to choose which cards they accept. These regulations have driven a long-run decline in the cost for merchants of accepting card payments (Gill, Holland and Wiley 2022). But reducing these costs further remains a focus and related policy work is ongoing.[10] The RBA and Treasury do not yet have a position on the extent to which the introduction of a retail CBDC would add to downward pressure on payment costs. That would depend on various aspects of a retail CBDC operating model, including associated fees. In building a retail CBDC, the potential effects on costs to merchants and consumers would be an important consideration. Competitive neutrality policies may also need to be considered, given a CBDC could compete with electronic payment methods provided by the private sector.

2.8 Supporting payments innovation

Related to the payments efficiency argument is an argument that issuing a retail or wholesale CBDC could foster growth and innovation in the market for the provision of payment services, resulting in new payment possibilities that otherwise would not emerge. This proposition has generally been more influential for policymakers in advanced economies, including the Bank of England and Riksbank (see Greener 2023; Sveriges Riksbank 2024). Central to the proposition is a CBDC technology platform that has two key features:

1. **Openness.** Permissions to develop payment applications on top of the CBDC platform should be sufficiently open to substantially lower the barriers that new entities face in providing payment services. Entities would likely still face licensing or regulatory requirements but could make use of the CBDC platform to develop new CBDC-enabled payment services. This contrasts with some private 'walled-garden' payment ecosystems that can restrict access and the development of payment services, especially by smaller firms (Cunliffe 2023). Relatedly, innovation would also be supported by a CBDC platform being interoperable with external systems.
2. **Flexibility**. The functionality of the CBDC platform should be sufficiently flexible to support a wide range of innovations in payment services, without foreseeing what those innovations will be.

Two major questions for policymakers are what prospects there would be for such innovation, and whether introducing CBDC would be the best way to support it. To explore these questions, in 2023 the RBA collaborated with the Digital Finance Cooperative Research Centre (DFCRC) to see how a retail or wholesale CBDC might support new innovations in payments (RBA and DFCRC 2023). The project invited industry participants to demonstrate potential use cases for retail or wholesale CBDC using a limited-scale pilot CBDC. While relatively few use cases surfaced for retail CBDC, there was significant interest from industry participants in exploring the tokenisation of financial and other assets on DLT platforms, with wholesale CBDC being used in the 'atomic' settlement of transactions in those assets.[11] Some industry participants also highlighted the potential for CBDC to support the emergence of new privately issued forms of digital money, such as by serving as a safe backing asset for stablecoins.

Given the potential benefits that could stem from asset tokenisation in particular, the RBA and DFCRC now have another project underway to explore different potential approaches to supporting wholesale settlement of tokenised asset transactions (Box C).

10 See RBA (2023) for a summary of recent initiatives.

11 Atomic settlement refers to a process where settlement occurs in an integrated fashion, such that it is technologically infeasible for one leg of a transaction to occur without the other.

Box C: Project Acacia – Settlement for Wholesale Tokenised Asset Markets

The RBA, in collaboration with the DFCRC, is exploring through 'Project Acacia' how different forms of digital money and associated infrastructure could facilitate the settlement of transactions on wholesale tokenised asset markets, in a way that is consistent with a stable and well-functioning financial system.

This research builds on the RBA and DFCRC's 2023 CBDC pilot project, which highlighted strong interest from industry in the tokenisation of assets and the potential for a CBDC to be used for the 'atomic' settlement of transactions involving tokenised assets. Tokenisation in this context refers to the digital representation of real-world assets as tokens that can be stored, traded and transferred on programmable platforms, such as those based on distributed ledger technology. These tokens act like digital bearer instruments that contain rich information and can be programmed via smart contracts to perform various functions, such as pre- and/or post-trade functions, that would be difficult to achieve in traditional financial markets.

Around one-third of the piloted use cases in the CBDC pilot project explored opportunities for a CBDC to enhance the operation of various types of tokenised asset markets. Assets that were tokenised in the pilot ranged from traditional fixed income securities, through to new and emerging asset classes such as carbon and biodiversity credits and tokenised invoices.

There has also been significant interest internationally – from the private and official sectors – in exploring the benefits and opportunities associated with asset tokenisation. For example, several major banks and capital markets firms have launched DLT platforms for tokenised bonds. Over US$10 billion of tokenised bonds have been issued globally in the last decade (McKinsey 2024), with major issuers including the World Bank, the European Investment Bank and the central banks of Thailand and Hong Kong SAR.

Jones (2023a) discusses some of the benefits and challenges associated with asset tokenisation. The benefits, which may not be the same across all markets and asset classes, could include:

- reduced risks, costs and improved capital efficiency from reducing the time between trade execution and settlement
- increased market liquidity resulting from the ability to more easily fractionalise assets (divide ownership into smaller parts), lowering barriers to investor participation
- reduced intermediary and compliance costs from being able to automate manual processes such as compliance checks, reporting and asset-servicing processes
- increased informational transparency and enhanced auditability, which can facilitate the development of new asset markets (such as nature-based assets like biodiversity and carbon credits), where underlying exposures are diverse, and data needs to be verifiable in real time to enhance trust.

The size of these potential benefits could be large. Based on the benefits observed following earlier periods of technological innovation in financial markets and a range of assumptions, Jones (2023a) estimated potential transaction cost savings from tokenisation of Australian financial markets in the range of $1–4 billion per year. A second set of estimates suggests savings of up to $13 billion per year could be available to issuers in Australian capital markets. These estimates do not include the potential benefits associated with the development of new markets that tokenisation may facilitate.

The focus on asset tokenisation has also prompted heightened interest in exploring the role that new forms of digital money could play in facilitating the settlement of tokenised assets. A key finding of the RBA and DFCRC CBDC pilot project was that the availability of tokenised money and assets on the same programmable platform could facilitate reductions in cost and risk in conventional models of trading, clearing, settlement and asset servicing, in at least two ways:

- *By enabling a closer integration of trading and settlement*: The 'atomic' exchange of tokenised money and assets on the same ledger could (in theory) occur instantaneously upon trade execution, driving down counterparty exposure.
- *By enabling programmable payments*: The ability to pre-program financial market transactions that involve payments (such as coupon payments on bonds), using tokenised money and assets, has the potential to reduce costs and risks associated with manual processes.

