

# The (R)evolution of money III: CBDC is here, careful design needed now

DLT Empowered Digital Currencies

# Foreword

Central bank digital currency (CBDC) has been catapulted from a remote concept to the core of the global economic policy agenda during the past twelve months. The debate about CBDC has advanced towards the adoption of CBDC and its implications for the financial system, in particular its impact on international payments. There has been consensus in the CBDC debate about issuance and distribution, and the focus is now on access policy, legislation, models for privacy and security, interoperability and integration. Accenture is actively engaged in CBDC projects around the world, including the central banks of France, Sweden, Switzerland and South Africa, and can offer a unique perspective on CBDC build and implementation work.

The adoption of CBDC is highly probable. Though the timing remains uncertain, the introduction of CBDC as a response to new payment needs and in support of greater diversification, competition and resilience in payments is highly likely. CBDC is set to become “just” another format of central bank money. This adoption of CBDC can be compared to the introduction of modern banknotes as a new payment medium during the nineteenth century.

CBDC expands the functionalities and utility of central bank money and advances new central bank money use cases. This updated report about the (R)evolution of money reviews on-going CBDC project work, offers an overview of the state of the CBDC debate and provides additional insights into the likely direction of CBDC adoption.

Is CBDC needed? Though resistance to and skepticism about CBDC remain, it would be a mistake to limit CBDC to only meeting known needs. This could lead to too reward looking a stance and may miss future relevant use cases. CBDC will endow the financial sector with greater choice and new capabilities. And central banks have an opportunity to shape what's next in payments.

This report targets central banks, commercial banks, financial market infrastructure providers and the general public to serve as background to advance the debate about whether central banks should issue CBDC. It is a complementary document to the [\(R\)evolution of Money I](#) and [II](#) reports of 2017 and 2019, respectively (Accenture, 2019). The topics chosen are not meant to be comprehensive but offer a good overview of the current debate.

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# Introduction

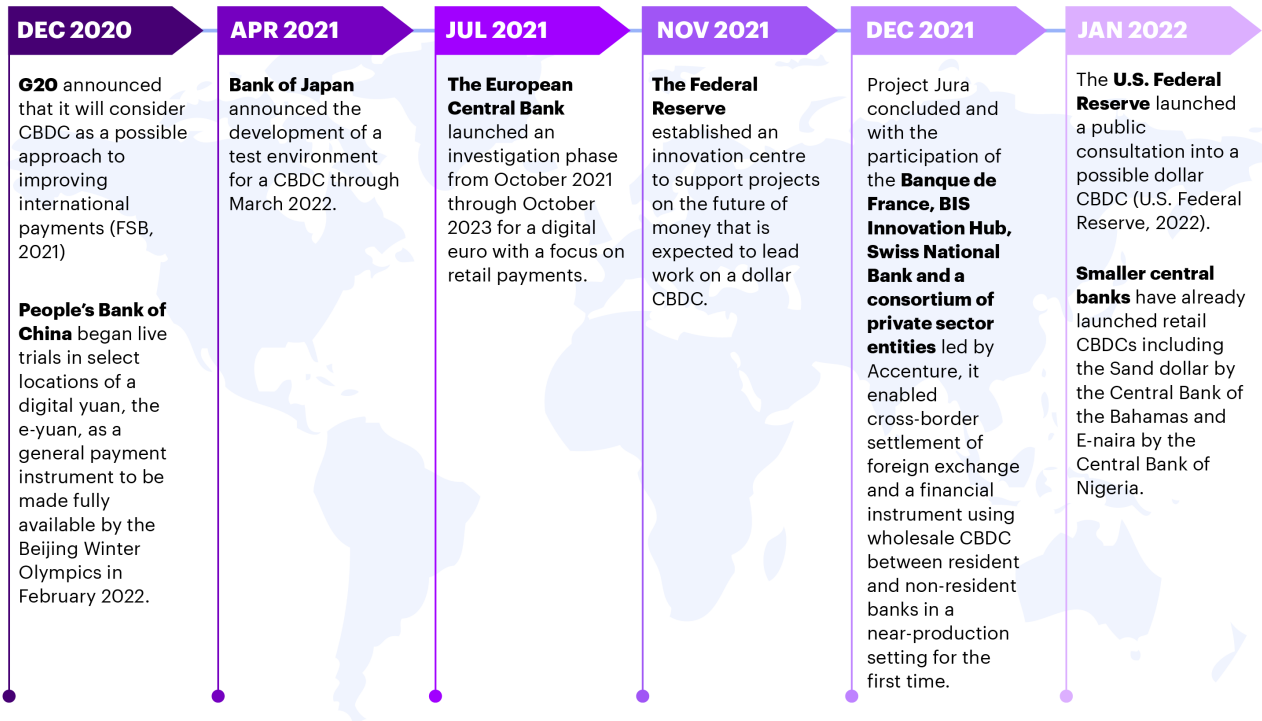
Central banks have accepted that central bank money needs to modernise to remain competitive and future-proof amid increasing digitalisation of payments. Central bank digital currency (CBDC) is a new medium to advance diversification and choice in financial markets. It promotes equitable access to central bank money across a wider range of financial markets' infrastructures to address existing payments deficiencies, serves new use cases and responds to evolving payment needs. Central banks increasingly recognise that CBDC offers them an opportunity to shape the future of money.

Central bank money is comprised of banknotes, coins and book-entry or scriptural money as central bank reserves or sight deposits. CBDC rests in the adoption of tokens as new payment mediums. The designation of a CBDC is limited in this report to token-based CBDC, as an account-based CBDC is considered similar to reserves.

The debate about the adoption of CBDC has progressed significantly. In June 2019, the announcement of a possible introduction of a Facebook (Meta)-supported currency (diem) changed the debate amongst regulators and instilled greater urgency in them to consider national digital currencies. The announcement served as a reminder that there are significant remaining gaps in payments, and that the preservation of the national currency as principal exchange medium can no longer be taken for granted and as such possibly weaken impact and reach of monetary policy. In October 2020, the European Central Bank (ECB), in its report about a digital euro, marked the beginning of a major CBDC initiative by a leading central bank, which recalibrated the scope and objectives of a CBDC (ECB, 2020).

## CBDC initiatives and adoption

Several CBDC initiatives are already under way around the world.



COVID-19 has brought out new payment behaviour among end-users. The use of cards and other means of digital payments in place of cash has shown how rapidly payment patterns can change.

CBDC is intended to complement existing central bank mediums. In international payments, CBDC may offer new approaches that change the reach and geography of central bank money. In securities settlements, CBDC may offer more efficient methods of trade processing. The programmability of CBDC can also give rise to new business models and applications that require smart money features and serve as a catalyst for a deepening of payments markets. Although CBDC is set to reside on a separate financial market infrastructure, integration with existing payment and core banking systems is seen as necessary for successful adoption.

The Bank for International Settlements (BIS) affirms that many central banks are working on CBDC-related projects (BIS, 2021). While only a minority of central banks see the adoption of CBDC in the short-to-medium term, most maintain that adoption is likely. Central banks also acknowledge that CBDC is not aimed at replicating existing payment processes, but rather support designing new processes based on a country's specific needs. The ECB in its digital euro report has explicitly stated that a euro CBDC could be held by non-residents, enhance the euro's role as an international currency and bestow the European Union with greater strategic autonomy (ECB, 2020). This could lead to a reorganising of foreign exchange markets highlighting the potential for disruption by CBDC.

Central banks remain divided on the choice of the CBDC medium and the impact of CBDC on the banking system amid a continued debate about the merits of account- versus token-based CBDC. Interoperability represents a persistent core concern for central banks, but new approaches may offer better insights for how this could best be approached. Fiscal operations have emerged as part of an important public policy debate in the context of financial inclusion, benefit distribution and taxation.

#### **Additional recent CBDC projects include:**

**Helvetia** by the Swiss National Bank and BIS Innovation Hub about the use of wholesale CBDC for large value payments.

**Khokha 2** by the South African Reserve Bank on interoperability with stable coins and money market integrity.

**m-Bridge** by the BIS Innovation Hub, Bank of Thailand, Central Bank of the UAE, Digital Institute of the People's Bank of China and Hong Kong Monetary Authority on exploring the establishment of a settlement corridor for wholesale CBDC in international payments.

# 01 Use cases

CBDC can have several use cases, but the strongest are applications where central bank money plays a special role. Central bank money is the preferred settlement medium for financial market infrastructures to serve large value payments because of the safety it exhibits.

### **Securities Settlement and Foreign Exchange Transactions**

The strongest use case for CBDC appears to be securities settlement and foreign exchange transactions, who are the largest users of central bank money. CBDC offers an end-to-end, token-based lifecycle for securities and foreign exchange trading. The advantages of instant and atomic exchanges bring significant benefits and efficiency gains for most large value use cases. And when instant settlement is seen as problematic, CBDC can offer variable settlement windows that accommodate different needs and permit flexibility.

