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INVITED PAPER

The Future of Money: Central Bank Digital Currencies

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Abstract This paper examines the rationale behind the exploration by the vast majority of central banks of introducing central bank digital currencies. This phenomenon is discussed in the context of the main drivers of central bank interest, the crucial role of public money in supporting and complementing private money channels, the role of digital ledger technology in facilitating the delivery of both wholesale and retail central bank digital currencies, and innovation in the forms of money that this enterprise represents. The implications for domestic and international monetary system architectures in the immediate, short-term, and long-term will be discussed. It will be argued that the delivery of central bank digital currencies represents an important development in the future of money, and requires agreement of the public following a wide-ranging debate at all levels in society.

Keywords Public money · Central bank · Digital currency · Distributed ledger

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The Role of Public Money

The vast majority of money (90%) used in modern economies is private money, principally issued electronically or digitally via commercial banks. The remaining 10% is public money, principally in the form of cash (paper money and coinage) issued to the public by central banks, with the value guaranteed by the central bank. Private bank money is backed by the central bank in the monetary jurisdiction concerned. What is being considered by the vast majority of central banks around the world is the issuance of electronic money directly to the public, rather than solely through banks and selected other financial institutions.

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For the public, there is inadequate recognition of the crucial role of central banks in ensuring trust in the currency used by the public. This trust anchor role of the central bank, backing private money issued by strongly regulated commercial banks, permits private money to be used throughout a modern economy. This central bank role is linked to the key characteristic of public (fiat) money, namely the ability to be used as an accepted unit of account within a monetary jurisdiction, an essential yardstick against which all commodities may be valued even though money itself is not a commodity (Einaudi, 1937). The other two characteristics of money in an economy, acting as a stable store of value and as a medium of exchange in a fiat currency economy, both rest on maintenance by the central bank of the unit of account function as a standard measure of value. This monetary framework of an economy must be borne in mind when considering why governments and central banks are rightly concerned about the dangers of the recent rapid acceleration in the provision of private digital money by unregulated private issuing companies, such as so-called cryptocurrencies and, later, stablecoins.

Central Bank Motivations

As suggested earlier, both government regulators within specific jurisdictions and central banks have over the past three to four years become aware of the need to act in relation to the proliferation and rapid growth of private money issuance. Although policy stances of the various monetary jurisdictions vary, there is consensus on the need for regulation and on maintenance of the crucial anchor role played by central banks and fiat money, domestically and internationally, if citizens' trust and financial stability are to be secured in a modern socioeconomic environment (Bank for International Settlements (BIS), 2020).

There is one significant split between the motivations of emerging market countries and those of developed countries. For the former, the main motivation is the presence of a substantial proportion of the unbanked among their populations with an 80 to 90% use of smartphones. This represents an ideal situation for the direct issuance of central bank digital currencies (CBDCs) to their populations via smartphone access. In countries such as Africa, this direct issuance can be used for remittances from their citizens working in other countries. In countries with modern, developed monetary systems, with a high proportion of the population having bank accounts, one factor encouraging the introduction of CBDCs is the secular decline of cash usage, together with the existing use of internet banking via computers or smartphones.

One concerning factor motivating central bank interest in CBDCs has been the unregulated, rapid expansion of stablecoins. More specifically, concern was emphasized by the proposed introduction of a Facebook (now Meta) stablecoin, Libra (later evolving into Diem), with a potential global customer base of 2.9 billion. Coupled with the tentative, slow approach by national regulators to dealing with the advent of stablecoins, central banks decided to take the initiative and explore CBDCs. The public misgivings about Diem and about Facebook/Meta more widely, indicating that a Diem stablecoin would not be a welcome innovation, apparently

led to Diem being abandoned by Meta in 2021. No reasons have been given for its demise. Nonetheless, whatever regulations are imposed by states either individually or collectively, it is unlikely that they will be sufficient either to suppress private sector monetary innovation (this would not, of course, be an aim) or non-criminal regulatory avoidance or to prevent regulatory arbitrage between different country jurisdictions (Perks et al., 2021).

More generally, central banks have recognised the opportunities, technological and operational, pioneered principally by the private sector, for new forms of monetary transmission (Barontini & Holden, 2019). These opportunities offer the potential for higher transmission speeds especially across borders, significantly lower costs, and other potential advantages in the monetary environment. The motivation is for a more widely-issued digital money, set in the context of a clearly developing digitisation of economic and social life.

