

Central Bank Digital Currencies

A Global Capital Markets Perspective

FEBRUARY 2022



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Foreword

Over 70% of central banks are starting to explore the introduction of central bank digital currencies (CBDCs), with progress ranging from theoretical papers to proof-of-concept exercises. Mainstream financial market participants are taking these exercises very seriously and are engaging in detailed work to try to understand how these developments, if brought to fruition, would recast existing markets. The Global Financial Markets Association (GFMA), as a collective voice on matters that support global capital markets, takes particular interest in this topic as its members will play a critical role in the potential distribution and intermediation of CBDCs.

This report is intended to identify those considerations which GFMA regards as critical to the success of potential CBDCs in wholesale markets (wCBDCs). It outlines the opportunities, challenges, and questions concerning the design, issuance, and legal status of a wCBDC while also introducing use cases to provide a framework for continuing a constructive conversation.

Our recommendations stress that central banks in collaboration with the private sector continue to explore the role that wCBDCs can play in driving innovation and efficiencies in wholesale markets. The adoption of wCBDCs should be balanced and the timeline for their introduction should be sufficiently cautious to mitigate any potential transition risk, impacting safety and soundness and financial stability. We recommend the use of sandboxes, proof of concept strategic dialogues with market participants, and pilot programs based upon defined use cases to test the application of wCBDCs to help identify the impact on capital markets. After sufficient analysis of lessons learned, financial institutions and regulators will require a defined transition period for effective implementation.

This report was commissioned from Boston Consulting Group (BCG) and Clifford Chance by GFMA and has benefitted from the active participation of and contributions from GFMA member firms representing the global capital markets industry. This report was developed based on research, interviews conducted with contributing member firms during the fourth quarter of 2021, and input from other market participants with particular expertise relevant to the topic of CBDCs. It is being published to promote a constructive dialogue on the potential benefits and issues which the introduction of wCBDCs could bring to the international and domestic financial markets, and to provide a basis for communication and collaboration between public and private institutions.


GFMA represents the common interests of the world's leading financial and capital markets participants to provide a collective voice on matters that support global capital markets. It also advocates on policies to address risks that have no borders, regional market developments that impact global capital markets, and policies that promote efficient cross-border capital flows to end users. GFMA efficiently connects savers and borrowers, thereby benefiting broader global economic growth. The Association for Financial Markets in Europe (AFME) located in London, Brussels, and Frankfurt; the Asia Securities Industry & Financial Markets Association (ASFIMA) in Hong Kong; and the Securities Industry and Financial Markets Association (SIFMA) in New York and Washington are, respectively, the European, Asian, and North American members of GFMA.



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1 | Executive Summary

The Global Financial Markets Association (GFMA) in collaboration with Boston Consulting Group and Clifford Chance, developed this paper to examine the introduction of Central Bank Digital Currencies (CBDCs) in wholesale market transactions. The paper provides an overview of design considerations to be addressed in the issuance and usage of wholesale CBDCs (wCBDCs) (see section 3), and some capital market use cases (see section 4) regarding how wCBDCs might be deployed in wholesale payments, security settlements, and cross-border foreign exchange (FX) transactions.

There is recognition that the adoption of wCBDCs could enhance the efficiency, resilience and effectiveness of money flows and capital markets, including:

- faster payment and settlement (same day, intraday or instantaneous) and 24/7 availability;
- more efficient, more transparent, and less costly cross-border transactions;
- optimization of financial resources (e.g., capital, funding, liquidity, and collateral); and
- opening up new avenues for financial product innovation.

One area of focus is wCBDCs as a payment instrument since it has the potential to significantly reduce settlement risks inherent in settlement processes and systems when securities are natively issued with Distributed Ledger technology (DLT)¹.

However, there is also recognition that other possible technologies and approaches exist to achieve those objectives. The benefits from the introduction of wCBDCs will only be achieved if both the wCBDCs themselves and the infrastructure which facilitates their uses are appropriately and effectively designed.

The issuance and usage of wCBDCs involves policy challenges and trade-offs. The following are the threshold factors that must first be considered:

- wCBDC may impact bank funding and credit intermediation, especially during periods of stress, and have the potential to crowd out private payment solutions;
- Direct access to central bank issuance of wCBDC needs to entail requisite regulatory protections, including AML/CFT/Sanctions oversight and enforcement;
- The form and method of distribution of wCBDCs and the eligibility of market participants involved in such distribution, must be evaluated carefully to ensure that there is adequate capital markets acumen, security, protection of data and privacy controls;
- The interconnection between retail and wholesale markets must be considered in relation to the introduction of wCBDCs such that a wCBDC designed for a particular wholesale market does not overlook potential impact on the related retail market;
- The technology underlying wCBDCs enables smart contract functionality and

¹ DLT is a decentralized database managed by multiple participants, across multiple nodes. Blockchain is a type of DLT where transactions are recorded with an immutable cryptographic signature called a hash. The transactions are then grouped in blocks and each new block includes a hash of the previous one, chaining them together, hence why distributed ledgers are often called blockchains. See <https://www.r3.com/blockchain-101/>

programmability, which can present potential benefits, but could also raise significant risks and challenges that the cost benefit must be evaluated;

- The introduction of wCBDC design model that differs substantively from legacy fiat central bank deposits may cause market participants and markets to trade wCBDC as a product separate from fiat currency resulting in different legal treatment. This could lead to market fragmentation, basis risk and other market risks currently unidentified;
- Suboptimal market efficiencies may arise if a) wCBDC operates in isolation and is not freely and more or less instantaneously convertible to other forms of central bank money, or if b) wCBDC trades over separate market infrastructure without any interoperability, or limited interoperability with other wCBDCs; and

- A transition period between decision to launch and actual implementation will be needed for central banks and all market participants to adapt to new or evolving processes that will in turn generate new roles and responsibilities to support the financial stability of the financial ecosystem.