#### **Box 1. Settlement times**

Settlement times have been reduced sequentially. In the U.S., the settlement cycle is the trade date plus number of business days to settlement. It was reduced in 1995 from T+5 to T+3 and again in 2017 to T+2. Moving from T+3 to T+2 reduced the average daily capital requirements for clearing trades by approximately 25 percent.\* Further reductions in settlement times have proven difficult amid market behaviour, legacy infrastructure and operational processes. In 2021, the DTCC announced a roadmap to reach T+1 for U.S. equities.

Some market participants may be reluctant to adopt real-time settlement as it would require all transactions to be paid in full at execution. Brokers may struggle to make the necessary financing arrangements.

\*DTCC, Key advances in clearance and settlement, 21 June 2021.

#### **Box 2. Atomicity**

DLT platforms enable the atomic exchange of tokens, i.e., both legs of the transaction succeed, or none do. Token exchanges therefore afford the elimination of settlement risk. For example, an exchange of one financial instrument for another would only occur if both legs of the transaction were executed simultaneously. It implies that the exchange will not incur an open position that would typically be hedged, reducing the need for risk mitigation measures. Where exchanges are instant and atomic, financial instruments offer unencumbered immediate reuses.

## **Retail**

Retail CBDC offers people the option to conduct most payments in central bank money, including digital payments. The wide variety of payment choices available to the public may limit adoption as CBDC does not offer a differentiated user experience. End-users are mostly indifferent when it comes to paying in central bank money or bank money, and payment decisions will likely be dominated by acceptance and convenience.

Retail CBDC may be introduced to ensure the public has access to central bank money. With the adoption of CBDC, central banks may accrue important benefits including a more diversified, resilient and autonomous payment system. As central banks adopt CBDC, they can set new impulses for necessary modernisation, competition and change.

### **Box 3. Decline of cash**

There has been an observed decline in banknotes and coins in circulation as payment instruments, increasing considerations for the adoption of retail CBDC. COVID-19 has accelerated a trend of declining cash use in several advanced economies, a result of alternative payment means and changes in payment behaviour.

The decline of cash may indicate that the public is indifferent to the use of central bank money. Or, because central bank money for the public is only available in physical form, the possibility to use cash is simply in decline. The disappearance of cash may therefore be supply and demand driven.

Cash remains a formidable payment instrument amid the atomised nature of the payment network. There are a minimum of, if any, requirements for conducting payments, and it can often be the only available payment infrastructure.

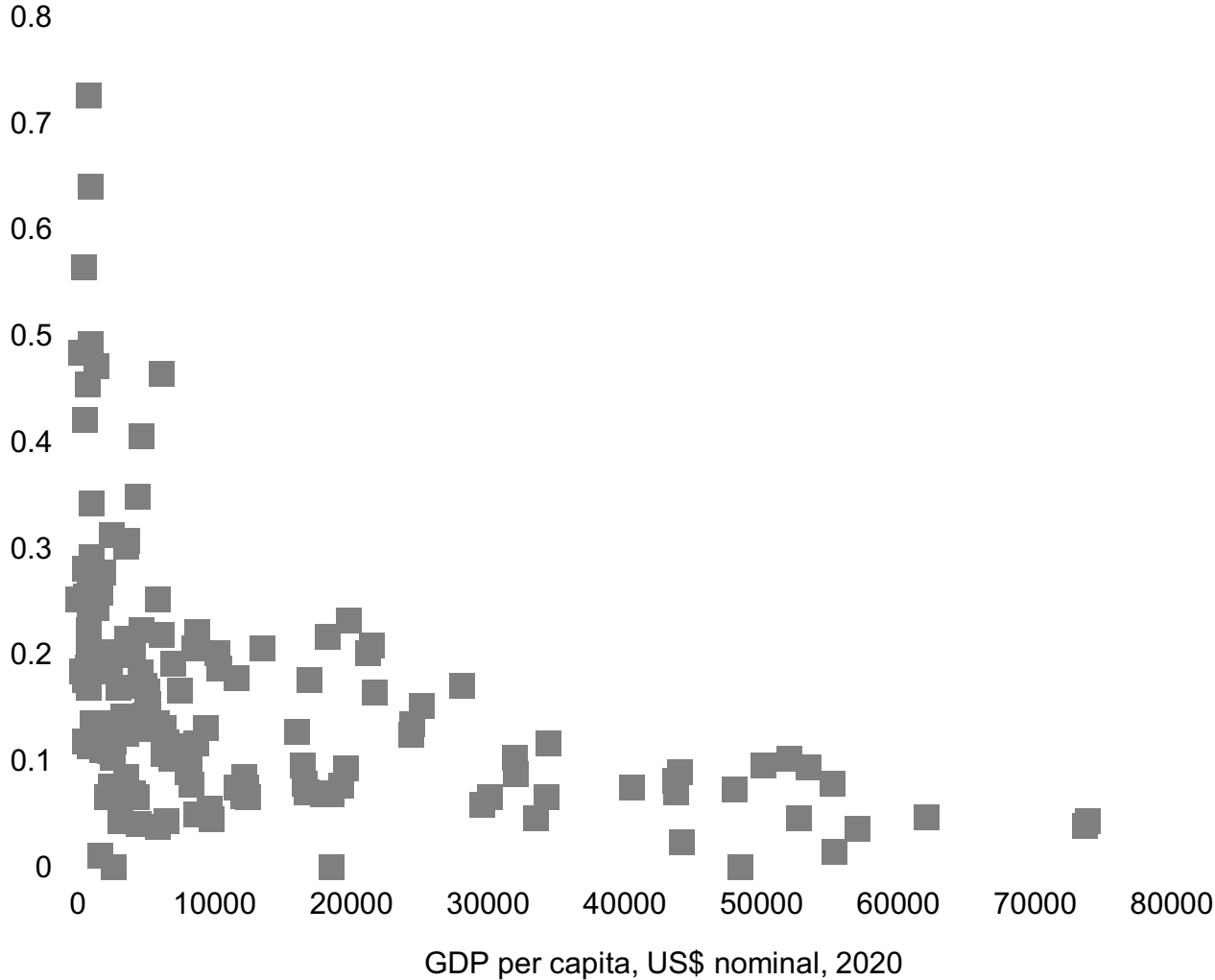
The total anonymity afforded by cash in payments remains an important and unmatched feature. The decline in cash, and in some countries near abandonment of it, points to a general decline for privacy in payments, indicating that privacy is being subordinated to payment convenience. While privacy matters, it is not clear if cash represents an appropriate benchmark for privacy in payments.

The decline of cash could be welcome on prudential, national and international security grounds. Cash is the preferred medium for conducting illicit transactions and the decline in cash may render it more difficult to sustain such transactions. The decline in cash would need to be universal and become a binding constraint as illicit transactions can be conducted in any currency.

The costs of cash are elevated and incur rapidly, increasing marginal costs with declining usage. For the European Union, the social cost of using cash is estimated at around 1 percent of GDP (Schmiedel, Kostova, & Ruttenberg, 2021).

**Figure 1. Income and currency circulation**

Currency in circulation/broad money, 2020



Source: IMF. 151 countries with available data. GDP per capita capped at US\$80,000.

The shift in the relative importance of payment instruments is also due to structural factors. For example, the use of cash in countries is related to income levels. Currency in circulation to broad money, as a proxy for cash usage, is at first sight negatively correlated with GDP per capita. This suggests that rising income and the accompanying increasing sophistication of the financial system reduces the use of cash relative to other monetary aggregates. Important discrepancies in the currency-to-broad-money ratio at a given level of income, particularly for lower income countries, appears to indicate that the role of currency is being influenced by a variety of factors (Figure 1).



## 02 Access

Central banks are traditionally highly selective about access to their balance sheets. Access is limited to financial intermediaries while some central banks also extend access to non-bank financial institutions. Central banks also tend to limit access to resident financial institutions. Issuance and distribution of central bank money is therefore local.

Banknotes enjoy universal access. While banknote distribution is limited to resident financial intermediaries, banknotes can be held by everyone. Large proportions of banknotes, including about 60 percent of U.S. Federal Reserve notes that are estimated to circulate outside the U.S., can be held abroad and the central bank typically has no control over the entities holding banknotes and transactions performed therewith.

CBDC is intended to serve as native settlement medium on new token-based financial market infrastructures. Entities active on those infrastructures will naturally want to have access to CBDC.

The international use of CBDC represents one of the most significant departures of prevailing central bank access policies. To allow CBDC to serve as settlement medium in international payments, non-residents will need to have access to CBDC. The criteria for access may be tiered and is likely to be based on a set of eligibility criteria, e.g., financial intermediaries meeting certain prudential, activity and/or supervisory criteria.

Access varies by use case. Intra-day only access may be envisaged where access is granted strictly to serve settlement. Foreign central banks may be granted special access to maintain CBDC as a reserve asset to be used directly in foreign exchange market interventions. Access may be limited to financial intermediaries to ensure payments can be conducted but does not serve end-users as store of value.