In Project Acacia, the RBA and DFCRC are seeking to understand the role that central bank money could play in supporting the safe and efficient settlement of transactions in wholesale tokenised asset markets. A key question is whether there is a need for a new form of tokenised central bank money in the form of a wholesale CBDC to maximise the benefits from asset tokenisation, or whether there are enhancements to existing infrastructure that could support settlement using ESA balances, perhaps complemented by privately issued tokenised money such as tokenised deposits.

After an initial phase of research exploring a range of different settlement models, the work is moving into a more applied phase that is likely to involve the development and testing of prototypes with industry partners. The project is likely to conclude in the second half of 2025.

2.9 Improving cross-border payments

In addition to the possibility of using CBDCs to improve domestic payments, there has also been considerable international interest in the potential for CBDCs to help address the cost, speed, access and transparency challenges associated with cross-border payments. The current correspondent banking arrangements produce substantial frictions in cross-border payments, as they can involve multiple parties and settlement systems to make a single transaction (see BIS CPMI 2016; IMF 2017). Hence, there has been significant international interest in whether CBDCs could enable more seamless cross-border transactions.

There have been several international research projects looking into CBDC-based solutions (summarised in BIS Innovation Hub (2022)). The RBA was involved in Project Dunbar in 2021–2022, which explored how a common settlement platform for multiple wholesale CBDCs could improve cross-border payments (BIS Innovation Hub *et al* 2022). The project showed that a multi-CBDC platform based on DLT could make cross-border payments faster, cheaper and safer through reduced reliance on intermediaries, simplification of settlement processes, consolidation of common processes and process automation using smart contracts. The use of DLT could also lessen the trust problems that would otherwise hinder jurisdictions from sharing critical national infrastructure such as settlement systems.

While Project Dunbar demonstrated the technological feasibility and potential benefits of a multi-CBDC system, it also highlighted challenges that would need to be resolved for this to be a viable solution for cross-border payments. These challenges relate to the cross-jurisdictional nature of international payments and the complexities of managing a shared platform across multiple jurisdictions. Notwithstanding the use of DLT, a key challenge relates to designing a governance model that would allay jurisdictional concerns about having insufficient control over a critical payments infrastructure.

Recent geopolitical tensions in eastern Europe, and resulting financial sanctions, demonstrate how important these issues can be.

Beyond Project Dunbar, research on cross-border multi-CBDC platforms is also progressing under Project mBridge, involving the Bank for International Settlements (BIS) Innovation Hub and the central banks of China, Hong Kong, Thailand and the United Arab Emirates (BIS Innovation Hub 2023c).

Having considered the results of Project Dunbar and other similar projects, the BIS assesses that multi-CBDC platforms show potential and deserve continued exploration (as in Project Agorá, announced by BIS Innovation Hub 2024), but are unlikely to be implemented over the next several years. Near-term progress on enhancing cross-border payments is more likely to come from efforts to improve existing cross-border payment processes and infrastructures, including harmonising payment messaging standards, widening access to and extending operating hours of payment infrastructures, and interlinking fast payment systems across countries (FSB 2023). The RBA has also been involved in work on several of these opportunities – including Project Mandala, which explores the streamlining of procedures and compliance for cross-border transactions.[12]

12 For a summary of RBA work on enhancing cross-border payments, see RBA (2023). For discussion on the benefits and challenges to interlinking fast payment systems, see RBA (2024a).

3. Other CBDC Considerations

Along with the potential benefits a CBDC could deliver, the international literature raises various risks and other considerations related to the issuance of CBDC. This section outlines some of these issues and our current thinking on them as is relevant to the merits of introducing a CBDC in Australia.

As in Section 2, this section begins with arguments that mostly apply to retail CBDC, and then moves to those that also apply to wholesale CBDC.

3.1 The implications for cash access

The Australian Government and RBA support Australians having continued access to cash for as long as they want to use it (Bullock 2023; Treasury 2023). As discussed in Section 1, should one ever be introduced, a retail CBDC would be aimed at complementing existing forms of money, rather than replacing them. It would be expected to share similar features to other payment methods like cash and cards, though not a perfect substitute for either.

Nonetheless, a retail CBDC could lower demand for physical cash in a similar way that a CBDC could impact households' preferences for bank deposits. That is, if consumers see cash and retail CBDC as substitutes, the latter's introduction could lower cash demand. Lower cash demand could then lead to lower cash access and acceptance if reduced cash turnover puts increased pressure on the financial viability of cash infrastructure operators (such as cash-in-transit and ATM providers) (Guttmann, Livermore and Zhang 2023). Regardless, while cash is now used less than electronic payment methods for consumer purchases, many people still want or need to use cash for most or all of their payments (Mulqueeney and Livermore 2023).

There has been limited research to date on how a retail CBDC might affect cash access. Existing literature suggests that while cash use may decline further if a retail CBDC is introduced, for countries like Australia that already have a low level of transactional cash use, the substitution away from cash is likely to be less pronounced (Khiaonarong and Humphrey 2022). Furthermore, the rate of adoption of a retail CBDC at the expense of cash use would likely be highly dependent on design features, such as those related to offline capability, privacy and remuneration.

Future work on retail CBDC will need to consider possible implications for cash access and therefore cash users. This would complement the work by the RBA, Treasury and participants in the cash distribution system to support the ongoing provision of cash services in Australia.

3.2 The effects on financial institutions

As discussed previously, international literature identifies several ways in which the issuance of a retail CBDC might improve the stability of the financial system, such as by supporting monetary sovereignty and underpinning trust in privately issued money. However, a retail CBDC would also offer households and businesses a new digital substitute for commercial bank deposits, which are an important source of bank funding. In Australia, for example, roughly 60 per cent of bank funding is sourced from deposits, with reliance even greater among small and regional banks given their limited access to wholesale

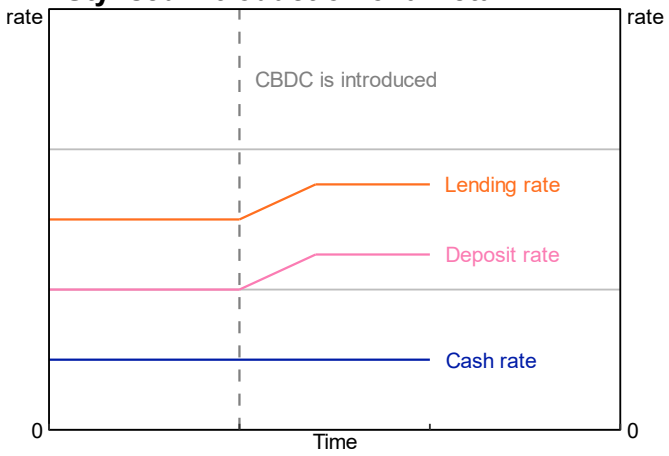
funding markets (Jones 2022). Depending on how a retail CBDC is designed, there is a risk that this could undermine some banking functions in normal times and especially under conditions of financial stress, as considered in turn below. We do not explicitly discuss the implications of wholesale CBDC here, except to note that one could present similar risks – albeit to a lesser degree – if access was broader than for ESAs.