A central conclusion of this paper is that “do no harm” should be the fundamental principle when considering design models for wCDBCs. For a wCBDC to be a beneficial and valuable instrument – enhancing the efficiency, resilience and effectiveness of money flows and capital markets – it must be crafted as part of a collaborative partnership between public and private sectors. A series of critical design and legal factors that are outlined within this paper must also be taken into account.

► DESIGN CONSIDERATIONS:

- **Access:** Limit access initially to regulated financial intermediaries that have access to central bank accounts in their respective jurisdictions. Consideration of broader access to be reserved to a later date when risks and rewards can be more effectively assessed based upon the initial implementation
- **Interoperability:** wCBDCs are expected to operate alongside legacy instruments and systems, and not to replace them. It is therefore important for wCBDCs to be interoperable with the broader financial market ecosystem. This includes establishing interoperability 1) with existing and new wholesale payment instruments and systems, 2) with broader capital market ecosystem and financial market utilities, 3) with cross-border foreign exchange systems, 4) with local wCBDC and any retail CBDC (rCBDC) that may exist, and 5) with DLT infrastructure and protocols. It is also preferred that local or regional CBDC systems and infrastructure should interoperate with each other, including in cross-border and multi-CBDC (mCBDC) arrangements. Global standard setters will take on the role of coordinating wCBDC developments and setting common standards among central banks, partnering with the private sector to design and implement the necessary solutions for interoperability. Any DLT network aiming to deploy interoperable solutions should be built to the highest resiliency standards. As integration with legacy systems is accomplished, integration with any further innovations in payment systems should be evaluated in a more careful manner
- **Legal Status of wCBDC** must be addressed in legislative frameworks, with the goal of retaining the same classification and treatment as legacy fiat currency.

- **Prudential Treatment:** Prudential treatment regarding the role of wCBDCs needs to be addressed and incorporated into global standards and regional policies. The prudential treatment of wCBDCs should be analogous to other central bank money, particularly with regards to capital and liquidity frameworks. To avoid unintended consequences, finance ministries, central banks, and prudential regulators should collaborate with the financial sector to ensure the design models of wCBDCs are in fact analogous to other central bank money.

- **Risk Management:** wCBDCs should be incorporated into existing risk management processes and solutions for clients.

- **Programmability:** The public and private sectors should work together to address the opportunity, the challenges, and risks associated with programmable money.

- **Privacy:** Even in a wholesale environment it is important that the system can comply with end-user privacy legislation.

► LEGAL CONSIDERATIONS AND USE CASES:

- **Application of standard market protections to transactions with wCBDC:** the use of wCBDCs for the purposes of settlement of transactions on a delivery versus payment (DvP) basis may require the legislative framework to categorize wCBDCs payments as equating to cash payments. This in turn will require a framework to expressly recognize that settlement finality, netting and other typical protections are applicable to transactions involving wCBDCs.

- **Recognition of foreign wCBDCs as legal tender:** to use wCBDCs for foreign currency transactions, it is imperative that legislative frameworks recognize wCBDCs as the legal tender of the jurisdiction where it was issued regardless of differences in wCBDC design characteristics that other jurisdictions may have applied.

We recommend that central banks in collaboration with the private sector continue to explore the role that wCBDCs² can play in driving innovation and efficiencies in wholesale markets. The adoption of wCBDCs should be balanced and the timeline for their introduction should be sufficiently cautious to mitigate any potential transition risk, impacting safety and soundness and financial stability. We recommend the use of sandboxes, proof of concept strategic dialogues with market participants, and pilot programs based upon defined use cases to test the application of wCBDCs to help identify the impact on capital markets. After sufficient analysis of lessons learned, financial institutions and regulators will require a defined transition period for effective implementation.

² The BIS Innovation Hub has been working on various projects to explore wCBDCs. Refer to this page for details (https://www.bis.org/about/bisih/projects.htm?m=1_441_720).

2 | Background

2.1 Introduction to CBDCs

CBDCs are envisioned as having two different functions – retail and wholesale. Retail CBDCs are designed for circulation in small amounts and conceived of as an alternative to banknotes or coins. wCBDCs are designed for settling financial market transactions and possibly circulating outside of the issuer's territory.

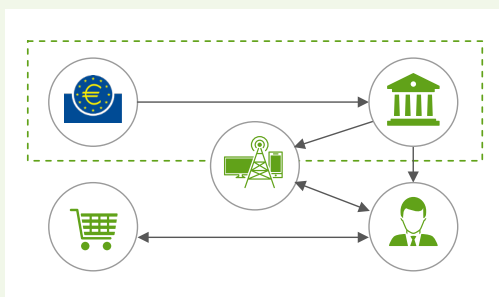
It would be possible to create an rCBDC without a wCBDC and vice versa. However, the introduction of a rCBDC could, and most likely would, result in knock-on effects for wholesale markets. This would be true, for example, when retail aggregators fund their operations via wholesale markets. Even though, rCBDCs and

wCBDCs do not have to utilize the same infrastructure, nor have the same legal status, interoperability and legal consistency globally will promote the safety and soundness, financial stability, and the integrity of markets.