Central banks will likely be reluctant to enlarge access to their balance sheet. Access will necessarily be linked to safeguards to ensure that a broader circulation of central bank money, including circulation outside the jurisdiction of the central bank, remains consistent with set policy objectives. Wider use of central bank money could complicate monetary policy if it produces more heterogenous monetary conditions. CBDC must be designed to provide such controls.

## 03 Financial inclusion

Financial inclusion remains incomplete in many countries, particularly in lower income countries. CBDC has often been associated with a new approach to facilitating financial inclusion. Access to financial instruments undoubtedly plays a major role in facilitating economic participation and integration, and helps household and businesses plan ahead, meeting contingencies as a fundamental basis for improving lives. However, the role of central banks in the provision of financial inclusion is contested and successful private sector solutions exist.

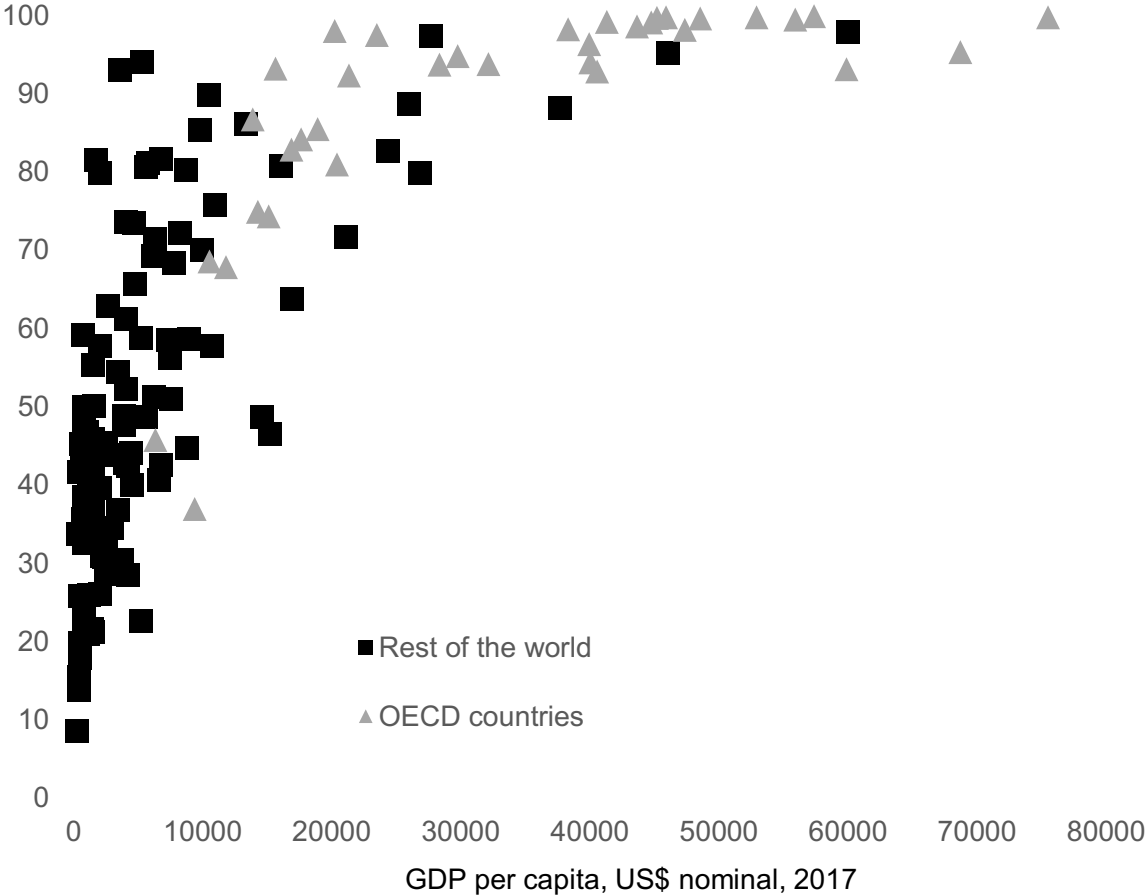
Financial inclusion is about access to reliable payment mediums, but also about banking services. Financial deepening remains a bank business and central banks would struggle to provide effective consumer- and business-facing savings and loan services. Access and use of banking services, not access to a bank account, seem to be the dominant factors that enable financial inclusion.

The role of central banks in financial inclusion may largely rely on partnering with other actors to collectively advance financial inclusion. Where a market solution exists, the role of the central bank would be to regulate. Where a market solution cannot be achieved, it is not certain a central bank solution could do so either. The role of other actors, such as telecom operators, is critical to build the needed infrastructure to enable mobile payments and meet minimum access requirements. Cash in/cash out providers are essential to facilitate access to cash, particularly as acceptance of alternative mediums may remain limited, necessitating a conversion into cash. The role of the central bank may depend on whether those objectives can be achieved with its intervention.

CBDC may play a role in decentralised finance (DeFi) applications as settlement medium. To the extent that DeFi may prove more effective in the distribution of financial services including to very marginal end-users, CBDC could support such applications as high-quality settlement medium.

**Figure 2. Income and financial inclusion**

Percent of adult population with a bank account, 2017



Source: G20, IMF. 142 countries. GDP per capita capped at US\$80000.

The pattern of financial inclusion suggests that it is highly correlated with income levels. Higher income countries, as represented by GDP per capita in nominal U.S. dollars, tend to exhibit a higher level of financial inclusion as approximated by the percentage of the adult population holding a bank account. At the same time, at a given level of income, there are important differences in financial inclusion levels suggesting that income is not the only constraint to providing high inclusion (Figure 2).

## 04 Settlement

CBDC focuses more on settlement rather than payments. The token implies that CBDC can be both a payment instrument to discharge an obligation, and settlement infrastructure as the payment would correspond to the settlement. The merger of payment and settlement would replace the conventional payment, clearing and settlement process and enable an important simplification of payment cycles. The use of CBDC as the native payment instrument on token-based financial market infrastructures would offer end-to-end processing in tokens.

CBDC in settlement could be part of a new backend architecture to process retail and wholesale payments. Retail payments could use CBDC to process payments that rely on the core systems including ACH and card networks. Wholesale payments could offer CBDC for large value payments and inter-bank clearing. The use of CBDC as backend architecture could allow payment processes to be built on a peer-to-peer network, enabling instant payment and settlement.

# 05 Medium

The preferred medium for CBDC remains open for debate. There is an on-going debate about account versus value or token-based approaches. While an account-based approach would rest on the existing payment architecture, a token-based approach would represent central bank money in a new digital token format. Accounts could constitute an extension or adjustment of large value payment or similar systems. Tokens would complement existing central bank formats and be built on a new financial market infrastructure.

CBDC is a digital representation of central bank money and constitutes a monetary liability of the central bank, it is fiat money and should be fully fungible with banknotes and reserves. CBDC would be the same dollar, euro, sterling, peso or rupee but in a digital token format. The singleness of a currency would be preserved with the adoption of CBDC.

Tokens can exhibit properties akin to a bearer instrument, like banknotes or cashier cheques, but in a digital format. The definition of tokens rests on what tokens can do and not what they are (which is harder to define). A digital token can be transferred from one holder by assigning ownership to a new holder, just like tendering a physical token or banknote where the token always remains a liability of the issuer.

Tokens can be equipped with the most complex business logic through programmability. And in certain types of transactions, tokens are particularly well adapted to perform. For example, delivery versus payment (DvP) and payment versus payment (PvP) transactions demonstrate the capability of tokens to perform bi-directional trades. Tokens can be exchanged atomically—both legs of the transaction succeed, or neither does—thereby eliminating open positions in token-based exchanges and the associated counterparty and settlement risks, including hedging costs.

### **Box 4. Introduction of modern banknotes**

CBDC can be compared to the introduction of modern banknotes during the nineteenth century. Banknotes represented a new medium, paper currency, and were seen as a modern payment means to overcome the constraints imposed by specie payments, i.e., gold and silver coins. Gold and silver coins were then the dominant medium and for a long time considered the only rightful payment means and designated legal tender.

Central banks were established during the nineteenth century, often to administer an orderly circulation of banknotes. In Germany, historical observers remarked that the main duty of Germany's first central bank established in 1875 (Reichsbank) was to control the excessive circulation of banknotes. The introduction of banknotes at the time was highly controversial amid concerns of "flooding the market" with paper that could cause major instabilities. When banknotes became legal tender, there was recognition that central bank money should be available in alternative formats to meet different payment needs (Mandeng, 2019).

Banknotes evolved and became the close-to-exclusive medium of central banks. While banknotes were once issued under a specie arrangement with the demonetisation of gold during the 1970s, today they are only fiat monies. Switzerland was one of the last countries to abandon a gold backing in 1999.