3.2.1 During normal times

Depending on its design, a retail CBDC could become an attractive form of money for some households and businesses in normal times, at the expense of some commercial bank deposits. Should this occur, commercial banks, which use deposits to finance their lending operations, could experience lower demand for their deposit products. Commercial banks might therefore have to offer higher deposit rates than otherwise to attract more deposits or raise more funding from higher cost and/or more volatile sources. All else equal, this could dampen the ability or incentive for commercial banks to lend, with one potential outcome being higher lending rates and lower volumes of lending than otherwise (Graph 7).

Graph 7

Stylised Introduction of a Retail CBDC



Source: RBA.

While it is difficult to gauge what the demand for retail CBDC would be, the evidence to date suggests that demand would be low, at least initially (explained further in Section 3.3). It is also worth noting that the concerns on this point often do not take account of how policy could respond. For example, central banks could offset unwanted impacts on credit conditions arising from the introduction of a retail CBDC by responding with lower policy rates than otherwise, resulting in unchanged monetary conditions overall.[13] Commercial banks also have other tools to retain deposits beyond offering higher deposit rates. For example, they can bundle other services with their deposit products, like offset accounts, credit cards or insurance. A Canadian study by Li, Usher and Zhu (2024) concluded that households have a 'strong preference for bundling additional financial products' with deposits, which would not be a feature of a retail CBDC.

13 As discussed in Section 3.3, an exception is if the central bank policy rate is constrained by a zero lower bound on the cash rate. It is also worth noting that, irrespective of the central bank's ability to respond with lower policy rates, there are other mechanisms that could dampen initial effects on credit conditions. For example, reductions in deposit funding could reduce the perceived riskiness (and hence cost) of banks' wholesale funding, since depositors in Australia have a claim on the assets of failed banks that ranks ahead of other unsecured creditors (see Turner 2011).

Still, researchers and policymakers have been exploring different policy and design options for preventing or managing distortions arising from high levels of retail CBDC take-up. The most frequently discussed option here is to put limits on the amount of retail CBDC that households and businesses can hold at any given point in time or transact over some specified period of time. For instance, the ECB has proposed a €3,000 holding limit on the digital euro for individuals and a zero limit for business and government accounts (ECB 2023).[14] Under the ECB's proposal, business and government users would need to link their retail CBDC and commercial bank accounts to enable automatic defunding of the CBDC account when payments are received. While a drawback of this policy is that it could undermine the usefulness of retail CBDCs by limiting how much can be held, it provides some assurance in case CBDC demand turns out to be unexpectedly strong. Separately, it has also been suggested that central banks could respond to strong retail CBDC demand by extending to commercial banks plentiful cheap loans to offset reduced deposits (Brunnermeier and Niepelt 2019). However, a commercial banking system that was heavily funded by a central bank would raise questions about the appropriate role of central banks and the potential loss of market discipline that ordinarily comes from commercial banks having to attract private funding.

3.2.2 During conditions of financial stress

A related concern associated with the issuance of a retail CBDC is that it could threaten financial stability by facilitating bank runs if households lost confidence in the banking system (Bank of England 2020; ECB 2020; RBNZ 2021; Board of Governors of the Federal Reserve System 2022). Currently, if households or businesses become wary about their deposits in a particular bank, they can 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 feasible for depositors to withdraw deposits all at once from the banking system as a whole, as there are practical limits to what can be withdrawn as cash via ATMs and branches. In the presence of a retail CBDC, a run on the banking system would become more feasible; if depositors had concerns about the entire banking system, they could seek to make large-scale transfers of their commercial bank deposits into CBDC.

As noted by Jones (2022), there is no consensus among researchers as to just how big of a financial stability issue this might be. Some have even gone so far as to suggest that a retail CBDC could enhance financial stability (Keister and Monnet 2022). A retail CBDC could, for example, provide authorities with better real-time information on deposit flows, enabling them to respond faster to runs, and thereby reducing depositors' incentives to run in the first place.

Reflecting the uncertainty regarding the severity of this financial stability risk, a major focus for policymakers and researchers has been to explore measures that could forestall bank runs involving retail CBDC, or at least restrict their impact. One class of measures involves discouraging or prohibiting large-scale acquisitions of retail CBDC, including imposing limits on retail CBDC holdings or transaction sizes, as discussed above. A second class of measures involves expansion of the capacity of central banks to act as lenders of last resort by, for instance, relaxing the terms at which central banks commit to providing emergency liquidity support to commercial banks (Monetary Authority of Singapore 2021). A third class of measures, explored less in the literature, is to make banks more resilient to deposit runs in the presence of a retail CBDC.

14 The proposed limit is still subject to revision following further research and industry consultation planned to occur throughout 2024.

Given the central role of the financial system in the Australian economy, a retail CBDC would not be issued in Australia without careful consideration of the impacts on the stability of the financial system, both in normal times and in conditions of financial stress. The RBA and the Treasury do not yet have a position on what the appropriate policy responses would be and have been exploring the trade-offs among them. Box D, for example, briefly discusses the effectiveness of a potential retail CBDC holding limit for households in Australia.

Box D: Potential runs of household deposits in the presence of a retail CBDC

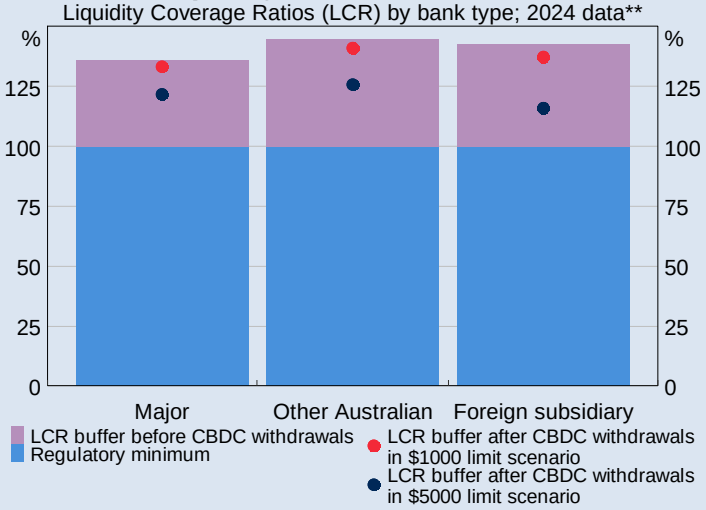
To examine the potential pace and scale of a household deposit run in the presence of a retail CBDC, we model two scenarios using data from June 2024. We suppose that household depositors that have accounts at a single bank (around 75 per cent of depositors) immediately withdraw deposits up to a hypothetical CBDC limit. We then examine how banks' liquidity coverage ratios (LCRs) would change because of those withdrawals (i.e. assuming no further withdrawals of funding simultaneously take place). The LCR is a prudential ratio requirement overseen by APRA that requires banks to have enough liquid assets to cover cash outflows in a short-term stress situation, such as during a bank deposit run.