Distributed Ledger Technology

The principal private sector innovation was the application of digital ledger technology (DLT) in the area of private money issuance. DLT has been around for some time and has a number of accounting and other database applications. DLT was defined by the Committee on Payments and Market Infrastructures (CPMI) of the BIS as follows:

> "DLT refers to the technological infrastructure and protocols that allow simultaneous access, validation and immutable record updating to a synchronised ledger that is used by a network of participants that may spread across multiple entities and/or locations. In the context of payment, clearing and settlement, DLT enables entities, to carry out transactions without necessarily relying on a central authority to maintain a single "golden copy" of the ledger" (CPMI, 2017, p. 4).

One potential problem for CBDCs is that immutability is problematic, except where there is a comparatively small set of validating partner nodes on the network, such as a group of regulated commercial banks.

In monetary terms, DLT came to prominence via Bitcoin's use of blockchain, a subset of DLT. The problem, from the technology perspective of central banks, was that the public, permissionless, distributed system was sealed. In other words, trust was confined in terms of management to those holding Bitcoins, with Bitcoins earned only via a complex cryptographic system by proof of work. Indeed, the originator of Bitcoin, Satoshi, intended the system to be almost impervious to penetration by the public authorities. Moreover, despite the name, Bitcoin should not be considered money as it is not a universally accepted unit of account. Its extreme volatility prevents it from being used as a general medium of exchange. Given that only a fixed maximum value of Bitcoin will be created, $21 million, eventually it may be accepted as a store of value like gold.

Many other private cryptocurrencies have been created without the need for proof of work, as the entitlement to receive the monetary units is based on proof

of stake. Over the past two years, an increasing number of cryptocurrencies have been launched that have pegged their value to the value of the U.S. dollar, so-called stablecoins. These private cryptocurrencies, based on DLT networks, have been seen by central banks as a meaningful threat to the use of public fiat currencies backed by central banks. However, for the unregulated issuers of stablecoins, there are problems with the nature, quality, quantity, and volatility of the reserves holding the pegged value. In May 2022, UST's stablecoin, the fifth most widely used, was unable to maintain its peg to the dollar (Browne, 2022). This also led to a collapse in value of other cryptocurrencies, including Bitcoin.

Notwithstanding the interest of central banks in the use of DLT networks for CBDCs, central banks are circumspect about how they might avail themselves of the potential advantages of DLT. Most experimentation with DLT networks by central banks has been associated with using CBDCs in large cross-border financial transfers. The core requirement for central banks (the CPMI definition of DLT provided earlier) is that there is a shared synchronous ledger. As is sometimes the case with experimental networks used in central bank projects (discussed briefly in the next section), these are referred to as blockchains or as distributed ledgers.

DLT offers several advantages, though with some offsetting disadvantages (Kannengießer & Lins, 2020). Currently, there are a relatively small number of DLT products suitable for CBDC usage, though no doubt others will emerge. Examples include Corda, Hyperledger, and Quorum.

Retail CBDC Projects

There are a growing number of retail-CBDC projects looking at how CBDCs might be delivered to the public, including non-financial corporations and institutions, in the form of either digital cash (tokens) provided directly to the citizen or via customer accounts held with regulated financial intermediaries, principally commercial banks. The projects vary from proof-of-concept projects to the actual delivery of CBDCs. There is insufficient space to describe in greater detail any of these projects, though their objectives will be mentioned and whether the selected projects have met these objectives.

The "early risers" were China, Sweden, and The Bahamas. These are briefly described to illustrate the potential for introducing CBDCs. The People's Bank of China (PBOC) began a proof-of-concept study in 2014. Since 2020, China has piloted the digital Yuan (now e-CNY), deploying the e-CNY at the Winter Olympics in February 2022. According to the PBOC as of 30 June 2021 (PBOC, 2021), e-CNY were applied in over 1.32 million scenarios, covering utility payments, catering services, transportation, shopping, and government services. More than 20.87 million personal wallets and over 3.51 million corporate wallets were opened, with transaction volume totalling 70.75 million and transaction value approximating renminbi (RMB) 34.5 billion.