## Box 5. DLT

Today, Blockchain and other distributed ledger technology (DLT) platforms are considered best suited to issue, manage and administer digital tokens. DLT platforms are distributed networks where validation, the recording of transactions and the integrity of the network are ensured collectively and simultaneously in multiple locations. DLT networks are highly supportive for conducting large volume, secure and fast peer-to-peer transactions. The native capabilities of DLT-enabled tokens offer advanced functionalities including programmability that allows the embedding of complex business logic to meet most financial transaction needs. The programmability may be allocated to an entity other than the central bank, e.g., a government entity, as central bank money should normally be unencumbered.

Permissioned DLT networks seem better adapted to support financial transactions than permissionless DLT networks. Since financial transactions are in many instances regulated transactions, transaction validation and network integrity would also have to be ensured by regulated entities. Combination between permissioned and permissionless networks may be possible by transaction type. Not all DLT platforms will meet necessary requirements for large scale financial transactions.

## Box 6. Account versus token-based CBDC

The backend architecture of a CBDC offers the possibility of employing an account-based or token-based approach.

**Account:** Central bank reserves are book-entry or scriptural money held in accounts of the central bank. Central banks typically make accounts available to banks and other financial intermediaries for the conduct of large value payments. An account-based CBDC would be an extension of the existing account architecture. A downside here is that innovation is very limited and would largely consist of a change in the access policy of the central bank. The advantage is that it would leverage existing technologies though it is not clear if existing systems can be extended to many users without significant modifications.

**Token:** Central bank money tokens would represent digital bearer instruments that can be held in digital wallets. A token-based CBDC would reside on a separate DLT-enabled, peer-to-peer network that would need to be seamlessly integrated with existing payment and core-banking systems. The advantage of tokens is that they perform the functions of payment instrument and settlement infrastructure at the same time, offer the possibility of being programmable and support a diversification of the payment's infrastructure. The disadvantage is that DLT represents novel technologies, exhibits new challenges and risks and may incur onerous integration costs.

Token-based systems would not replace existing processes, but rather expand them. They may offer a simpler approach to produce targeted outcomes where adjustments of existing systems would be inefficient.

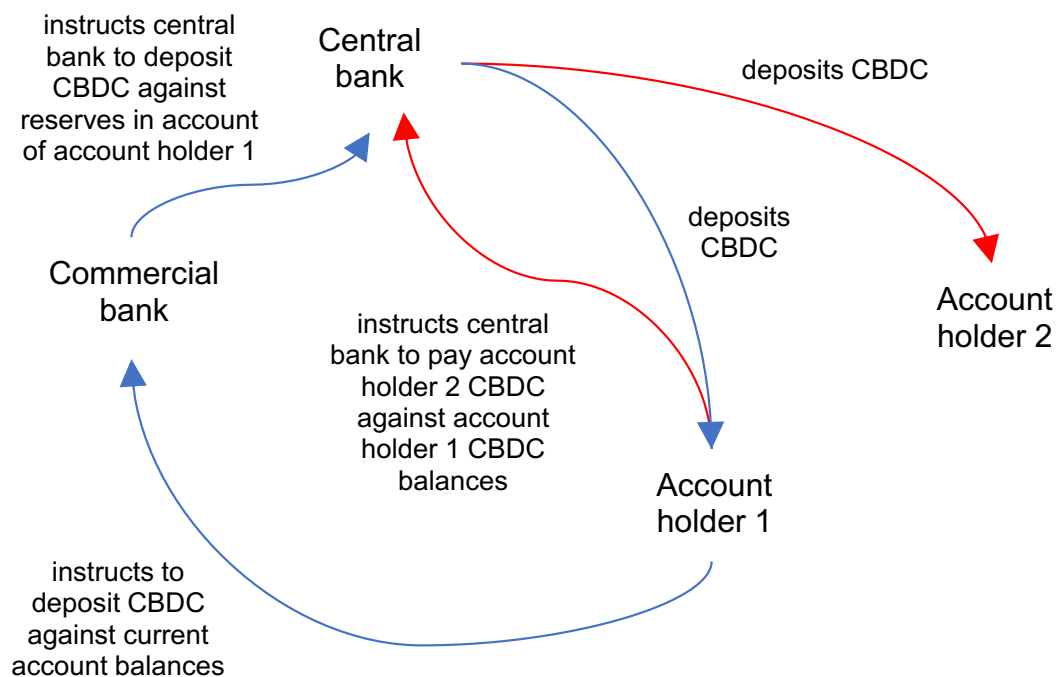
Account and token-based systems would normally operate through intermediaries to ensure KYC and AML provisions do not need to be met by the central bank. Both systems offer the possibility of identifying account and wallet holders and may extend some, though not absolute, privacy to holders and transactions.

# 06 Issuance, distribution and circulation

The issuance of CBDC would occur only against reserve balances. The CBDC would represent a change in the composition of central bank liabilities and not be an extension of the central bank's balance sheet.

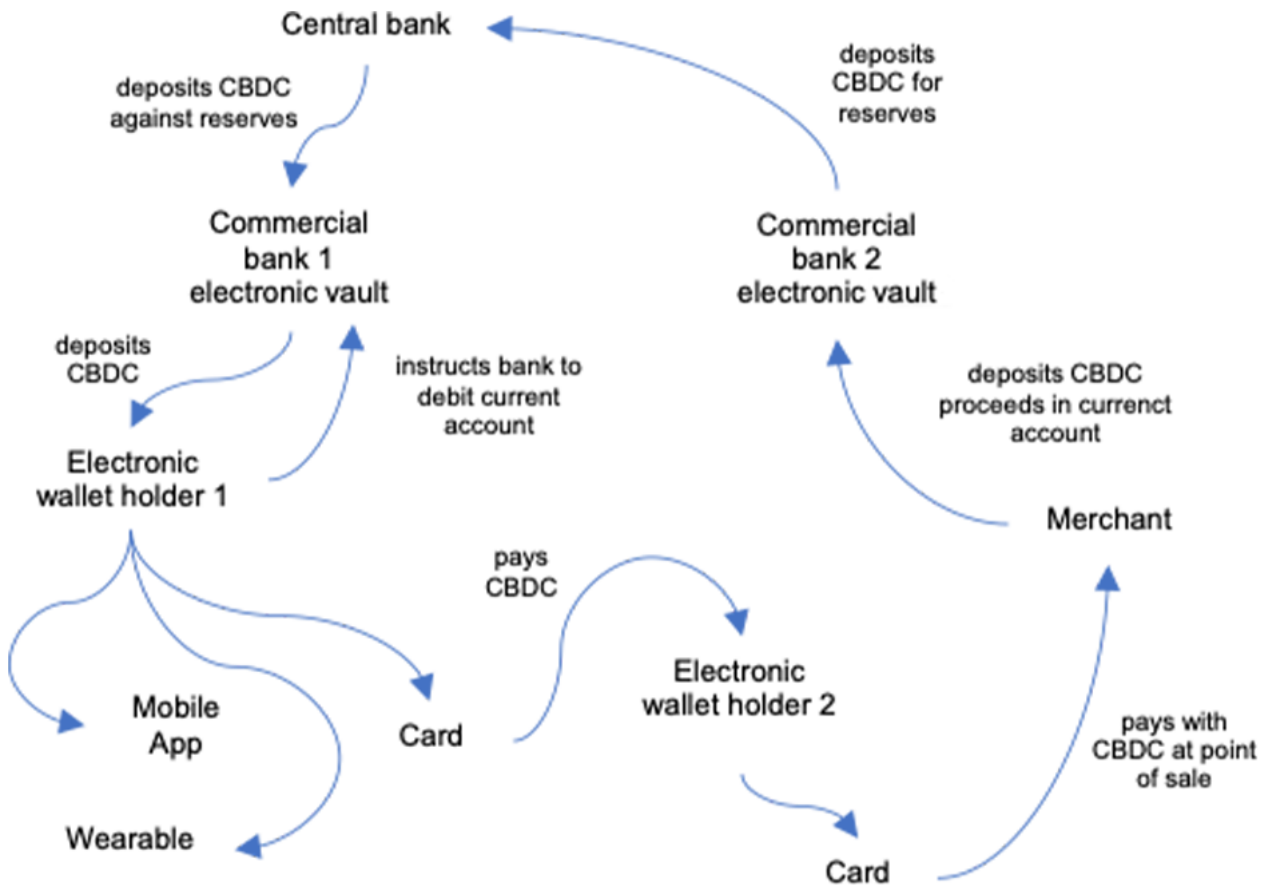
The distribution of CBDC would occur on the basis of existing and new actors. Account-based systems would rely mostly on existing payment rails and be held in accounts issued by financial intermediaries. Token-based systems would use DLT-platforms and the CBDC would be held in electronic wallets issued by banks and other financial intermediaries.