The potential impact on a bank's LCR depends on the size of the CBDC holding limit – which we assume for illustrative purposes to be $1,000 to $5,000 in our modelling – and the extent of the bank's reliance on retail deposit funding. Deposit runs up to the lower CBDC limit, of $1,000 per depositor, result in a limited decline in bank LCRs. In levels, the LCRs remain well above the regulatory minimum and each bank's internal target, before taking account of any other funding withdrawals that might simultaneously take place (Graph 8). While LCRs also remain above regulatory minima with the $5,000 holding limit scenario, they get close to the bank's internal target ratios.

Graph 8

Bank Liquidity Scenarios with a CBDC*

Liquidity Coverage Ratios (LCR) by bank type; 2024 data**



* Averaged over banks of each type.
** Dots show the LCR following a move to a retail CBDC wallet with the shown limits. Scenario assumes that only depositors who have accounts with a single bank move deposits into CBDC up to the limit.

Source: APRA; RBA.

There are limitations with this type of scenario analysis, as it relies on numerous assumptions that make the findings highly uncertain. We lack the granularity of data (such as which depositors have accounts at other banks) and information on the behavioural impact of a retail CBDC on depositor propensity to

run to accurately model the impact. Furthermore, the analysis does not reflect the likely response of banks and regulators to a retail CBDC. Most notably, we would expect banks to respond to higher liquidity risk by holding more liquid assets and regulators could alter the calibration of the LCR. As such, there are many factors that would need to be considered if CBDC holding limits were imposed. There may be a case for imposing conservative limits until the potential impact of a retail CBDC on banks' liquidity risk and the management of liquidity risk is better understood.

3.3 Setting and implementing monetary policy

Separate to a potential role in preserving the uniformity of money (Section 2.3) and monetary sovereignty (Section 2.4), a retail CBDC could affect decisions about the appropriate stance of monetary policy, and the ability of central banks to implement that stance. This section discusses both issues in turn, working under the assumption that retail CBDC does not pay interest.

3.3.1 Setting monetary policy

Though we do not expect the effects to be large, a retail CBDC could affect decisions about the appropriate stance of monetary policy through two conceptually distinct avenues:

1. It could change the neutral level of the cash rate, which is the rate that is not either stimulatory or contractionary for economic activity.[15] This can be thought of as a permanent level shift in interest rates. Most of the literature investigating the effects of retail CBDC on the stance of monetary policy focuses on this aspect.
2. It could impact the extent to which changes in the cash rate influence economic conditions. Economists typically refer to this as the strength of 'monetary policy transmission'.

Regarding the neutral level of the cash rate, a key observation made throughout the literature is that retail CBDC would be a new source of competition for commercial bank deposits. As discussed in Section 3.2, this means that for any given level of the cash rate, commercial banks might have to offer higher deposit rates or shift their funding to higher cost sources than otherwise.[16] Such changes could dampen the ability or incentive for commercial banks to lend, with one potential outcome being higher lending rates and lower lending volumes than otherwise.

Section 3.2 also noted that commercial banks might need to respond to the introduction of a retail CBDC by improving their resilience to rapid funding outflows, potentially by holding more liquid assets and/or substituting funding to more stable sources. Either approach would add to the costs bank incur, and thus compound any effects on bank lending rates and volumes.

Overall, the combined effects of these mechanisms would mean that any given level of the cash rate is associated with weaker economic conditions than would be the case without a retail CBDC. In other words, these mechanisms would cause the neutral level of the cash rate to decline, and central banks would need to offset any unwanted effects on economic conditions by targeting a lower cash rate than otherwise. In most circumstances this would be achievable. Exceptions are scenarios in which the cash rate reaches zero, as it did for many central banks during the COVID-19 pandemic.[17]

15 Ellis (2022) explains this concept in more detail.
16 Here we assume that the RBA would not respond to the introduction of the retail CBDC by offering loans to commercial banks to offset the loss of deposits to retail CBDC.
17 A retail CBDC that pays interest would be a stronger source of competition against bank deposits, magnifying this effect on the neutral rate.

Note, however, that a CBDC could also affect the neutral rate through other mechanisms, some of which work in the opposite direction. For example, a CBDC could boost economic growth through innovation in payment and other services that use a CBDC, which is a mechanism that could increase the neutral rate (McCririck and Rees 2017). Infante *et al* (2022) also raise other mechanisms that could affect the neutral rate. The net effect of these mechanisms on the overall direction of the neutral rate is uncertain.

Regarding the effect of retail CBDC on the transmission on monetary policy, there are also credible mechanisms that work in competing directions. For example:

1. If households and businesses substitute some of their interest-bearing assets (such as deposits) into a retail CBDC, a lower share of their asset portfolios will earn interest. For people that are net savers, this would lessen the sensitivity of their cash flows to changes in the cash rate. However, for households and businesses in aggregate, cash flow sensitivity reflects the differences between net borrowers and net savers. As such, this effect could be expected to strengthen the transmission of monetary policy, absent other influences.
2. The degree to which a (non-interest bearing) retail CBDC competes with deposits intensifies as deposit rates reach lower levels. Therefore, as the cash rate declines, commercial banks become more constrained in the extent to which they can pass on rate moves to their deposits and hence loans (with this effect unwinding again as the cash rate increases). On its own, this effect would weaken transmission.[18]