Sweden's Riksbank commenced the first active phase of its pilot study in 2019 and its second phase was completed in early 2022. The interesting feature of the Swedish testing is that it has both tested a direct token-based approach and used DLT. Although the technical network solution worked in an advanced economy, for short transaction

chains, longer chains presented problems, for example with automated redemptions, and technical adjustments to resolve the problems have not yet been explored. DLT technology also raises questions about how the platform can meet legal requirements. Such work highlighted the importance of regulatory frameworks and cooperation with payment market players if an e-krona is to be established in retail trade. Nonetheless, the pilot study demonstrated, in practical terms, how the network could use existing hardware in the market today to handle card network payments, and provide a good basis for the Riksbank's continued work on the design of and requirements for a possible issuable e-krona (Swedish Riksbank, 2022).

In 2019, the Bahamian Central Bank launched the Exuma pilot, expanding to Abaco in 2020. Exuma comprises Great Exuma and its surrounding cays (islands). The Bahamian Central Bank considered Exuma as best representing the main configuration of The Bahamas, making it the optimal site to begin pilot testing before scaling up operations to the entire country. About 96% of surveyed Exumians owned mobile devices, and approximately 40% used such devices to perform some form of bill payments or online banking transactions. Close to two-thirds of respondents disclosed a willingness to use mobile devices for payments or commercial transactions in the future.

On October 20, 2020, the Central Bank of The Bahamas took the Sand Dollar from pilot to production in a national rollout, which made CBDC available to the general public (Central Bank of The Bahamas, 2021). Public access to the Bahamian digital currency increased during the first quarter of 2021. All authorised wallet providers will offer interoperable Sand Dollar services. This means that both enrolled businesses and individuals will be able to send funds to and receive funds from any other digital wallet once the transaction is in Sand Dollars.

Other central banks in Thailand, Nigeria, and the East Caribbean conducted pilots and the latter two launched CBDCs. Preliminary work was also commenced by the European Central Bank (ECB), the Bank de France, the Bank of England, and later in the U.S., involving the Boston Federal Reserve and Massachusetts Institute of Technology. Initial reports were published on these projects (Project Hamilton, 2022).

This list is by no mean comprehensive, given the exploration of retail CBDCs by well over 80 central banks around the world, but indicates the momentum behind the developing consideration of CBDCs. However, a cautious approach is being taken in the advanced monetary economies, given concerns expressed by politicians, commercial banks, and other commentators.

Retail CBDC Designs for Potential Implementation

Some of these concerns will likely be addressed as developed economies move towards consideration of account-based CBDC designs, rather than direct digital cash or token-based designs, favoured by emerging market countries and experimented with in the Swedish pilot study. There are essentially four designs available for delivery of retail CBDCs (BIS, 2020), involving operational and technological choices (Dashkevich et al., 2020). Each of these models could involve the use of tokens (digital cash issuance) or account-based issuance, the most likely to be selected.

Design 1 is the direct model. This is the one adopted to a degree by the emerging market economies whose population is dispersed geographically, often across islands, with a large proportion of the population being unbanked. The Bahamas is an example. The model involves the central bank issuing and distributing digital cash, in the form of electronic tokens, directly to those with smartphones into digital wallets held on the smartphones, though also providing an offline option via a physical card system or by utilising Bluetooth connections between two separate phones. This model design is unlikely to be favoured by modern market economies.

At the opposite end of the design spectrum is the indirect model. In contrast, this model still involves the central bank issuing the digital currency, but it is distributed indirectly via commercial banks and other regulated financial intermediaries. Added to this indirect issuance is a singular difference when compared to any other CBDC design model, in that there is no direct claim of the account holder on the central bank. This distinction led the International Monetary Fund (IMF) to question whether the model is a CBDC. Notwithstanding this comment, and as the BIS and others have argued, digital money is still issued by the central bank and is, therefore, a CBDC. Insofar as this model might be adopted by central banks, the customers would not notice any difference compared with the contemporary monetary system.

The next model is termed a hybrid model and, as the name implies, combines the characteristics of both the direct and indirect models. In a hybrid CBDC, the model splits the payment system, with the commercial banks (or other financial intermediaries) managing the retail transactions, but the central bank keeping a ledger recording the retail transactions, with again a direct claim by the customer on the central bank. This is the model apparently operated by the PBOC in China.