The use of wCBDCs for cross-border payments would require interoperability among different wCBDCs, which may operate on diverse national DLT or not use DLT at all. Projects currently underway³ that aim to facilitate cross-border payments by enabling the interoperation of different DLTs are generally referred to as multi-CBDCs (mCBDCs) arrangement. For detailed description of the types of CBDCs, refer to the Appendix 5.1.

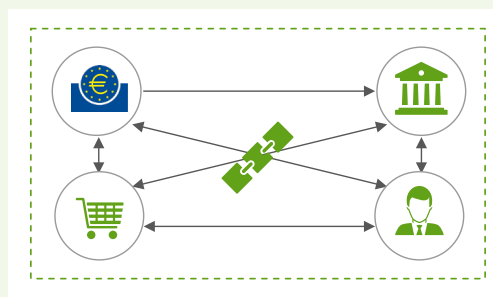
Figure 1 | Wholesale CBDC and retail CBDC

Wholesale CBDCs



Used to facilitate interbank settlement, i.e., payments between the banks and other entities that hold accounts at the central bank

Retail CBDCs



Used for payments between individuals and businesses or other individuals, akin to digital bank notes

³ Refer to BIS Innovation Hub projects.

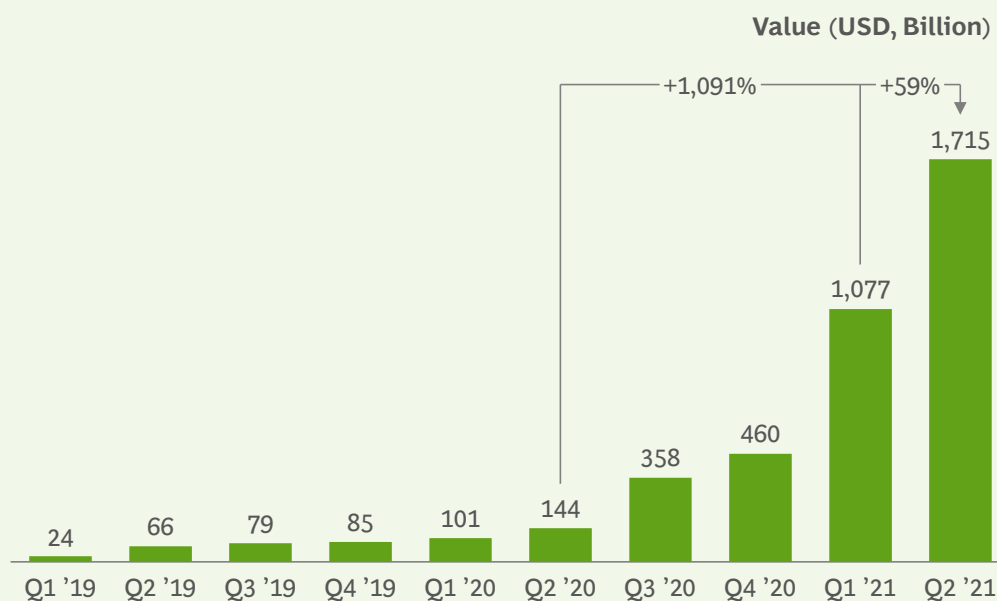
2.2 Private forms of digital payment instruments

wCBDCs may co-exist alongside private forms of digital payment instruments. These can be broadly divided into free floating cryptocurrencies (such as bitcoin), whose value is determined wholly by market demand, and stablecoins, which use stabilization mechanisms (such as reserves) to preserve a fixed valuation relative to a reference asset. Stablecoins arguably could occupy the same economic niche, and perform a similar commercial function, as CBDCs. Over the past few years, the total market capitalization of stablecoins in issue has grown rapidly, topping 174.7 billion USD in January 2022⁴. Stablecoins with the largest market

capitalization currently include Tether (78.0 billion USD), USD Coin (50.7 billion USD), and Binance USD (16.1 billion USD). Stablecoin transactions have also increased exponentially to 1.7 trillion USD in the second quarter of 2021⁵, a 1,091% gain year-over-year. See Figure 2 below.

Stablecoins come in a wide variety of forms and risk characteristics. Recently, responding to a request from BCBS to opine on prudential treatment of crypto assets, GFMA set out a proposed risk taxonomy for different types of stablecoins, identifying more and less risky versions of these assets⁶. We recognize that stablecoins are created for different purposes and, thus, in our view, a straightforward “CBDC versus stablecoin” comparison is not possible.

Figure 2 | Stablecoins quarterly transaction volume



Source: Messari Report DeFi review Q2 2021

⁴ Data from CoinMarketCap.com.

⁵ See R Watkins and R Talamas, “Q2’21 DeFi Review”, July 2021.

⁶ See “Joint Trade Associate Response to the BCBS Consultative Document on the Prudential Treatment of Cryptoasset Exposures”, September 2021.

Stablecoins are usually issued and transferred on DLT platforms. This may provide certain efficiencies in regard to payments and settlements:

- Stablecoins can operate 24/7 and the transactions can be instantaneous;
- Stablecoins are easily accessible, and can be used both domestically and across borders;
- Stablecoins can achieve a degree of interoperability, and some stablecoins are currently replicated on multiple blockchains or DLT. For the market to grow and innovate further, a universal interoperability network that securely connects all relevant networks is needed

However, stablecoins also carry risks:

- In many cases there is limited information and transparency about reserves, or the management of those reserves and the risk taken;
- Most stablecoins are transferred through systems and entities that do not require disclosure or verification of user identity, or inhibit AML/CFT/Sanctions compliance.