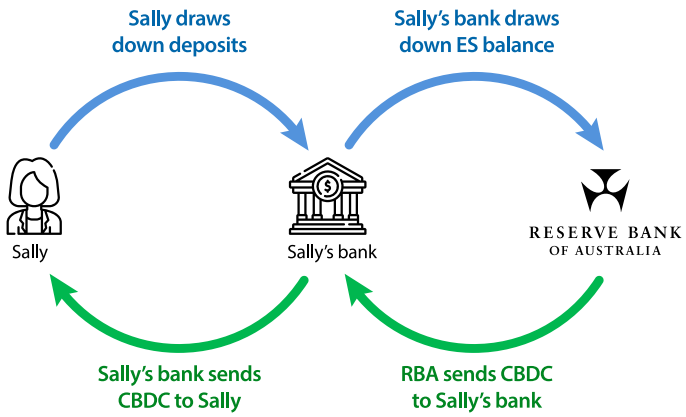
In any case, it would be surprising if the size of any impact on the neutral rate or on monetary policy transmission becomes large enough to create material challenges for policymakers. First, the size of the effects would depend heavily on CBDC demand, which current indications suggest would be low (at least initially): the early take-up of retail CBDC has been limited in the jurisdictions that have issued one; the use cases explored in the RBA's 2023 pilot CBDC study contained few retail applications (as discussed in Section 2.8); and Australians, on average, appear not to value the added safety of money issued by central banks compared with commercial bank deposits (as discussed in Section 2.1). Second, policymakers have options that would limit demand if needed (such as holding limits discussed in Section 3.2).

3.3.2 Implementing monetary policy

The RBA implements monetary policy through administered rates that anchor the interest rate at which banks borrow and lend ESA balances to one another on an overnight basis (called the 'cash rate'), consistent with the Reserve Bank Board's cash rate target. This core central banking function interacts with retail and wholesale CBDC because issuance of either would mean the RBA receives payment for them in the form of ESA balances or banknotes, which would remove those ESA balances or banknotes from circulation (Figure 1). Changes in the amount of CBDC on issue could thus affect the overall supply of ESA balances. A question that the RBA must confront is whether this new influence on the supply of ESA balances could lessen the RBA's control over the cash rate.

18 Paying interest on a retail CBDC could change this materially. For example, it would reverse the first mechanism, which could weaken the potency of monetary policy. And it would nullify the second mechanism. But it is also possible that a remunerated CBDC could raise public awareness of rate changes, which could strengthen overall transmission.

Figure 1: Stylised Process for Acquiring Retail CBDC



One possibility is that the introduction of retail or wholesale CBDC, holding everything else equal, increases the volatility of ESA balances. This would occur if, for example, the demand for retail CBDC was also volatile because of seasonal patterns in payment behaviour. Added volatility would probably be easily managed by the RBA, especially with its planned move to an 'ample reserves' or 'full allotment' system for controlling the cash rate (Kent 2024). Though this move is not motivated by the potential issuance of CBDC, an advantage of the system is that it obviates the need for the RBA to accurately control the supply of ESA balances to hit its cash rate target.

Less straightforward for the RBA would be CBDC scenarios that cause significant reductions in the supply of ESA balances, such that a large volume of ESA balances would need to be replenished to preserve the functioning of the ample reserves system. Such a deficiency in the supply of ESA balances could occur, for example, if households substitute a large share of their deposits into a retail CBDC, or if wholesale CBDC were designed to be held by a much broader set of entities than those that can currently hold ESAs. Some potential use cases for wholesale CBDC, such as developing new financial markets or shortening the time between trade execution and the payment settlement in existing markets, could further increase demand for CBDC by expanding the overall volume of payments in the financial system.

What makes meeting high demand for CBDC less straightforward is that the relatively limited levels of government debt in Australia could limit the ways in which the RBA could replenish large amounts of ESA balances, at least without the risk of creating market dysfunction.[19] The options available to the RBA – such as conducting longer term domestic market operations against non-government debt collateral – typically involve growth in the size of the RBA's balance sheet and some expansion in the RBA's exposure to financial risk.[20] An alternative approach would be to design retail or wholesale CBDCs in ways that minimise their consequences on available ESA balances. Retail CBDC, for example, could be made to be less attractive or impossible to hold in large quantities by offering tiered remuneration rates or imposing holding limits. As discussed in Section 3.2.1, however, there are costs to this approach.

3.4 The legal basis of CBDC

This section considers two separate but related issues: the legal power of the RBA to issue a retail or wholesale CBDC; and the characterisation of those CBDC under applicable existing legal and regulatory

19 For a discussion of the market dysfunction concerns, see Rustia, Schwartz and Stenner (2024).
20 Current eligibility guidelines are outlined in RBA (2024b).

frameworks. The former concerns the source and scope of powers related to the issuance of government-issued money. The latter relates to the treatment of that money once it has been issued, and related implications upon activities involving that money and those that engage in those activities.

The views offered on these issues are preliminary. Greater certainty around a CBDC's design characteristics would be required to support more concrete conclusions.

3.4.1 Legal authority to issue

In the first half of the 20th century, a variety of coins and banknotes issued by commercial banks, state governments, and even foreign governments, circulated both formally and informally throughout Australia. However, since the Commonwealth assumed exclusive responsibility for government-issued money, it granted the role and power of issuance to specified public entities and office holders through legislation. The *Currency Act 1965* establishes the Australian dollar as the country's currency, prescribes its denominations (dollars and cents), and authorises the Treasurer of Australia to direct the making and issuance of coins. Similarly, the *Reserve Bank Act 1959* authorises the RBA to issue 'Australian notes' and specifies the denominations of those banknotes.

Whether these and other existing statutory powers extend to the issuance of a retail or wholesale CBDC is uncertain. As discussed above, digital central bank money already exists in the form of ESA balances held with the RBA by certain financial institutions, to settle their obligations with each other. While ESAs have a clearly established legal basis and status, retail and wholesale CBDC would both have new characteristics. In its 2023 project with the DFCRC, the RBA issued a limited-scale pilot CBDC for both retail and wholesale purposes, but while it constituted a real legal claim on the RBA, it was created as a contractual commitment of the RBA (RBA and DFCRC 2023).[21] By contrast, current practice for physical currency suggests that the soundest legal basis for issuing any future CBDC would be statutory.

Even if current statutory powers could support the issuance of a form of CBDC with particular characteristics, designing a CBDC with an objective of fitting it within the confines of existing powers could limit its potential benefits. This consideration, and the scope of the RBA's current statutory powers to issue 'Australian notes', means that statutory reforms may be required. This is especially so if the CBDC is intended to support retail transactions.