A key underpinning element of the hybrid CBDC model is the legal framework that segregates the claims on the CBDC from the balance sheets of the commercial banks or financial intermediaries. This segregation permits the separate CBDC holding and management to be transferred to another financial intermediary in the event of the failure of an intermediary, protecting it from the creditors of the failed company. Technologically this is possible as the central bank retains on its ledger a copy of the CBDC retail holdings and transactions.

The fourth model design, the one favoured by the BIS as most likely to be widely adopted by central banks, is the intermediated model design. Similar to the hybrid CBDC model, the private sector financial intermediaries, principally commercial banks, manage the retail transactions. However, in this model, the financial intermediaries also maintain the ledger containing a record of all retail transactions. The central bank maintains a central ledger of only the corresponding wholesale transactions, matching the retail activity. Again, there remains a direct CBDC user claim on the central bank.

Aside from the fact that the CBDC consumer or client retains a direct claim on the central bank, this model operates in the same way as the familiar two-tier, wholesale CBDC system, with the account-holding commercial bank or financial intermediary holding the Know Your Customer (KYC) authentication and executing all retail payments and account management, including maintenance of a retail transactions ledger. The role of the central bank in this model is simply to maintain a wholesale-payments mirror ledger record, corresponding to the retail balances kept

by the commercial bank or financial intermediary, thus ensuring final settlement, as is done in the prevailing monetary architecture.

If central banks decide to use DLT for database recording, it is likely that this would be hidden from the public, including the intermediaries and final customers. by an application programming interface (API). This would lead to a two-layer structure, with a user-friendly application being provided separately for public access. This structure is already used in the East Caribbean CBDC model and is also favoured by the Bank of England.

Impacts on Commercial Banks and Customers

There is little doubt that the institutions most affected by the launch of CBDCs will be commercial banks. In the current monetary system framework, the developed cooperative relationship between the central bank and commercial banks enables a secure, trusted, and efficient payments system. The credit system enables the offer of loans to creditworthy customers, including businesses, to facilitate economic growth. The ability of commercial banks to create deposit liabilities to match their loan assets is facilitated by these deposit liabilities also appearing as reserves on the liabilities side of the central bank balance sheet.

Concern has been raised that the issuance of CBDCs may result in pressure on commercial bank deposits such that disintermediation may occur. A United Kingdom (UK) House of Lords report (House of Lords, 2022) depicted a worst-case scenario about the potential of CBDCs to cause a proportion of customers to transfer money out of their existing bank deposit accounts into their CBDC wallets. This action would weaken the balance sheets of commercial banks, thereby increasing the size of the central bank's balance sheet.

In practice, the impact for commercial banks will depend crucially on the retail-CBDC design selected by the government and the central bank for delivery of the CBDCs. This modality will also be influenced by how customers react to having both private money deposit accounts and CBDC deposit accounts. If the latter are used mainly as current or checking accounts, then the disintermediation impact may be minimal.

Uncertainty about the level of disintermediation is extreme. A Swiss National Bank (SNB) study in November 2021 (Li, 2021) suggested that the percentage moved from commercial banks accounts to CBDC accounts could range between 4 and 52%, depending on whether customers regard CBDC accounts as being closer to cash or to deposits.

Essentially, until specific-use cases are tested for specific retail CBDC designs, there is no way with any degree of certainty to predict the impacts. Given the other advantages of CBDCs and the ability of commercial banks to offset impacts, though at some costs that may be reflected in possibly higher customer loan charges, it seems appropriate to proceed without undue concern about disintermediation.

The role stablecoins could play in terms of co-existing with retail CBDCs has yet to be resolved. In the U.S., there certainly appears to be a desire to regulate stablecoins as an enabling mechanism to permit the issuance of digital currency in the

form of accounts, side by side with commercial banks. Effectively, this may lead to the adoption of a narrow banking approach as competitors to commercial banks (Liao & Caramichael, 2022). However, in several other global monetary jurisdictions, stablecoins seem unlikely to play a role. It is also possible that large financial and other corporations may wish to use stablecoins for transfers between branches and subsidiaries.