The creation and distribution of stablecoins is broadly unregulated today. Regulators and

governments perceive that stablecoin arrangements perform many of the functions as regulated institutions, and a number of new government proposals would subject stablecoins to regulation. For example, in the U.S., the President's Working Group on Financial Markets (PWG), along with the Federal Deposit Insurance Corporation (FDIC) and the Office of the Comptroller of the Currency (OCC), recently recommended that stablecoins used for payments be placed under a federal regulatory framework. This would include requiring stablecoin issuers to be insured depository institutions and custodial wallet providers subject to federal oversight. Some of the issuers are trying to apply for bank licenses, particularly after the publication of the report⁷.

It is unlikely that the issuance of CBDCs will stop stablecoin development. Instead, we foresee a "multi-coin" environment, where stablecoins and CBDCs co-exist. The question of whether they compete with or complement each other will depend on their applications, local regulations and CBDC designs. Ideally, well-regulated stablecoins or other forms of digital commercial bank money can help fill in the gaps in uses that CBDCs are not designed for, or in jurisdictions where CBDCs are not available.

⁷ See President's Working Group on Financial Markets, the Federal Deposit Insurance Corporation, and the Office of the Comptroller of the Currency, "Report on Stablecoins", November 2021.

3 | Building Blocks for Wholesale CBDCs

Designing a wCBDC raises several fundamental questions, and necessary trade-offs. These include (but are not limited to): What kind of access model should be used? Would wCBDCs be available to foreign entities and, if so, would they contribute to policy goals or institutional mandates? How could wCBDCs be made interoperable with other new or existing payment systems? Which technologies should the ecosystem be built on? Should central banks become technology companies or partner with private players? What are the impacts on risk, compliance, regulations, etc.?

In order to address these uncertainties and facilitate the development wCBDCs, we have

identified 5 essential building blocks for consideration by central banks and other financial market authorities:

1. Access
2. Interoperability
3. Legal Status
4. Prudential Treatment
5. Risk Management

We discuss each building block in detail in a 3.1 to 3.5; other considerations are explored in section 3.6.

Figure 3 | Building Blocks of CBDC



3.1 Access

Access to central bank money for non-banks today is limited to cash, and access to central bank accounts is limited to financial institutions and financial market infrastructures (FMIs) that must pass strict regulatory requirements.

The ability to hold wCBDCs directly places the holder in the same position as if they had a central bank account. Thus, the question of who should be allowed to hold a central bank account is the same question as the question of who should be allowed to hold wCBDCs directly. In order for a wCBDC to be broadly used as a payment mechanism for direct payments among wholesale market participants, direct access would have to be extended beyond the payment institutions referenced above. Such an expansion would have significant policy consequences and trade-offs for central banks to consider, some of which are identified in the Project Jura paper⁸. These consequences arise in relation to macroeconomic policy and in particular could impact the efficacy of monetary policy instruments

There are broadly two possible models for wholesale market participants to access wCBDCs: 1) direct access by obtaining central bank wCBDC accounts or wallets, 2) indirect access via regulated financial institutions that are direct participants. Note that the indirect access model resembles the existing two-tier financial system. Under this model, the roles and responsibilities of central banks, intermediaries and PSPs remain largely the same.

We recommend that central banks carefully evaluate the benefits and trade-offs of including different types of intermediaries to handle wCBDC payments and distribution. The principle of “same activity, same risk, same regulation” should prevail as a guiding principle.

At this stage, we propose the direct access model where wCBDC is limited to regulated financial intermediaries that have access to central bank accounts (i.e., the indirect access model for other institutions). However, over time, central banks may consider extending settlement services to select financial institutions in this phased approach:

Phase 1: As noted above, access to wCBDC should at present be limited to regulated financial institutions (depository institutions and regulated payment systems providers) who currently have full and direct access to central bank accounts and services. Based on the experience gained from this indirect access model, central banks may consider whether to move to phase 2 as below.

Phase 2: Limited access (settlement accounts) to select financial institutions with governance, risk management, AML/CFT/Sanctions, capital, liquidity and operational resilience standards that are comparable to regulated financial institutions.

Any such expansion of access to central bank money and payments systems via wCBDC in phase 2 must be weighed against risk and financial stability considerations. For example:

- If CBDCs are liabilities of the central bank, they will not constitute deposits with commercial banks, and the ability of commercial banks to make loans will be proportionately reduced. This could reduce the supply and increase the cost of commercial bank credit to the real economy. A further knock-on effect could lead to central banks transforming from their current market stability role as the “lender of last resort” to a “business-as-usual source of funding” for all market participants;
- central banks must address onboarding and AML/CFT/Sanctions issues which would arise from an expansion of access to

⁸ See BIS Innovation Hub, Banque de France, and Swiss National Bank, “Project Jura – Cross-Border settlement using wholesale CBDC”, December 2021.

wCBDCs beyond bank intermediaries. Central banks would have to develop capabilities that financial intermediaries already have extensive experience with.

There are also a number of questions which require answers:

- whether wCBDCs can be created without pre-funding?⁹
- whether intraday and EOD credit should be available to all participants or just selected participants (and who provides it and how)?
- whether wCBDCs should be recorded on or off intermediaries' balance sheets?