3.4.2 Legal status of a CBDC under existing frameworks

Money has status under existing legal and regulatory frameworks – status that is necessary to support money's economic functions (especially as a medium of exchange). This status affects the treatment of activities involving money, and of entities engaging in those activities, under various regulatory frameworks, including those intended to help mitigate risks associated with certain uses of money.

An example is legal tender status, which is a statutory designation of a lawful mode of payment.[22] Currently, only physical cash – Australian coins (up to certain amounts) and Australian banknotes – has legal tender status. Should the Australian Government decide that any future retail CBDC must be able to function as legal tender, it is likely this intention would need to be enacted through law reforms.

A survey of other legal and regulatory frameworks indicates that types of money are primarily characterised for purposes related to the regulation of currency, taxation, financial services and

21 Specifically, the legal arrangement was structured as a deed poll in favour of all holders of pilot CBDC, whereby the RBA committed to redeeming all holdings of pilot CBDC for Australian dollars at par at the conclusion of the pilot.

22 For an introduction to the concept of legal tender, see RBA Banknotes (undated).

combatting financial crime. This was anticipated by the CBDC pilot project, although it was ultimately not necessary to resolve the legal characterisation issues around the pilot CBDC and the project use cases.[23] More concretely, previous governments have signalled a policy intention that, for the purposes of certain financial crime and taxation legislation, any future retail CBDC would be treated as 'money', rather than 'digital currency', under those frameworks.[24] This is just a small sample of the characterisation issues that would need to be identified and addressed to ensure any retail or wholesale CBDC is legally effective, operates in accordance with its intended purpose, and has no unintended consequences under existing legislation.

Our view is that reliance should not be placed on a CBDC's design to ensure it has a legal status that it would be desirable for the CBDC to have. Instead, to achieve the greatest possible legal certainty and to provide the opportunity for public input on reform proposals, the preference of the RBA and Treasury is to identify desirable functions and then make any necessary enabling amendments to applicable legislation. In the event a decision is taken to issue an Australian retail or wholesale CBDC, public agencies would work together to anticipate and seek to implement any legislative or other regulatory reforms that would be required as part of issuing a CBDC.

3.5 The impact of design on performance, scalability, security and other non-functional requirements

In designing a retail or wholesale CBDC to realise any potential benefits, it will be important to consider implications for the 'non-functional' characteristics of the CBDC. These characteristics describe features of how a CBDC performs its functions (rather than what those functions are). This includes, for example, transaction processing speeds, the platform's security from faults and malicious attacks, the finality of transaction settlement and the degree of transaction privacy. Although technology is always improving to lessen the need for compromise, in designing a CBDC there are likely to be areas where tensions arise between desired non-functional characteristics as well as with other (functional or non-functional) design objectives. Policymakers would need to carefully consider how to manage these trade-offs.

One of the major tensions that arises is between privacy and transaction processing speeds. For example, to improve user privacy in a proof-of-concept wholesale CBDC issued as part of Project Atom in 2021, the participants used an encryption technique known as Aztec, which hides transaction data from entities not involved in transactions (RBA *et al* 2021). The additional computational burden associated with the encryption technique resulted in slow transaction speeds, which subsequently required CBDC tokens to be issued in larger denominations than would be optimal. Privacy technology is evolving rapidly, and this tension is lessening over time. But it may not disappear entirely.

Another tension lies between the degree of CBDC user programmability (which may be desirable to foster innovation in payments) and the degree of platform security. A CBDC that allows for high levels of user programmability, such as by supporting smart contracts, would be a departure from traditional

23 For example, questions arose around whether the pilot CBDC constituted 'money' under the *Anti-Money Laundering and Counter-Terrorism Financing Act 2006*, and whether a wrapped pilot CBDC constituted a 'financial product' under the *Corporations Act 2001*. These were threshold questions for whether the pilot participants were providing designated services under the former framework, and financial services under the latter. Ultimately, the Australian Securities and Investments Commission and AUSTRAC issued exemptions in support of the project, which removed the need to resolve these questions. For further discussion, see RBA and DFCRC (2023).

24 See Revised Explanatory Memorandum, Anti-Money Laundering and Counter-Terrorism Financing Amendment Bill 2017; Explanatory Memorandum, Treasury Laws Amendment (2017 Measures No.6) Bill 2017. In the case of the *Anti-Money Laundering and Counter-Terrorism Financing Act 2006*, the section 5 definition of 'digital currency' specifically excludes digital representations of value 'issued by or under the authority of a government body.

systems where code development and execution is controlled by system administrators. One risk that is difficult to mitigate is that bugs introduced by users could affect the availability and integrity of the overall platform. Administrators could enforce user testing and third-party code reviews to mitigate this risk. But it would be impractical to develop formal proofs of the soundness of user-written code (Ethereum Foundation 2023). As with the tension between privacy and speed, technology will likely evolve in this area to help mitigate any risks posed by programmability. In the meantime, central banks may need to restrict programmability features provided to users in a CBDC, or at least ensure most of the programming is conducted off-platform, so as not to threaten system security.

3.6 Other considerations

This section discusses several other issues that would need to be factored into CBDC design decisions, but which are still in the early stages of research and thinking. Forming a better understanding of these issues will be an important part of the RBA and Treasury's future CBDC work program.

3.6.1 Financial and environmental costs

Issuing a CBDC, especially one for retail purposes, would involve material financial costs. The RBA, for instance, would need to devote resources to setting up and running the core infrastructure. The private sector would need to integrate a CBDC into their existing systems and operational processes. There would be an environmental footprint as well, such as through the energy consumption of new data centres. These costs, as well as the risks associated with CBDC issuance, need to be weighed against the potential benefits of CBDC to ensure any decisions about issuance are made in the public interest. Working in the reverse direction, understanding the sources of different financial and environmental costs is also necessary for identifying the CBDC designs that offer the best value for money.

Though there is still a lot of work to do to form a better understanding of these costs, two aspects are already clear:

1. *The size of the financial costs would depend heavily on CBDC design and are likely to be significant.* For example, in a recent ECB call for applications to develop components of a potential digital euro, the estimated cost for developing the offline capability alone was more than all of the other components for tender combined (ECB 2024b). The aggregate costing range was €430 million to €1.2 billion, which excluded many sources of major cost, including staff expenses at the ECB and the costs for the private sector to integrate a digital euro into their systems and business practices.
2. *The size of the environmental footprint would also depend heavily on design.* For example, Arvidsson *et al* (2024) highlight that decisions about the degree to which control and backup of the ledger are centralised in the central bank (as opposed to being distributed across some external entities) would have a big impact on the electricity consumption of a retail CBDC.