**Figure 3. One-tier CBDC distribution**



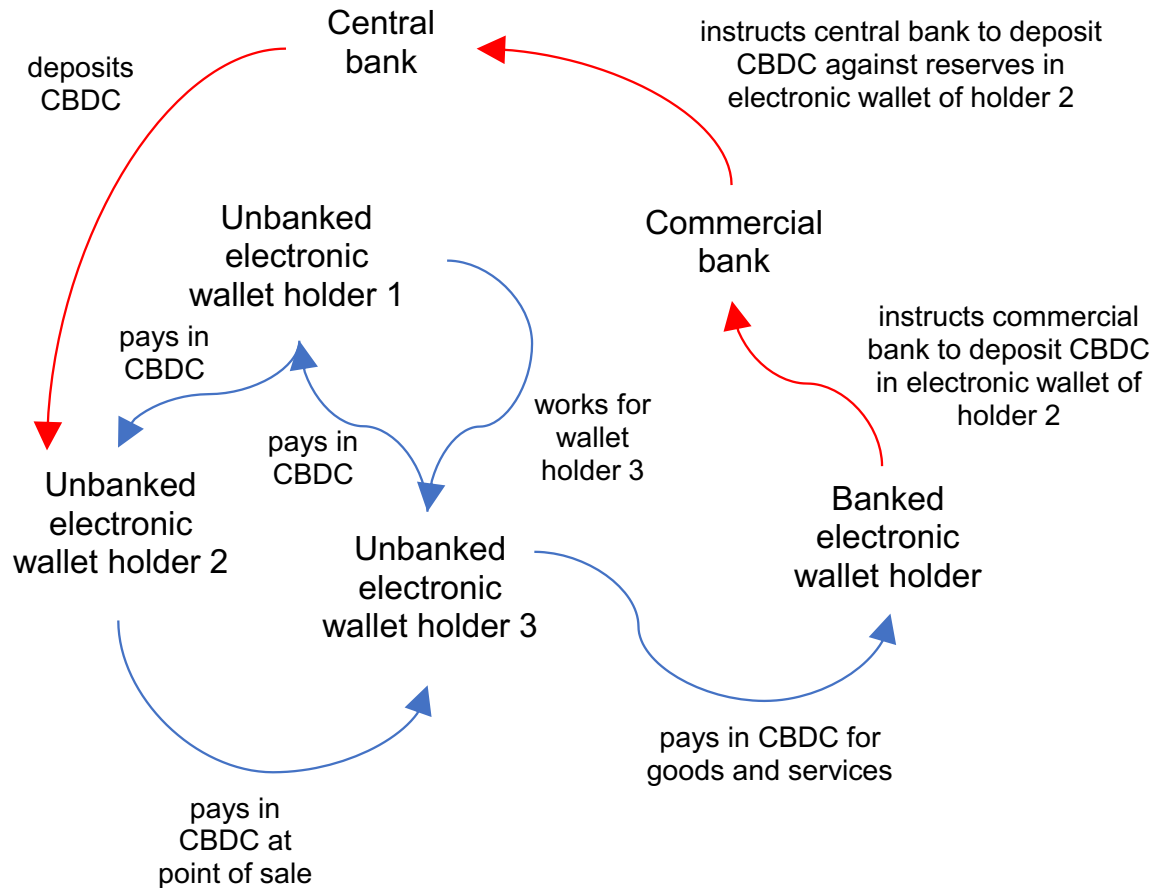
In a one-tier CBDC distribution system, the central bank would distribute CBDC directly to intermediaries and end-users and be party to all transactions. The wallet or account maintenance could be performed by a third party to allow the central bank to avoid dealing directly with the public. Commercial banks would most likely still arrange for reserves to be deposited at the central bank to obtain CBDC against balances held by end-users. CBDC is brought into circulation by the central bank by debiting commercial bank reserves, and by commercial banks debiting account holders' current account balances. Payments are made from account or wallet holder to wallet or account holder, whereby an account or wallet holder could be a merchant, by sending instructions to the central bank to transfer CBDC from one account or wallet to another (Figure 3). Instructions could be sent through end-point devices including mobile phones.

**Figure 4. Two-tiered CBDC distribution**



In a two-tiered CBDC distribution system, the central bank issues CBDC against reserves into the electronic vaults of the commercial banks or other eligible financial intermediaries and payment service providers. Commercial banks distribute CBDC to end-users against current account balances. End-users can hold CBDC in different applications, including but not limited to, mobile phone applications, cards and wearables, e.g., watches. CBDC can be used in peer-to-peer payments and at points of sale. CBDC is withdrawn or destroyed by the central banks upon being returned by the commercial banks against crediting of reserves (Figure 4).

**Figure 5. Mixed tiered CBDC distribution**



In a mixed-tier CBDC distribution system, the one- and two-tier systems can be combined. The central bank issues electronic wallets to non-banked account holders while commercial banks continue to bring CBDC into circulation with the non-bank public. Mixed-tier systems are applicable where the central bank seeks a proactive role in the distribution of CBDC, while issuance of CBDC occurs through the banking system. This is relevant in systems with a high share of unbanked end-users. A wallet holder is paid their salary in CBDC and can conduct payments in CBDC. Banked wallet holders can receive payments in CBDC. They can give instructions to their commercial banks to deposit CBDC in wallets of unbanked holders (Figure 5).

Each distribution system exhibits advantages and disadvantages. The one-tier model offers a flat structure and provides a basis for direct engagement by the central bank in the distribution of CBDC to end-users. The one-tier model would be highly concentrated around the central bank, implying that the central bank would be involved in every transaction and deal directly with the public, something central banks are generally not set up to do. The two-tier system largely relies on the role of commercial banks to be effective intermediaries for the distribution of CBDC to end-users, preserving existing monetary relations in the economy. The mixed-tier model could create asymmetries between the role of the central bank and commercial banks in providing access to CBDC, but may be the only approach to advance financial inclusion of the unbanked population.



# 07 Integration

Any CBDC will need to offer, or be compatible with, a solution to connect legacy with DLT-enabled payment systems. This would enable seamless payments across payments infrastructures to support payments innovation, choice and diversification while mitigating the risk of fragmentation of the payments environment. CBDCs will coexist with existing financial market infrastructures, and a seamless integration therewith is critical to ensure market integration is always maintained.

CBDC will need to be able to exchange data with the legacy system. Since many legacy systems operate on the basis of secure messaging typically using SWIFT messages, CBDC will need to communicate with SWIFT messages. The translation of SWIFT messages to be read and understood, and vice versa by a DLT-enabled platform, would allow legacy systems to perform operations initiated in the legacy system and DLT platforms to process instructions emanating from the legacy system.

# 08 Interoperability

CBDC will be issued on a dedicated DLT-platform. The DLT-platform will likely be one of several with different financial instruments circulating on different DLT platforms. The possibility for different DLT platforms to exchange information and values, also known as interoperability, remains one of the most important challenges for DLT-enabled financial market infrastructures and actors. Existing, stand-alone systems communicate with other systems only through secure messages. With the proliferation of DLT platforms, the likelihood that different tokens will reside on different DLT platforms increases. In principle DLTs are closed systems that do not allow any incursions to preserve the integrity of the platform.

### **Interoperability could be achieved by establishing some interdependence between DLT platforms:**

**Migration of control:** Tokens can be deployed onto different platforms while retaining essential controls for the issuer. The DLT platform would require a mechanism by which the issuer would be able to restrict usage of the token. This allows a home token to be deployed on a host platform while retaining controls as if the token resided on the home platform.

**Synchronisation of tokens:** Transaction synchronisation may help solve a fundamental requirement in finance to enable atomic transactions that achieve DvP and PvP. If transaction synchronisation can be achieved across DLT platforms by imposing a common, external time element on both DLT platforms, then, if both transaction parties operate on both DLT platforms, a simultaneous transfer of tokens can be performed. Hash-locking, operations on DLT platforms exhibiting the same trigger, including through hashed time lock contracts (HTLC) would de facto allow bidirectional instructions to perform simultaneous transactions on two DLT platforms and offer interoperability

**Shared protocol:** The adoption of a common, shared protocol to facilitate cross-DLT platform transactions may not constitute interoperability in a narrow sense, but offer the possibility to exchange information and value across platforms while maintaining platform-specific properties. The adoption by all transaction parties of common elements would enable transactions across DLT platforms, but would be close to the adoption of the same DLT platform.

## 09 Re-issuance

Central banks can issue CBDC for different DLT platforms, and as such ensure CBDC can be used widely across a variety of environments. Recertification or reissuance would enable the original issuer of a token, or trusted party thereof, to issue the same value for a different DLT platform. This would allow an exchange of tokens on the same DLT platform and not require other intervention mechanisms.