Wholesale CBDC Projects

The most intensive project work by advanced market economies' central banks has been in the arena of international cross-border financial payments, with the use of wholesale-CBDCs utilising fiat currencies. Indeed, via its BIS Hong Kong Innovation Hub, the BIS is supporting the m-Bridge multi-currency wholesale CBDC prototype project, involving the four central banks of China, Hong Kong, Thailand, and the United Arab Emirates. Several cross-border wholesale CBDC projects other than the m-Bridge project (Jura, Dunbar, and Helvetia) have all shown promising results, involving also commercial banks and other financial institutions.

The reason for this concentration of effort has several motivations. Related specifically to the rapid increase in stablecoin development, the first motivation is concern about increased international financial instability if stablecoins are used for a significant amount of large-scale cross-border financial transfers. Second, is the advantage that the use of DLT in these projects offers to central banks, which is the ability to establish multi-currency (fiat) use of Real Time Gross Settlement (RTGS) systems in a cross-border environment, with significantly reduced costs and increased transfer speeds. Third, this approach will enable central banks using public, fiat money to ensure control and financial stability over large-scale financial transfers, across large regional trade and investment areas, via wholesale CBDC issuance.

The latest (January 2022) central bank project (Project Helvetia, 2022) to report on wholesale CBDC (wCBDC) cross-border payments technology, using fiat currencies and tokenised assets, is Phase II of Project Helvetia This project is monitored by the BIS Innovation Hub and involves the SNB, CitiBank, Credit Suisse, UBS, and the Hypothekarbank, Lenzburg. Phase II extended consideration of the practical complexities, legal questions, and policy implications of issuing a wCBDC.

Regional CBDC Initiatives and Digital Currency Areas

As indicated, the exploration of cross-border wholesale CBDCs is taking place in a regional or supra-regional area context. This setting opens up the possibility of expanding the use of a single digital currency across several geographically contiguous, or even non-contiguous, monetary jurisdictions. Indeed, in the initial thinking on its CBDC, e-CNY, China considered this possibility, linking it to trade payments. At this early juncture, small and large countries are considering CBDCs as a means of launching their own CBDC systems, both retail and wholesale cross-border, in terms of their own fiat currencies. Indeed, it would provide a clear statement of

sovereign independence for a country. However, the choice is not simple or clear (Brooks, 2021).

In countries that are currently subject to dollarisation, there are benefits from having an alternative currency to act as a store of wealth, especially when the stability of the host country's monetary system is weak. However, in the longer run, such dependence may hamper the possibility of achieving adequate financial development (Bannister et al., 2018). It is a question for emerging market countries, especially those who may want monetary sovereignty, but are perhaps too small to be able to operate their own currency in international markets.

Another relevant factor that may apply to monetary jurisdictions that are part of large supra-regional trading organisations is the potential desirability of using the dominant trading currency for payments purposes, especially cross-border payments. If the dominant currency is issued as a CBDC, then substitution of this digital currency for national currencies may become attractive. Loss of monetary sovereignty is a country with weak institutional structures may actually benefit from currency substitution. It is an argument used to justify the 22-year dollarisation of Ecuador. However, if currency substitution was on a wider regional basis, whether legally agreed (as is the case now in the Euro Area) or by formal agreement (as in Monaco, Andorra, or *de facto*, as in the case of Montenegro and Kosovo), then potential digital currency areas (DCAs) would also be viable.

These potential extensions suggest that the advent of CBDC issuance by large monetary jurisdictions, such as the European Union (EU), the U.S., or China, with extensive trade linkages across their geographical supra-regions and beyond, may lead to sizeable DCAs (Brunnermeier et al., 2021) being created. These, DCAs would be held together not only by trade, but also by digital interconnectedness. Should these wide DCAs develop, they may provide a tempting alternative for several emerging market countries as opposed to initiating their own fiat currency CBDCs. The increasing regionalisation of trade integration and financial integration, especially in the Asia–Pacific region and the Euro area, points in this direction as do parallel attempts by the U.S.

As already indicated, China has led in terms of launching wide piloting of its CBDC, the e-CNY. Accompanying this initiative has been the establishment of a Blockchain Service Network (BSN) that will also, initially in Asia, support the adoption of the digital currency. In September 2021, BSN began operating in Korea (Ledger Insights, 2021). A key focus is to try to create interoperability between different blockchain offerings, currently covering over 100 nodes in 80 Chinese cities, where infrastructure is provided for smart city technologies.