3.2 Interoperability

CBDCs will supplement rather than replace existing payment instruments - as the European Central Bank (ECB) notes: "A digital euro would be introduced alongside cash; it would not replace it."¹⁰ Similarly, in a wholesale context, wCBDCs will coexist with existing forms of money (e.g., central bank and commercial bank deposits) and their payment rails would coexist with existing payment systems. wCBDCs will also need to be connected to the broader capital markets ecosystem and applications (e.g., securities settlement, funding and liquidity, and collateral management), and the international cross-border trade and payments infrastructure.

Given the breadth of the wCBDCs potential connections, connectivity and interoperability are essential considerations in the design of its framework, standards, protocols, and technology architecture. More specifically, connectivity and interoperability should be considered across the following dimensions:

1. Interoperability with existing wholesale payment instruments and systems
2. Interoperability with new payment instruments and systems

3. Connectivity with the broader capital market ecosystem and financial market utilities
4. Interoperability with cross-border FX systems, including other international CBDCs
5. Interoperability between local wCBDC and any rCBDC that may exist
6. In the context of DLT-based CBDC infrastructure, interoperability between different DLT protocols

From a technical perspective, considerations should also be given to multi-party cryptography and decentralized consensus networks, which could allow for the creation of robust and scalable interoperable systems.

One of the main applications for wCBDC will be to serve as the payment leg of DvP settlement). The wCBDC infrastructure will therefore need to be interoperable with existing capital markets ecosystems and financial market infrastructures (FMIs), including central securities depositories (CSDs) and central clearing counterparties (CCPs). Many FMIs are currently experimenting with the adoption of DLT for the delivery leg of such transactions. The integration of wCBDCs with such initiatives could facilitate the use of smart contracts and have the potential to reduce settlement risk, unlock significant value for issuers and investors, and shift value pools across the capital markets ecosystem. This integration would amplify the importance of existing processes to maintain robust operational risk, AML/CFT/Sanctions, resiliency, and cyber risk management capabilities, and would need to be evaluated in light of industry products and processes which are adjacent to or dependent on current DvP models and their associated timeframes.

In addition to securities settlement, CBDCs may also help address several friction points in the

⁹ Pre-funding refers to the exchange of current central bank money for wCBDC, thus not increasing the money supply through new issuance of wCBDCs.

¹⁰ See European Central Bank, "A digital euro".

cross-border payments process identified by the Financial Stability Board (FSB)¹¹, including fragmented messaging formats, complexity of compliance checks, limited operating hours, legacy technology platforms, funding costs, long transaction chains through correspondent banking relationships, and weak competition. However, the utility of CBDCs for these purposes could be significantly inhibited by insular CBDC design preferences, systems and networks. BIS acknowledges these possible shortcomings and has explored three potential models of interoperability for mCBDC arrangements:

- Model 1, compatibility of technical and regulatory standards;
- Model 2, interlinking through shared technical interfaces or clearing mechanism;
- Model 3, integration in a single platform.

An example of an mCBDC development effort is Project Dunbar, which brings together the Reserve Bank of Australia, Bank Negara Malaysia, Monetary Authority of Singapore, South African Reserve Bank with the BIS innovation Hub to test the use of mCBDC's for international settlements. Another project that also explores the use of mCBDC is 'Inthanon-Lionrock to mBridge', again led by the BIS Innovation Hub, with participation by Hong Kong Monetary Authority, the Bank of Thailand, People's Bank of China and The Central Bank of the United Arab Emirates. (See Appendix 5.1.3 for detailed discussion about mCBDC models). These projects have demonstrated the feasibility of developing a framework that encompasses architecture and systems required to implement any or all of these three models.

3.3 Legal status

Different jurisdictions approach the legal aspects of money status in different ways, and it is not possible to prescribe a single approach. However, we believe that at a minimum there

needs to be legal clarity and consistency regarding what characteristics a token must have in order to be treated as money or as property, and this should include (a) the identity of the creator, (b) the form of the token, (c) the legal consequences of any limitations on creation, ownership, transfer or destruction of a token created, and (d) any mandatory requirements (such as compliance with privacy law) which will apply to the holder of a token.

Once tokens are created by a central bank and recognized by their local law as money, another critical question is how wCBDCs will be treated as a matter of law within the jurisdiction that they are issued. An account-based wCBDC should operate in the same way as an RTGS account balance; from a legal perspective, it represents an obligation of the central bank owed to the holder of the cryptographic keys that allow access to the account. In this regard, we note that many of the proposed monetary policy objectives that have been put forward to support the creation of wCBDCs only work in the context of account-based wCBDCs.

Token-based wCBDCs would be a new phenomenon, and their legal status would have to be firmly established before they became widely used. Unlike account-based wCBDCs, token-based wCBDCs would require central banks to recognize an obligation to the bearer of a token whose identities may not be immediately apparent or known. On the face of it, a token-based wCBDC is similar to a payment instrument (such as a bank note); it represents a payment obligation. In particular, and importantly, in general a transfer of an instrument or certificate is a transfer of property. However, tokens are a form of property that cannot be physically held. This raises the question of what legal status token wCBDCs have. In circumstances where access to wCBDCs is limited to a small number of PSPs acting on their own accounts or intermediating wCBDCs

¹¹ See Financial Stability Board, "Enhancing Cross-border Payments, Stage 1 report to the G20", April 2020.

for the wider market, the answer to this is crucial as it determines whether an intermediating PSP would be:

- acting as a custodian of the wCBDC and therefore granting the beneficial owner proprietary rights over the wCBDC; or
- acting as an agent and recognizing a claim over the wCBDCs (unless other protections are developed); or
- some other appropriate roles relevant to the wCBDC.