3.6.2 Cultural considerations

Previous work and recent RBA discussions with the academic community have highlighted that different cultural groups in Australia can have very different payment behaviours and needs. These differences might relate to some of the considerations already discussed in this paper (such as financial exclusion and preferences for privacy) as well as others.[25] Policy decisions regarding the issuance and design of a

25 For examples relating to Australian indigenous communities, see Thomas *et al* (2023); Treasury and RBA (2011).

retail CBDC would need to be respectful of those differences and be careful not to introduce any cultural disadvantage. Ideally, a retail CBDC would be a tool to help reduce cultural disadvantage.

Future work will need to explore these issues in more detail. This could draw on some of the same strategies used by the RBNZ, such as targeted consultations (GravitasOPG and One Picture 2023) and plans to give communities opportunities to design retail CBDC features to meet their own needs (RBNZ 2024).

3.6.3 Merits relative to other forms of government intervention

Fundamentally, the potential benefits of retail CBDC all involve the government directly providing a new service (the CBDC) to meet a policy need or opportunity. But these potential benefits might also be achievable with other approaches, such as facilitating, regulating or otherwise incentivising private issuers of money to do so. The merits of pursuing the CBDC solution therefore depend on how it compares to these alternatives. This consideration is especially relevant for three of the potential CBDC benefits that have been discussed in this paper (Box E).

Further work will need to consider the merits and drawbacks of CBDC alternatives. This work might draw on similar policy debates in the energy, healthcare and transportation industries (see, e.g., Berger-Thomson, Breusch and Lilley 2018), although considerations specific to the provision of money are also likely to matter.

Box E: CBDC objectives that could be met with other forms of government intervention

Supporting minority groups with specific accessibility requirements. Instead of meeting this need with the direct government provision of CBDC, there are policy possibilities that involve incentivising the private sector. Moreover, in similar situations outside of payments, there are precedents in Australia for both types of approaches. For instance, Aboriginal Hostels Limited (AHL) is an Australian Government agency committed to the direct provision of culturally appropriate short-term accommodation to First Nations people who need to live away from country to access key services (AHL, undated). This entity exists among other private providers of more generic hostel services. By contrast, the Government's Regional Connectivity Program uses grants to incentivise the private provision of telecommunications infrastructure for remote communities (see Australian Government Department of Infrastructure, Transport, Regional Development, Communications and the Arts, undated).

Improving payments system resilience. Resilience is a policy objective in Australia where any key piece of infrastructure is involved. In most settings, government interventions to improve and sustain resilience usually take the form of regulation, with the regulation of the Australian banking system being a notable example. There are, however, also instances of direct service provision. One example is Snowy Hydro Limited, which operates under expectations to 'enhance reliability and energy security and … lower prices for consumers through the promotion of competition in wholesale and retail energy markets' (Australian Government 2021). Another example is the Reserve Bank Information and Transfer System (RITS), which is Australia's real-time gross settlement system for high-value payments, as well as several other types of payment. It is owned and operated by the RBA, with an objective of ensuring safe and efficient settlement (RBA, undated-b).

Offering different payments privacy. Improving the privacy of Australians is a policy focus in many settings inside and outside of payments. Historically, the preferred approach has typically focused on

strengthening privacy regulation, rather than direct government provision (see Australian Government 2023). The Australian Government's Digital ID initiative is a significant counterexample though.

4. Assessment and Future Work Agenda

There are many potential benefits and costs to consider regarding the issuance of a retail CBDC, and considerable uncertainty around many of the issues. For example, is a retail CBDC needed to support the uniformity of money? What would be the implications for cash use and access? Does the public have a right to hold digital state-backed money? And from an efficiency standpoint, how would it compare with other forms of government intervention (such as those discussed in Section 3.6.3) that might achieve broadly similar objectives? Reflecting this uncertainty, forming a position on whether issuance of a retail CBDC would be in the public interest requires careful judgement.

The RBA and Treasury's current assessment is that a clear public interest case to issue a retail CBDC has yet to emerge in Australia. This assessment is partly informed by the observation that Australians are generally well served by the capabilities and resilience of our current retail payments system. However, the RBA and Treasury remain open to the possibility that this assessment could change over time as the benefits and costs of retail CBDC are better understood, both internationally and in a domestic context.

Issuance of a wholesale CBDC in Australia could represent a more incremental change to the status quo, since there already exists a digital form of central bank money for wholesale use in the form of ESA balances. Therefore, relative to retail CBDC, there are likely to be fewer new issues and uncertainties to resolve. Moreover, the current assessment is that wholesale CBDC has potentially more tangible benefits and use cases, and so from a relative point of view, it is a more promising topic for further applied research.

As discussed earlier, the most compelling of the potential benefits of wholesale CBDC is to support innovation in wholesale markets, especially the tokenisation of asset markets. As observed internationally, industry participants in Australia are actively exploring the potential for asset tokenisation for a variety of reasons, including its potential to increase efficiency in the issuance and trading of assets, reduce settlement risk, and reduce reliance on intermediaries. The existing and potential markets that could conceivably be tokenised are collectively large, so the benefits could be far reaching (Jones 2023a). And given that it is safest to conduct asset settlement in central bank money where practicable − a point recognised in the Principles for Financial Market Infrastructures (CPSS-IOSCO 2012) − it would be desirable for such settlement to also be supported in tokenised asset markets, especially those that have prospects of becoming systemically important. The RBA is currently undertaking research to understand the role that different forms of digital money and associated infrastructure could play in supporting the tokenisation of asset markets.

The main area of uncertainty relates to how best to support the tokenisation of asset markets. One set of questions relates to technology. Would it be better to issue a wholesale CBDC, upgrade the infrastructure underlying ESAs, or some combination of these approaches? A separate issue relates to access to wholesale forms of money. Would access need to be expanded beyond institutions that currently hold an ESA to realise the benefits and, if so, to which entities and what would be the implications of widening access?

Given the various questions that remain, the RBA and Treasury will continue to pursue an active and multi-faceted work program on CBDC over the coming years. This will comprise a number of initiatives, summarised in Table 2, including:

- **Public engagement on retail CBDC.** A retail CBDC would be a digital form of money designed to be held directly by the Australian public. Reflecting that, it will be important to better understand the public's needs, preferences and concerns relating to CBDC.