BSN has also been installed in at least eight cities abroad, and attracted cooperation from Google, Microsoft, and Amazon web services, although most of the BSN infrastructure is hosted on China-based cloud providers. The network is also integrated with some of the largest public blockchain networks, including Ethereum, EOS (Electro Optical System), Tezos, Hyperledger, and ConsenSys Quorum. The intention is for BSN to work towards getting blockchains to communicate in the same manner that computer networks interact using internet protocol. The BSN is proposed as an international standard.

The U.S. has started to express some concern about this development, suggesting that.

> "a successful BSN could threaten U.S. dominance in these areas. —- If successful over the long term, the digital yuan could threaten the economic and strategic interests of the United States. —— A digital yuan in global circulation and a China-dominated blockchain infrastructure would go a long way toward cementing Beijing's economic influence and soft power around the world" (Murray, 2021, p. 1).

The potential for China to extend its e-CNY across the Asia–Pacific supra-region, and perhaps also across several African countries where it dominates in relation to smartphone networks, as a wide-ranging DCA is obvious.

However, aside from the secular drift of trade toward becoming more strongly regionalised, there is also the desire of monetary authorities across many jurisdictions to ensure that potential provision by private stablecoin operators does not threaten regional and global financial stability. One way in which this may be achieved (BIS, 2020) is to develop the use of wholesale cross-border CBDCs, with collaborating central banks across regions and supra-regions, as a clear public-good alternative to private unregulated stablecoins.

International Dimension

The global financial architecture never fully recovered from the impact of the Global Financial Crisis (GFC). The composition of global reserves changed markedly. In 2007, the IMF Special Drawing Rights (SDRs) represented around 90% of the total, falling to 25% in 2020. Bilateral swap lines (BSLs) grew to 45% in 2020. Two significant lines were those provided by the U.S. Federal Reserve, but other regional reserves and provisions (30%) were available via other structures, such as the Chiang Mai Initiative Multilateralization covering many members of the Association of Southeast Asian Nations (ASEAN) and led by the ASEAN + 3 (Thailand, Malaysia, Indonesia, Singapore, the Philippines. Brunei, Vietnam, Cambodia, Myanmar, and Laos. + China, Japan, and Korea) (CMIM, 2017, 2021). Concerned about the lack of conditionality in these arrangements and to strengthen the effectiveness of the Global Financial Safety Net, the IMF proposed, perhaps not surprisingly, that BSLs be accompanied by an IMF-supported program to help the recipient country address its balance of payments needs (Perks et al., 2021).

However, what the situation points to more importantly is the absence of any global reserve currency. Notwithstanding the current major role still played by the U.S. dollar as a "stand-in" reserve currency (it represents 60% of the total foreign currency reserves of all central banks), the international position is inherently unstable in a world of substantially changing global trade patterns. At some point, reform will be necessary. It should be noted that the position of the U.S. in this respect is less challenged by China, or even the EU with 20% of foreign exchange reserves held in euro, than by a steady chipping away by a variety of other small jurisdictions with bilateral reserve holdings of 12% (Arslanalp et al., 2022). China has made no secret of its preference for an international trade and monetary system that is not

reliant on one dominant country. Their long-term view was articulated in 2009, by the then Governor of the PBOC, Zhou Xiaochuan, suggesting the need for an "international reserve currency" to "secure global financial stability" (BIS, 2009, p. 1).

Notwithstanding the fact that, at this point in time, the potential for the development of wide-ranging DCAs is speculative, the effort being put into cross-border CBDCs by the BIS and several central banks, suggests some examination of how supra-regional DCAs might develop over the next decades to secure stronger global financial stability. Starting with the U.S., despite its laggard progress so far in relation to the establishment of a CBDC, the U.S. dollar is used as the main currency (dollarisation) in 13 jurisdictions, and 10 more where it is a significant secondary currency. Many of these jurisdictions would qualify as being in a U.S. supra-region, though not all. The potential to create a digital dollar DCA is manifest.

Clearly, the EU and its extended euro area, including the wider Single Euro Payments Area (SEPA) with 36 member countries, is already evincing a positive positioning on the establishment of a DCA, based on a digital euro. Its evolution to a large supra-regional DCA, especially given its importance as a trading bloc, is an obvious route.