The legal ramifications suggested by these three possibilities are in turn wide-ranging, producing regulatory and ownership implications for the account banks.

Where tokens can only be held or transferred by a closed group of pre-identified users, they are operationally and functionally almost identical to existing central bank accounts. However, if tokens can be held by a wider group of holders (either directly or through banks acting as custodians), it will be necessary to conduct relevant AML/CFT/Sanction checks on the potential holders before permitting a transfer of ownership of the token.

Fundamentally, in order to be able to determine the status of a wCBDC, its treatment when held by intermediaries and the impact of an intermediary's insolvency, legislative frameworks must legally classify wCBDCs as fungible with fiat currency.

3.4 Prudential treatment

If wCBDCs become a settlement medium in wholesale capital markets, substantial CBDC balances will have to be held by banks and other financial institutions. Therefore, prudential regulators must set a robust and appropriate treatment for those instruments which is predictable over the medium and long-term.

The starting point for consideration of this risk is to look at how exposure to a central bank in its domestic currency is viewed; generally, these exposures are treated as risk-free assets. In addition, it is worth noting that if CBDCs were given a less favorable prudential treatment than central bank cash balances, their usability for regulated firms that comprise the core of the wholesale market would be significantly reduced impacting market efficiency.

Consequently, to fully realize the benefits of wCBDCs, they should be considered analogous to other central bank money. This would allow wCBDCs to be treated as high-quality liquid assets (HQLA) and included in a bank's Liquidity Coverage Ratio (LCR) liquid asset buffer, and also treated as central bank cash for the Net Stable Funding Ratio (NSFR) Available Stable Funding (ASF) and for Leverage Ratio exemptions (aligned with other central bank liabilities/claims).

Hence, to ensure smooth adoption of wCBDC, **we recommend¹² that the prudential treatment for wCBDC should be the same as other forms of central bank money (e.g., cash, coins, and deposits held by banks at central banks).**

3.5 Risk management

3.5.1. Financial stability

The greatest threat to financial stability from wCBDCs would arise from uncontrolled access to the wCBDCs. As discussed above, this would remove credit capacity from the commercial banking system. This would also create the possibility of "boom and bust" cycles of distribution and redemption, which could be very damaging at moments of systemic stress. It is important that at the initial stage access to wCBDC is limited to regulated financial intermediaries. This could mitigate these potential financial stability issues.

¹² See GFMA "[Joint Trade Associate Response to the BCBS Consultative Document on the Prudential Treatment of Cryptoasset Exposures](#)", September 2021.

3.5.2. Credit and liquidity risks

If a wCBDC is not easily convertible into other forms of central bank money on a one-for-one basis, or if it is designed to be used in a separate payment system and not interoperable with the current system, the risk of market fragmentation and inefficiency would increase. For example, two repo markets may emerge. In one, transactions may be settled with current central bank accounts, and in other one, transactions may be settled in wCBDCs. Liquidity reduction would occur in both markets because financial institutions would have to operate and maintain balances in two systems.

More broadly, the application of bank liquidity rules to holdings of wCBDCs needs to be addressed. The general principle regarding liquidity is that potential outflows should be matched to potential inflows, with any difference covered by a pool of liquid assets. Critically, this pool must be composed of assets denominated in the same unit of account as the potential outflows - for example, USD outflows must be matched by holdings of liquid USD assets. The issue raised by the emergence of wCBDCs is whether (a) outflows denominated in a particular wCBDC must be matched by holdings of that wCBDC, or whether they can be covered by holdings denominated in the underlying currency and, symmetrically, (b) whether holdings of wCBDC assets should be counted towards the liquidity requirements in respect to outflows in the underlying currency. This is not a simple yes or no question since the answers will to some extent depend on the on-ramps and off-ramps available to convert a currency into a wCBDC and vice versa. However, as pointed out in section 3.4, for wCBDCs to succeed, a currency and the wCBDC in relation to that currency ought to be regarded as the same thing.

3.5.3. Operational risk

The key distinction between CBDCs and central bank balances is that the operational processes required to employ them in transactions are different. Consequently, banks and other entities will have to build, stress-test and scale processes for dealing with wCBDCs. However, the mere presence of different operational processes does not necessarily imply added operational risk. On the contrary, wCBDCs on DLT could reduce operational risk, as GFMA and other trade associations argued in their response to the BCBS request for their opinions about the prudential treatment of crypto-asset exposures¹³.

During this transition period before the full-blown emergence of wCBDCs, central banks and market participants should collaborate in designing the CBDC processes and create sufficient controls to mitigate risks. Any operational risks that arise from the payment and settlement rails used, as well as the exchange of CBDC for other assets, would need to be identified and managed, same as in the use of traditional fiat for those purposes. However, there is no reason today to expect that the operational risk framework required in dealing with wCBDCs would be any different from those involved with other payment systems¹⁴.

It is also important to remember that one of the long-term objectives of the introduction of wCBDCs is to reduce operational risks, as increasing automation should reduce the possibility of human error.