  While one approach internationally has been to open this engagement by publishing a consultation paper that solicits public responses on CBDC, central banks that have taken this route have subsequently highlighted some important limitations with it. Some policymakers found the consultation paper approach a difficult way to obtain a representative range of views that addressed the desired issues (ECB 2021; RBNZ 2021; Bank of England and HM Treasury 2023). This is not helped by the complexity of the topic and related policy trade-offs, which can be a barrier to the general public initially engaging on the issues that policymakers are typically most interested in better understanding. Reflecting this international experience, the RBA and Treasury are considering alternative approaches to public engagement on retail CBDC in Australia.

  One approach, which may be better suited to obtaining views on a complex topic like retail CBDC, would be to conduct 'deliberative workshops' over a period of time with groups that are either representative of the broader Australian population or of particular interest groups.[26] Other central banks have also drawn on deliberative methods for some of their CBDC research; examples include the consultations conducted by Kantar Public (2022; commissioned by the ECB) in the euro area, and GravitasOPG and One Picture (2023; commissioned by the RBNZ) in New Zealand. This deliberative engagement approach could be complemented over time by representative surveys, such as the RBA's existing biennial Consumer Payments Survey, following a period of education outreach. The RBA and Treasury will continue to explore consultation options, with a view to undertaking some form of public engagement on retail CBDC in 2025.

- **Industry and academic advisory forums**. Though industry and academic participants have been consulted on a range of CBDC issues over recent years, the RBA and Treasury are committed to convening regular CBDC advisory forums in the period ahead. These would provide an opportunity for more systematic engagement with experts from industry and academia on all aspects of retail and wholesale CBDC and would play a similar role to external forums the RBA already convenes to gather views on monetary policy. A plan for these forums will take shape over the next six months, with a view to launching them in the first half of 2025.

- **Further research and experimentation, including with industry**. Much of the RBA and Treasury's understanding of the merits of retail and wholesale CBDC has been advanced through experimentation and conceptual research, with many of the results summarised in this paper. This includes purely internal work, as well as collaborations with academia (such as in Fairweather *et al* 2024), domestic industry participants (such as in RBA and DFCRC 2023), and policymakers overseas (such as in BIS Innovation Hub *et al* 2022). These research efforts will intensify over the coming years. In relation to retail CBDC, in addition to further exploration of potential benefits and use cases, there is likely to be a heightened focus on exploring different possible design characteristics, including their trade-offs. Some of the topics that are likely to feature in this future research program include:

26 Escobar and Elstub (2017) offer an introduction to these methods.

- how a two-tier distribution model for a retail CBDC could work in practice, including the relative roles of the private and public sector
- how the design of a CBDC platform could support innovation and competition in the payments market
- technological feasibility and policy implications of offline functionality
- privacy and data-sharing design options and policy implications.
- identifying appropriate policy options for the preservation of financial stability, including the calibration of potential holding limits.

The results of this research program will be summarised in a further paper the RBA and Treasury will prepare in 2027 examining the merits and potential form of a retail CBDC.

In relation to wholesale CBDC, near-term work as part of Project Acacia will involve further exploration of the role that different forms of money and associated infrastructure could play in the settlement of tokenised asset transactions. Building on the success of the 2023 CBDC pilot research program, this initiative will involve close engagement with industry. Treasury will also continue to progress related reforms including asset tokenisation and identifying barriers and potential benefits.

There will also be a continuation of the large program of international work to enhance cross-border payments, including the role that new forms of money could play (such as outlined in BIS Innovation Hub (2024)). As part of this work, the RBA will look to engage in collaborative research with other central banks.

- **Stepping up engagement with peer jurisdictions**. Policymakers in several peer jurisdictions – most notably the euro area, United Kingdom, Sweden and New Zealand – are moving into advanced stages of retail CBDC planning. There will be much to learn from their experiences, especially if any of that planning results in the first issuance of a retail CBDC in an advanced economy. The same applies to jurisdictions where the market and regulatory framework for stablecoins is maturing quickly. There are likely to be lessons about the promise of potential alternatives to retail CBDC.

  Likewise, policymakers in several peer jurisdictions are also conducting projects exploring different approaches for settling tokenised asset transactions using central bank money.[27] The RBA and Treasury will step up engagement with relevant policymakers internationally to ensure that CBDC research learnings from abroad are appropriately reflected in the research program in Australia. This includes the ongoing work on wholesale CBDC and will also feature in the updated paper by the RBA and Treasury on retail CBDC in 2027, by which time it is possible that at least one advanced economy will have issued a retail CBDC.

- **A well-functioning sandbox to pilot CBDC.** The Enhanced Regulatory Sandbox (ERS) is a framework administered by ASIC that provides an environment for unlicensed businesses to test new financial products and services for a limited period of time. Industry feedback suggests that the ERS in its current form has not been successful in encouraging new participants to test new products and services. An upcoming independent review of the ERS will assess whether it encourages competition and innovation in emerging forms of money and payments, including CBDCs. Treasury

27 For example, the Swiss National Bank is piloting a wholesale CBDC for settling tokenised assets on the regulated platform of SIX Digital Exchange (SDX) (see Swiss National Bank 2023). The ECB is also exploring different models for central bank money settlement of transactions on market DLT platforms (see ECB, undated).

will work with Government to consider the recommendations of the independent review and, where appropriate, implement reforms.

Table 2 summarises the key deliverables from our workplan, including indicative completion times.

Table 2: Roadmap of Selected CBDC Research Initiatives of the RBA and Treasury

Initiative	Description	Indicative timing
Project Acacia	Exploring how different forms of digital money (such as ESAs, wholesale CBDC and deposit tokens) could be used to support the settlement of transactions in tokenised asset markets (collaboration with the DFCRC). A further phase of this work will examine the role that new forms of digital money could play in improving cross-border payments, most likely in collaboration with other central banks.	Underway and expected to complete in second half of 2025 From 2026
Industry and academic CBDC advisory forums	Launch advisory forums to engage stakeholders and gather input from industry and academia on our retail and wholesale CBDC work.	From first half of 2025
Public engagement on retail CBDC	Using surveys and deliberative consultation methods to understand public needs, preferences, and concerns regarding retail CBDC.	From 2025
Enhanced Regulatory Sandbox	Work with Government to consider any recommendations of the independent review of the Enhanced Regulatory Sandbox.	From 2025
Retail CBDC considerations paper	Publish a follow up paper on RBA and Treasury thinking regarding the merits and potential form of retail CBDC, including an assessment of the experiences of other jurisdictions.	2027

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