Central banks can offer issuance of CBDC on a pre-qualified number of DLT platforms. If a financial asset issued on Ethereum needs to be settled in CBDC, the market participant will request from the central bank a CBDC token issued on Ethereum. This transaction would have to be performed instantly and could consist, for example, of a request to reissue a central bank claim, reserves or CBDC issued on Corda, into a CBDC issued on Ethereum. The central bank, and only the central bank, can take receipt of a CBDC issued on one DLT platform and exchange it for a CBDC to be issued on another platform.

CBDCs will need to always be unambiguously recognisable as a central bank liability. Central banks are unlikely to accept a CBDC token that has been re-issued or in any way altered by a third party (the allocation of programmability to a third party, such as the Ministry of Finance, to perform fiscal operations may be an exception). This requirement may prevent possible approaches to interoperability that rest on some token alteration. The possibility to issue a synthetic asset or a reissuance or recertification by a third party should therefore generally be discarded for CBDC.

## 10 Programmability

Tokens are programmable and allow the embedding of complex business logic into token transactions to support conditional, automated and escrow payment operations, which can involve multiple tokens. Programmability represents one of the key advantages of tokens and equips tokens with features determined by the issuer and irrespective of the holder. The complexity of the business logic can give rise to new payment use cases and can also serve to ensure set prudential standards are met. Programmability can restrict access to CBDC, ensure certain types of transactions attract additional needed checks and allow for self-being executing transactions that are conditional on meeting predetermined criteria. Scope and reach of programmability can be extensive and project the new functionalities CBDC should afford.

Programmability allows CBDC to be smart. CBDC as a payment instrument can form an extended arm of monetary policy implementation. The potential complexity of programming

can also give rise to new applications subject to random and anticipated events that promise to extend the frontier of central bank money and extend the scope to compete with alternative payment and settlement arrangements.

CBDC can be programmed to serve fiscal operations from simple tax deductions to disbursements subject to predetermined criteria. Progressive taxation could be embedded in a CBDC subject to external triggers. Value-added tax payments could be made progressive by linking to the earning patterns of the payer. CBDC could serve to advance novel forms of taxation and assistance.

Similarly, programmability would be beneficial to any entity using CBDC to facilitate and automate more complex financial transactions. While programmability would probably be limited to preserve the unencumbered nature of central bank money, there could be applications where programmability may help streamline certain types of transactions and the processing thereof. Complex transactions, such as in derivatives, structured products or those subject to certain external conditions could be settled more effectively using programmed CBDC where central bank money would constitute the preferred medium.

## Policy considerations

# 11 Disintermediation

The principal concern about the introduction of retail CBDC is financial stability. The non-bank public may substitute bank claims for CBDC, undermining banks' business models. Banks and other non-bank financial institutions may also replace bank-based transactions with CBDC affecting different financial system actors asymmetrically. The principal concern rests on the assumption that the non-bank public would have a strong preference to hold CBDC instead of bank deposits amid the safety of central bank money. As there is little to no evidence of migration, structural or cyclical, from weak to strong or from private commercial banks to government-owned commercial banks or postal services possible in today's system, it is not clear the banking system would be vulnerable to a deposit run. During the global financial, economic and COVID-19 induced crises, large-scale shifts out of bank deposits and into banknotes were rare.

Bank disintermediation may occur if the public perceives important advantages to hold central bank money and banks fail to sufficiently differentiate their offerings. CBDC design is likely to determine actual substitution and needed remedial measures are available though there are concerns (Brunnermeier & Niepelt, 2019); (Kumhof & Noone, 2018). Recent research about the impact of CBDC on banks affirms that a negative effect is unlikely (Andolfatto, 2020).

The desired relative holding of central bank and bank money may be state-of-the-world dependent. In tranquil times, the non-bank public may consider bank and central bank money to be close substitutes (substitutability between central bank and bank money is high). In situations of financial distress where the substitutability between central bank money and bank money is low, the public may incite digital runs on banks if rapid conversion between bank money and CBDC is possible. At the same time, the central bank can always replenish possible deposit withdrawals and can do so in a digital environment instantaneously where

the lending rate could become a policy variable. Measures such as CBDC withdrawal limits could be imposed to slow down possible runs.

The distribution of a retail CBDC should preserve existing relations between banks and end-users, mitigating the possible migration effect. The non-adoption of an interest-bearing CBDC would also help differentiate bank deposits from CBDC. Banks may naturally need to revisit if existing deposit products can remain competitive in the presence of CBDC.

Central banks may need to take compensatory measures to slow adoption of CBDC if CBDC balances crowd out bank balances at scale. If CBDC causes a structural downward adjustment of bank balances, banks may need to reconsider increasing the diversification of their funding sources.

## 12 Privacy

CBDC may need to grant a certain level of privacy to facilitate adoption in retail and wholesale transactions. Privacy is not a universal concept and decisions will need to be taken to define who should afford privacy to whom, and what a reasonable benchmark for privacy should be. DLT-enabled platforms, though not all, extend full visibility of all transactions. Transactions are broadcasted to the entire network, though network participants often operate on pseudonyms. This is problematic for financial transactions. In retail, there are certain privacy preferences including revealing one's identity when conducting payments. In wholesale, financial intermediaries do not want to share their financial transactions. Careful CBDC design is required to address prevailing privacy concerns.

In retail, the societal preferences for privacy and transparency should determine actual privacy requirements. Privacy concerns only arise where CBDC substitutes fully for cash, including foreign cash. The coexistence of cash and CBDC would naturally divert transactions requiring high levels of privacy to cash. Considerations need to be given if cash is the appropriate benchmark for privacy and if it is within the central bank's remit to accommodate possible privacy concerns.

Privacy concerns have been repeatedly accommodated in securities payments and payment versus payments (ECB, 2019). The design of a CBDC may offer privacy in payments using pseudonyms, restricting visibility of payments to a minimum and offer thorough encryption of sensitive information and other safeguards. CBDC technology will in part determine the practically feasible level of privacy.

Conditional privacy of CBDC could form the basis for any transaction under pre-determined limits that do not attract additional scrutiny and could be similar to cash ceilings where they exist. Transactions above such limits could trigger additional checks or could be prevented.

The importance of privacy is contested and varies by country. Countries with a high propensity of card-based payments seem willing to forgo anonymity. The use of cash also varies significantly by age-group. In the Euro Area, based on household surveys, only 13 percent of respondents indicated that anonymity constituted an important advantage of using cash (Esselink & Hernández, 2017). However, in the public consultation accompanying the ECB's digital euro project, 43 percent of respondent thought privacy was the most important feature (ECB, 2021; ECB, 2020).

For wholesale, concerns are normally limited to disclosing transactions to third parties. While the identities of the transacting parties are typically disclosed, amounts and frequency of transactions are normally not shared. Accommodation needs to be found to ensure only the transacting parties can view each other's transactions. Some DLT platforms are built on provisions that afford such privacy.

## 13 Legislation

Central bank money is governed by central bank legislation. Countries will differ in their interpretation of whether central bank laws should be amended to accommodate issuance of CBDC. Such need may arise where the language in the central bank law identifies the allowable mediums for central bank money, i.e., paper or coins, or where the legislative history supports a narrow definition of the use of central bank mediums.

### Box 7. CBDC and the European Treaty

Prima facie evidence suggests that the Treaty of the European Union (TFEU) offers the possibility to issue wholesale CBDC and allow non-banks and non-residents to hold CBDC. The Treaty (Protocol No 4) specifies that the ECB shall have the right to authorise the issue of euro banknotes and that the ECB and national central banks (NCB) may issue such notes (Article 16). The Treaty also authorises the ECB and national central banks to open accounts for credit institutions, public entities and other market participants (Article 17). The Treaty further specifies that national central banks may operate clearing and payment systems within the European Union and with other countries (Article 22).

Issuance of wholesale CBDC is permissible if the ECB and national central banks were to issue electronic wallets to hold CBDC to financial institutions that would qualify as accounts.

The Treaty does not restrict issuance to resident institutions. A euro CBDC could therefore be issued to and held by non-resident credit institutions and other market participants. National central banks can also operate CBDC-based payment systems with other countries.

The issuance of a retail CBDC may be constrained by the types of entities permitted to hold an account with the NCBs. However, if a retail CBDC were to be considered a banknote, issuance of a retail CBDC would also be possible. Interpretation will rest on the assumption that the Treaty envisaged to restrict the medium the ECB and NCBs can use for banknotes.

Central bank laws are generally assumed to not be prescriptive in the mediums central banks can issue and will not aim to unduly restrict the operations of the central bank. The notion of banknotes (central banks are typically authorised to issue banknotes and coins) can be interpreted narrowly as paper currency, or more widely as a token instrument. In the latter case, CBDC would be compatible with the notion of a banknote. Central banks are also normally authorised to open accounts for financial intermediaries. The notion of an account

can be interpreted narrowly as a book entry in a ledger, and more widely as a vessel to hold value. In the latter case, an electronic wallet where CBDC would be held corresponds to such a vessel.