3.5.4. Reputational risk

Designing and implementing wCBDCs is not a trivial effort. All the risks discussed above, such as financial stability risk, liquidity risk, funding risk and cybersecurity risk must be carefully managed. Otherwise, the reputation of central

¹³ See GFMA “Joint Trade Associate Response to the BCBS Consultative Document on the Prudential Treatment of Cryptoasset Exposures”, September 2021.

¹⁴ See SIFMA, “Consultative Document on the Prudential Treatment of Cryptoasset Exposures”, September 2021.

banks and market participants will be damaged, negatively impacting the adoption of wCBDCs.

In summary, “Do no harm” should be the fundamental principle to follow, as pointed out by a group of central banks¹⁵ and BIS in October 2020¹⁶. Central banks should not overlook the potential risks of introducing wCBDCs and need to balance the benefits and risks and to act conservatively when making decisions. **A properly structured wCBDC should not diminish a central bank’s ability to conduct monetary policy and maintain financial stability and should help participants reduce and manage credit, liquidity, and operational risk.**

3.6 Other considerations

3.6.1. Programmability

When designing CBDCs the question arises as to whether they should be “programmable” and where the tech layer stack for the conditionality should be built in. A programmable wCBDC is referred as “a digital form of money which the user can program to follow an inherent logic for a predefined purpose, based on attributes of the digital money itself.”¹⁷ Such restrictions could be either permanent or time limited.

Programmability is potentially a benefit for the wholesale markets – the ability to make transactions “self-settling”, so that they no longer require reliance on third party systems and decisions. The evolution of systems over time, will be challenging since the ability to program DvP settlement into both securities and money would potentially require programmability to operate across different

distributed ledgers. The creation of such interoperability, however, is the underlying primary goal for the successful development, implementation and role of wCBDCs.

The notion of programmable money is not new. A crossed cheque with its limitations on how it can be handled is a form of programmable money, as are conditional payment instruments (such as letters of credit in export financing), which have been around for centuries. However, the scope that DLT creates for programmable money means that the potential uses cases are entirely hypothetical, and it is not yet clear how programmability might be designed and developed when using digital infrastructure.

There are legitimate disagreements about whether programmability is a desirable feature in a digital payment instrument at all. One of the most important characteristics of existing central bank money in the form of notes and coins is that its transfer is unrestricted. However, in the context of a digital currency, programmability offers intriguing potential uses. For instance, in Phase II of Project Inthanon, the Bank of Thailand evaluated DvP settlement for tokenized bonds in interbank market trading and in repo markets against cash tokens issued by the Bank of Thailand¹⁸. However, this was only possible because the project adopted a single-ledger model for tokenized cash and securities. For similar programmability to be broadly used across a variety of different asset classes, the multiple ledgers involved would have to be designed to allow for interoperability.

The Jasper-Ubin¹⁹ project demonstrated that such interoperability is possible. In this project,

¹⁵ Group of central bank refers to Bank of Canada, Bank of England, Bank of Japan, European Central Bank, Board of Governors of the Federal Reserve, Sveriges Riksbank and Swiss National Bank.

¹⁶ See Bank of Canada, Bank of England, Bank of Japan, European Central Bank, Board of Governors of the Federal Reserve, Sveriges Riksbank, Swiss National Bank, Bank for International Settlements, “[Central bank digital currencies: foundational principals and core features](#)”, October 2020.

¹⁷ See F Main, “[Money in programmable applications, cross-sector perspectives from the German economy](#)”, December 2020.

¹⁸ See Bank of Thailand, “[Inthanon Phase 2](#)”, July 2019.

¹⁹ See Bank of Canada, Monetary Authority of Singapore, “[Enabling Cross-Border High Value Transfer Using Distributed Ledger Technologies](#)”, May 2019.

the Monetary Authority of Singapore (MAS) completed a cross-border transaction with the Bank of Canada (BoC) without any intermediaries. The separate blockchains involved - Ubin (MAS) and Jasper (BoC) - were based on two distinct blockchain platforms (Corda & Quorum) but executed payment-versus-payment (PvP) settlement through the use of Hashed Time Lock Contracts (HTLC)²⁰. The success of this experiment confirmed the feasibility of settling across countries, currencies, regulations and blockchain platforms.

Programmability, however, and particularly combined with interoperability, also creates risks and a number of difficulties will have to be overcome before it is ready for widespread use in digital currencies. If the array of programmable features in distributed systems increase, additional safeguards are likely to be required, and all infrastructures involved must support the same programmability, meaning harmonization across multiple separate ledgers, including governance and operational standards.

Additionally, security features and cybersecurity protections would need to be developed and implemented, taking into consideration other variables that relate to interactions with other systems needed for settlement or execution. Also, centralized controls, for example to lock stolen funds or query suspicious transactions, are more difficult to implement on a distributed system. Reliance upon programmability of a token also raises questions as to:

- whether such programming may be inherently static, and incompatible with changing needs (such as regulatory or legal restrictions adopted after issuance of the token)
- whether the underlying blockchain may have adequate security to maintain the integrity of such programming

- whether it may be managed in a dynamic manner to be sufficiently adaptable to changing needs and requirements.

In addition, serious thought needs to be given to the consequences of programmability for the fungibility of CBDC with conventional currency. Programmable features regarding the supply of, returns on or other features concerning CBDC may cause it to be valued differently, and potentially traded separately, from its conventional analogue. Central banks will need to consider the market fragmentation, liquidity limitations and other inefficiencies that could result from effectively having parallel currencies.