Equally, China, with its leading CBDC position with the e-CNY and immersion in the ASEAN economic area and the Regional Comprehensive Economic Partnership (RCEP), is already a leading member of a supra-region. With extension via the Belt and Road Initiative trade routes and accompanying Digital Silk Road, China is already in prime position to establish a large DCA.

These three prospective DCAs alone would cover a considerable number of the major jurisdictions worldwide. If there were three globally dominant DCAs covering the three major supra-regions and their tributary jurisdictions, the stage might be more readily set for agreement on an independent global unit of account. If this appears somewhat utopian, recall that intensifying global cooperation must occur in order to deal with climate change. Eventually, similar collaboration will be required to establish a stable global financial and monetary architecture. This is not to suggest that such an outcome is currently on the horizon, but major global policy shifts will be required over the next 25 years. This is one area where reform is overdue. Nonetheless, several substantial monetary, economic, and political hurdles must be overcome for it to become a reality.

Future of Money: The Next Decade

The importance of the progress made by central banks in pursuing CBDCs should be seen as a major innovation of the monetary systems in the countries that are already involved and those to follow, and a modification in the future of money. The next decade is likely to witness a considerable expansion in the number of central banks launching wholesale and retail CBDCs.

The initial expansion is likely to be in cross-border wholesale CBDCs, developed from the BIS prototype multi-currency w-Bridge platform, in conformity with an international standard. The use of DLT network infrastructure is likely to underpin these monetary systems. Such systems should see gains in both the speed of transactions and, importantly, a substantial reduction in costs. The

majority of large value cross-border transfers will be made in this manner, involving central banks, commercial banks, and other financial intermediaries. These effectively linked multi-country RTGS systems are likely to involve supra-regions that may extend internationally (DCAs), following regionalisation of global trading and investment patterns. This development will improve global financial stability and, eventually, could lead to the inauguration of a genuine global reserve unit of account. However, there are several monetary, economic, and political hurdles to be overcome if such a position can be reached.

Retail CBDC implementation will be slower to emerge, notwithstanding the several already launched CBDCs in emerging market countries, motivated by enfranchising the unbanked, facilitating remittance payments and, of course, China. In modern developed economies, there will be hesitancy related to attempting to ensure the take-up of digital money by the public and adequate involvement and protection of commercial banks. Incremental launching of retail CBDCs over the next five to ten years or so in these countries may involve only limited application of DLT. Moreover, it seems unlikely that any major issuance of digital cash (tokens) to the public will occur, given the need to ensure that privacy is secured. Therefore, issuance in these countries will principally be via account-based CBDCs, using commercial banks and possibly other regulated financial intermediaries. In the U.S., it seems likely that stablecoin issuers will be involved in the delivery of CBDCs to the extent of their ability to become "narrow banks", though only after being regulated.

There are some advocates of the view that private money and public money are, effectively, direct equivalents (Waller, 2021). Private money almost by definition is not a public good. Public money is intrinsically a public good. For full societal trustworthiness, private money has to be backed by public money issued by the state. Of course, private money may co-exist with public money as it does now via its issuance through regulated commercial banks, whose ultimate probity is guaranteed by the state.

What seems clear and necessary, in relation to this debate, is maintenance of a crucial role for public fiat money and the trust-anchor role of central banks in maintaining public trust in the monetary system architecture as societies transition to using digital forms of money. Public guardianship of the stability, security, and trustworthiness of the monetary system will be a fundamental demand of the public for the new era of digital money to be delivered.

Globally, the underlying fragility of the global monetary system may be eased initially by the ability to use wholesale CBDC to facilitate currency transfers at regional and supra-regional levels. In the longer-run, assuming political policy barriers can be overcome, there is the potential for the new digital monetary system to eventually deliver a global reserve unit of account along the lines of Keynes 1944 Bancor proposal. (Kregel, 2021).

Of course, whether the widespread innovation of CBDCs takes place is a political, not simply a technocratic, issue. Therefore, it is important that the modalities and impacts of all aspects of this major technocratic shift in the nature of money are carefully explained to the public and thoroughly debated and discussed at all levels. The proposed changes to the monetary system architecture require full understanding of, and acceptance by, the public.

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