### **Box 8. Legal tender**

Central banks may consider designating CBDC as legal tender to signal that CBDC is intended to maintain parity with other central bank mediums. Legal tender describes an instrument recognised by law that can be used to settle all debt, public and private. There is not always an obligation, though, to accept a legal tender instrument in payments.

A legal tender designation for CBDC may help reinforce the notion that CBDC is merely a different representation of the same national currency. Central bank reserves are typically not identified as legal tender. Legal tender designations are not necessary for widespread adoption of a payment instrument.

Legal tender designations were bestowed late on banknotes. Germany introduced modern banknotes with the establishment of the German Central Bank (Reichsbank) in 1875 but banknotes (Reichsbanknoten) became legal tender only in 1909; in Switzerland, banknotes became legal tender only in 1999. In the United Kingdom today, banknotes issued by the Bank of England are legal tender in England and Wales, but not in Scotland and Northern Ireland.

## **14 Regulation**

CBDC constitutes a different central bank medium. A priori, CBDC does not seem to require attracting any regulation, or regulation different from other central bank mediums.

Considerations for extending existing e-money regulations, which are meant for commercial banks, to central bank money may unjustifiably constrain the utility and objective of central bank money.

The circulation of CBDC offshore may give rise to new considerations about the rules that should prevail between home and host regulations. The central bank may insist that its home regulation should apply when CBDC is used in transactions outside the home country. The notion of extra-territorial regulation remains controversial. A home central bank will resist a foreign CBDC to be governed by external regulation. The debate arising in relation to possible sanctions or exclusion from certain payment systems constitute external regulation.

## **15 Analysis**

CBDC may afford the central bank new visibility of transactions conducted in central bank money. In principle, all CBDC transactions are traceable to varying degrees depending on technology choices and could offer the central bank the possibility to follow retail transactions that are normally outside the central bank's reach. Because CBDC transactions would be instant, monitoring could be in real time and encompass locational, industry-specific and other dimensions. This could offer novel input about the formulation of monetary

policy and represent an alternative approach to track consumer behaviour. The new visibility could also be available if CBDC were to circulate offshore and could provide the central bank with insights into the use of central bank money in international transactions. These considerations will naturally have to be weighed against possible privacy concerns and may give rise to sharing of information between home and external supervisors.

## 16 Monetary policy

CBDC is unlikely to affect monetary policy. CBDC represents a new medium that would coexist with existing central bank mediums. Possible concerns associated with the introduction of CBDC include high levels of adoption that cause a significant recomposition of monetary aggregates and a fragmentation of the money market. The central bank will always continue to control the size of the monetary base but may not be able to fully control its composition.

The hypothesis is that CBDC would be monetary policy neutral. It is thought that the central bank would maintain full control of short-term interest rates and the monetary base. This rests in large part on the expectation that CBDC would be adopted to complement existing central bank monies and not cause a significant increase in the propensity to hold central bank money.

CBDC may offer new approaches to monetary policy implementation. The new functionalities embedded in CBDC could enable central banks to pursue modifications of their monetary policy frameworks. CBDC will need to be perceived as fully fungible with existing central bank mediums. To maintain the singleness of the national currency, CBDC ought to be accepted as simply a different representation of the same national currency, and not give rise to different exchange rates between banknotes, reserves and CBDC. A firm commitment by the central bank to exchange at par CBDC would support fungibility. The basis for the singleness of the national currency is the continued integrity of the money market that depends on the ability to move funds seamlessly between CBDC and other mediums. The seamlessness should not be dissimilar from existing conversions of cash into reserves, and not be unduly impaired by fees or other frictions that may harm fund movements.

The channel through which CBDC could affect monetary policy is estimated to be mostly through the interest rate and expectations channels. If CBDC gives rise to high levels of adoption and crowding out of other monetary aggregates it may affect monetary policy effectiveness. If CBDC is less responsive to monetary policy impulses, for example due to a preference to maintain large CBDC balances to support CBDC-related transactions, it would weaken the central bank's ability to stabilise short-term interest rates. If CBDC is perceived to cause a significant change in net foreign assets, the central bank may need to consider mitigating measures that ensure the public's expectations about the stability of the exchange rate regime can be maintained.

The increase in the propensity to hold CBDC would naturally affect the size of the central bank's balance sheet. This may incur additional, and at times unwanted, risks for the central banks and may shift public expectations about the ability of the central banks to remain effective. The central bank could take remedial measures including using quantitative and



price measures to alter the relative attractiveness of different central bank and bank mediums as an extension of conventional monetary policy interventions.

The adoption of an interest-bearing CBDC could be envisaged. The possibility of CBDC to be interest bearing has been viewed as neutral to positive (Bordo & Levin, 2017); (Davoodalhosseini, 2018). For a wholesale CBDC, interest bearing may be considered to maintain parity with reserves. For a retail CBDC, an interest bearing CBDC would constitute a novelty and act as a new policy instrument. It would allow the central bank to directly affect money balances held by the non-bank public. As central banks normally shun direct monetary controls, e.g. reserve requirements, an interest-bearing retail CBDC may be controversial. While an interest bearing CBDC offers additional policy levers, particularly in low and negative interest rate environments, it could also complicate monetary policy in the absence of a stable nominal anchor.

CBDC will need to preserve the capacity of the financial system to channel liquidity to the real economy. The central bank may consider additional measures if the adoption of CBDC leads to a crowding out of parts of the financial systems that have been effective liquidity transmitters (see the section titled '*Disintermediation*' for more on this). At the same time, CBDC may give rise to new financial system entities, including payment service providers and other non-bank financial entities, that may prove similarly capable of effectively channelling liquidity to the real economy.

A CBDC may increase the velocity of central bank money. As CBDC-based payments would be performed instantly, central bank money balances would immediately be available for re-use. It would only affect transactions that are not currently subject to instant settlement, for example foreign exchange, card network and ACH transactions. This could reduce actual CBDC balances necessary to ensure orderly payment transactions.

### **Box 9. Fixed exchange rate regime**

The adoption of CBDC under fixed exchange rate regimes may cause additional concerns due to an immediate need to control the size of the monetary base. The importance of net foreign assets to signal the robustness of the fixed exchange rate regime implies that innovation in external financial flows and the propensity to hold central bank money may affect perception of the viability of the regime. If CBDC leads to important monetary innovations, additional safeguards may be needed to ensure expectations about the stability of the exchange rate remain well anchored.

CBDC may affect net foreign savings if non-residents are allowed to hold home CBDC balances. Large CBDC balances and the possibility that non-residents are less responsive to monetary impulses provided by the home central bank may complicate the conduct of monetary policy. Large CBDC balances held by residents and non-residents may also divert liquid balances from instruments normally used in open market operations, lead to a weakening of the interest rate channel and complicate the control of short-term interest rates. Additional measures may be needed to prevent an undue increase in CBDC balances and could consist of imposing ceilings and "throwing sand", which is introducing frictions to raise costs, into CBDC transactions.

The possibility of deploying "helicopter money," the free distribution of central bank money, has often been associated with CBDC. Such a measure has remained highly contentious. While CBDC may make such measures easier to implement, helicopter money is not be a measure exclusively associated with CBDC.



The possible use of CBDC by non-residents may expand direct monetary policy considerations beyond national borders. Central banks may decide to accommodate demand for CBDC by non-residents directly thereby extending liquidity accommodation to non-residents. This would shift monetary policy implementation from largely a domestic focus through the home banking system towards an international focus.

## 17 Fiscal operations

CBDC may serve as a new infrastructure for conducting fiscal operations. Most fiscal operations naturally have a monetary impact. CBDC is a payment medium but can also serve as an infrastructure to distribute fiscal assistance and levy taxes. The distribution of benefits would constitute a fiscal operation but could use CBDC to implement such assistance. For example, the direct deduction of sales tax at the point of sale would constitute a fiscal operation leveraging on the CBDC infrastructure.

Cooperation between the monetary and fiscal authorities need to be envisaged to ensure CBDC can serve broader economic policy objectives while safeguarding the division between monetary and fiscal operations. The programmability of CBDC may allow the central bank to delegate programmability and perform fiscal operations with the fiscal authorities to keep CBDC free from undue restrictions. Central banks may be concerned with undermining the universality of central bank money that may be a deterrent for adoption.

### International considerations

## 18 International payments

CBDC has been recognised as a possible approach to address persistent deficiencies in international payments and settlement. The difficulties arising in international payments are in large part due to money remaining local. Money almost never crosses borders—cash is a rare exception—and can only be exchanged directly between entities holding an account at the same bank.

An important potential innovation in international payments is to allow non-residents to hold CBDC. If CBDC can be held by non-residents, an outright settlement in central bank money would be possible between resident and non-resident entities, allowing central bank money to be used to settle international financial transactions. The safety of central bank money would thus be extended to international payments, improving conditions for international exchange.

The ECB in its digital euro report has explicitly stated that a euro CBDC could be held by non-residents and enhance the euro's role as an international currency and bestow the European Union with greater strategic autonomy (ECB, 2020). China is also expected to use the e-yuan to advance internationalisation of its currency amid only modest gains to date. While the use of CBDC for wholesale international payments seems strong, its use for retail payments and remittances may be more ambiguous.

There is widespread agreement that international monetary relations are strained with persistent large external imbalances and heightened exchange rate volatility. The continuous, strong dependence on a narrow set of national currencies for conducting international financial transactions seems to be a dominant factor. If more currencies were available, the international financial system would likely be more balanced and offer a greater variety of sources of currency liquidity to perform needed adjustments and accommodate payment needs. Some of those advantages can also accrue to smaller currencies if CBDC can make it easier to access and use them. CBDC may thus shift the relative attractiveness of currencies and lead to greater diversification in international payments.

The use of smaller currencies in international payments may be contentious. Concerns that the use of a currency by non-residents undermining monetary policy stability may be warranted if non-residents are less responsive to changes in monetary policy than residents.

Central banks have differed historically in promoting currency internationalisation; for example, the Bank of Japan with the yen free accounts and the Bundesbank being opposed to international use of the mark. Rapid internationalisation of the yen and the mark during the 1980s does not seem to have posed undue constraints on the effectiveness of national monetary policies. It is also not clear if the important international use of the dollar constrains the effectiveness of U.S. monetary policy. While the role of smaller currencies may be different amid additional vulnerabilities, the case for using local currencies for cross-border payments rather than third-country currencies seems to be a strong one.

#### **Box 10. High level architecture of CBDC cross-border deployment**

Different architectures and governance arrangements exist for cross-border CBDC deployment to determine access for foreign institutions. Those models are characterised by commercial banks and other financial institutions being able to hold outright the CBDC of a foreign central bank. Conventional models relying on the correspondent banking model may continue to exist as an alternative approach.

**Multi-network:** Each central bank maintains a separate CBDC network and allows foreign institutions to participate. Foreign institutions can take delivery of the home and foreign CBDCs.

**Foreign network:** Home central bank deploys its CBDC on a foreign network that has the participation of the foreign central bank, its home network and home and foreign institutions. Home and foreign institutions can take delivery of the home and foreign CBDCs.

**Settlement corridor:** Home and foreign central banks set up a third network based on commonly agreed upon principles and allow participation of home and foreign institutions. Home and foreign institutions can take delivery of the home and foreign CBDCs. The home and foreign CBDC would normally not be used in the respective home and foreign national CBDC networks.

The international use of a currency will need to be compatible with regional arrangements. Take for example, in the Middle East with existing financial payment and settlement systems including the Gulf Cooperation Council Network (GCC Net) and the Gulf Cooperation Council Real Time Gross Settlement (GCC RTGS) System, cooperation is needed and also with the Arab Monetary Fund through the Arab Regional Payment System (ARPS).

The possible use of CBDC for remittances would imply that remittance payers could send CBDC to the remittance receiver offshore. Additional arrangements may comprise, allowing remittances to be sent to offshore financial intermediaries and be converted locally into local currency balances. CBDC would compete with existing money transfer services but may be the preferred medium by local financial intermediaries. The use of a home CBDC for retail transactions in a host destination will remain controversial.

The adoption of a CBDC by a foreign central bank could lead to its adoption by residents and give rise to a substitution of the local currency or “dollarization.” The level of adoption would depend on the access provided by the issuing central banks. In principle, unless the resident public has a higher propensity to hold a foreign CBDC compared with financial balances denominated in the same foreign currency, changes in the composition of resident portfolios are unlikely to shift significantly with the availability of foreign CBDCs. The ease of access is expected to be the key determinant for home adoption of a foreign CBDC and availability of alternative mediums including a home CBDC.

### **Box 11. Dollar CBDC**

The possible issuance of a CBDC by the U.S. Federal Reserve would make the most important currency available on a wider range of payment platforms, expanding its ubiquity. It could increase use and demand for dollars, and further increase dependence thereof.

The Federal Reserve has remained cautious in its approach and no timetable has been announced. Indications by the Federal Reserve suggest that work is advancing to give consideration for a future introduction.

The availability of a digital dollar will increase pressures for other central banks to contemplate a similar adoption for their national currencies. The possible introduction of a digital national currency ecosystem could shift incentives towards offering native mediums to share similar infrastructures. Access to a dollar CBDC outside the U.S. is presumed to be one of its principal attractions but is not certain.

The adoption of a dollar CBDC may change reserve management practices of countries fixing to the dollar. Since CBDC could be held outright as a reserve asset, it may replace traditional reservable assets and lead to a recomposition of reserve assets. And possibly, to some extent, crowd out treasury notes and other reservable assets.

Central banks will require certain supervisory functions to be maintained for transactions conducted offshore or by non-resident entities. While regulations are normally national in scope, central banks may seek to extend some regulations to non-residents to ensure transactions in CBDC meet domestic monetary policy objectives. Access by non-resident entities will likely be restricted and based on certain eligibility criteria that may comprise whether host regulation is comparable to home regulation or other prudential standards.

## **19 Foreign exchange**

The use of CBDC could transform the foreign exchange market. The foreign exchange market is the biggest user of central bank money with a daily turnover of about US\$6.3 trillion. Changes to access policy would represent a necessary condition to advance use

cases for CBDC in international payments and settlement. Access to enable non-residents to hold CBDC would allow foreign exchange trading to be conducted directly in CBDC. The direct exchange of CBDC through atomic transactions would make foreign exchange trading riskless in terms of settlement, credit and liquidity (though operational risks would remain). It would make foreign exchange transactions safer and offer a basis for advancing orderly international financial integration.

Foreign exchange transactions currently rely on the principle that foreign claims can only be assumed through a correspondent bank. Currencies are exchanged at a set exchange rate between buyer and seller. In the standard correspondent banking model, the bank account of a buyer of a foreign currency would be debited by the amount of the purchase in local currency and assumes a claim of the equivalent amount in foreign currency against a local or typically foreign correspondent bank. Settlement through CLS Bank based on a PVP transaction would occur through the simultaneous debit of the local currency account at the local central bank, and credit of the foreign currency at the correspondent bank's account at the foreign central bank while the foreign currency buyer would assume a claim on the correspondent bank. Outright settlement in central bank money between local and foreign entities is not normally possible.

If CBDC were to be exchanged directly, in a principal for principal transaction, each counterparty would be able to assume an outright claim on a central bank. If transactions are atomic and instant, the executed trade is payment and settlement at the same time, and both counterparties would be able to instantly reuse the funds obtained. This should eliminate the need for netting and clearing of transactions. CBDC could therefore lead to a complete reorganisation of the foreign exchange market.

# Next steps

Central banks have conducted numerous experiments around CBDC. Several proofs of concept have demonstrated that CBDC can meet a large number of use cases and offer new approaches to payments and settlement. Wide-based adoption has remained elusive. However, more central banks consider CBDC as simply another format of central bank money that can serve more payment platforms and systems, advancing new functionalities and broadening the reach of central bank money. CBDC can itself be considered a catalyst towards a more diversified payment system that may give rise to new actors and use cases.

CBDC for retail payments was introduced in the Bahamas, Nigeria and China already, but adoption seems limited. End-users will mostly be indifferent between using central bank money or other monies for payments. While the central bank would benefit from a more diversified, resilient and autonomous payment system strengthening the sovereignty of the state, central banks may also conclude that the vast range of digital payment means for consumers, where available, may not warrant a CBDC.

The wider adoption for wholesale payment seems most likely amid the controlled nature of a wholesale payments environment. Central banks may be willing to make a native payment instrument available for token-based financial market infrastructures, which would also afford the same quality of settlement that conventional exchanges and other trading venues provide through their access to central banks' large value payment systems. It would additionally help maintain a level playing field between different financial market infrastructures.

Next steps for central banks will likely include increasing considerations for pilots and partial adoption. Pilots would allow CBDC to be deployed in more production-like settings to inform central banks about the conditions that must be met by central banks and market participations for a successful introduction of CBDC, including possible regulatory and legislative adjustments where needed.

Leading central banks are expected to advance towards establishing more permanent platforms or test environments with access to CBDC for the financial sector. It would allow them to explore possible use cases and gradually build needed infrastructures to reach a production-ready deployment.

Banks and other financial intermediaries will likely launch more products compatible with future CBDC and will need to take measures to establishing capabilities to be effective intermediaries of CBDC including but not limited to offering CBDC services and infrastructures to their clients. Financial market infrastructure providers, including central securities deposits, will likely embrace emerging CBDC use cases. New financial actors will request and likely obtain access to CBDC—upon meeting set eligibility criteria—to offer similar settlement conditions as incumbents.

CBDC is set to come at scale. Many business models may not be feasible using existing systems but would be by leveraging new technologies offering alternative use cases, more direct financial relations and more efficient services throughout the asset and financial product life cycle. CBDC is fulfilling that promise.

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