In addition, if a programmed CBDC is deemed to be a different product from legacy fiat currency for legal purposes, there could be questions as to whether the programmed CBDC can be netted against legacy fiat currency, whether it is fully acceptable for settlement purposes and whether it would enjoy the same legal treatment under existing insolvency laws and regulatory regimes.

There are other issues that require further evaluation and broader agreement before programmable CBDCs can become a reality as well. For example, how to limit risk, including hacking or tampering; who will be able to impose restrictions or conditionality and where in the tech stack that should happen; what will the verification method look like; and how will programmable tokens interact with traditional and other systems and infrastructures.

While we believe programmable money can unlock new innovative solutions, value and efficiency, the private and public sector should work together to continue the exploration and address the impediments and concerns discussed above.

²⁰ a smart contract that returns funds to sender if conditions are not met within a certain timeframe. The contract would lock or restrict assets until all conditions are met and at which point, the assets are transferred in their entirety to the desired wallet address.

3.6.2. Cybersecurity

Financial services firms are 300 times more likely than other companies to be targeted by a cyberattack – and dealing with those attacks carries a higher cost for banks than for any other sector, according to a BCG study from 2019²¹.

Attacks targeting wCBDC systems could come in various forms and with different purposes. Criminals could try to profit from hacking, create inefficiencies in wCBDC ecosystems, terrorize participants, or steal non-public data. A successful cyberattack on a wCBDC system will not only impact the direct users, but also damage the reputation of the central bank and reduce confidence in the wCBDC system. Cybersecurity is thus critical to the successful development of wCBDCs.

This is problematic, since the level of cybersecurity risk is a direct result of other design choices, such as access, interoperability, programmability, etc. Cyberattacks on a general purpose CBDC system will be more difficult to defend, due to the wide range of user access and end points. However, since wCBDCs reside in closed systems, they should be less susceptible to attack.

Choice of technology also has implications for cybersecurity. Cyber protections for centralized systems have evolved over decades and include many well developed IT best practices, security strategies and industry standards. A system based on public DLT, which is currently unlikely to be used in conjunction with wCBDC may be harder to defend, since it is almost impossible to guarantee that each node in the system will operate at the highest cybersecurity standards. A system based on permissioned DLT (a more likely option to be used with wCBDC) may be more controllable than public DLT but will still require permitted participants to have sufficient controls in place to limit their vulnerability while

not interfering with efficiency, safe transactions and required levels of privacy.

3.6.3. Operational resilience

Despite improvements in recent years, centralized real-time gross settlement (RTGS) systems remain susceptible to faults, errors and outages, as they create a single point of failure. While total outages are uncommon, they are not unheard of. For instance, there was an 8-hour outage of the Bank of England's antiquated RTGS system in 2014²² caused by configuration changes made to the system.

wCBDCs operated on permissioned DLT system may be less exposed to some of the problems facing RTGS systems. This is because DLT systems are not dependent on a centralized manager, but instead have many stakeholders and generate multiple copies of the ledger and can operate even when some of the nodes are not operational. Furthermore, an independently validated multiple-node consensus mechanism should be resistant to contagion and ensure that each participant's balance is traceable. If a single node is brought offline, the system should continue to function. However, hacking episode involving DLT-based systems have been documented and DLT should not be considered a panacea in this regard.

Assuming central banks adopt CBDCs and place liabilities outside RTGS systems, the development of new technologies and mechanisms for asset transfers, authentication, record-keeping, data management and risk management with the long-term aim of significantly reducing settlement delays should accelerate.

It is worth noting that wCBDC would not replace RTGS. Both systems would likely run in parallel, with the possibility of a permanent switch over to wCBDC architectures in the long term. This period of coexistence should enhance overall

²¹ See Boston Consulting Group, "Reigniting Radical Growth", June 2019.

²² See Deloitte, "Independent Review of RTGS Outage on 20 October 2014", March 2015.

systemic resilience but may also increase operational burdens. It will be important to determine how the benefits of CBDC could be extended to the traditional infrastructure.

when designing and implementing wCBDCs. Our key recommendations are summarized in the table below.

3.7 Conclusion

Throughout this section, we identified the key building blocks for central banks to consider

Table 1 | Recommendations for wCBDC design and implementation

Recommendations	
Access	Access to central bank money and the payment system is a primary design consideration for CBDCs and could have a profound impact on the financial market ecosystem. While there are benefits of extending access to non-regulated institutions, we recommend that central banks act cautiously. At this stage we propose access to wCBDCs be limited to regulated financial institutions that are eligible to hold central bank accounts in their respective jurisdictions.
Interoperability	wCBDCs are expected to be an additional payment instrument and system and not intended to be a replacement for existing ones. To realize wCBDCs' benefits in payments and settlements, it is important for wCBDCs to be interoperable with the broader financial ecosystem. This includes interoperability with both existing and new wholesale payment instruments and systems, with other capital market FMIs, and with cross-border FX systems. It is recommended that central banks and policymakers collaborate and set common standards, and partner with the private sector to design, experiment and implement solutions for interoperability.
Legal Status	In order to be able to determine the status of a wCBDC, its treatment when held by intermediaries and the impact of an intermediary's insolvency, legislative frameworks must legally classify wCBDCs as fungible with fiat currency. This will also be determinative in establishing the duty of care required of intermediating entities for a CBDC that is held by them or accessed through them. Standards for obtaining a security interest in CBDC must also be established.
Prudential Treatment	wCBDC is designed to be an alternative form of central bank money and a direct liability of the central bank. Hence, to ensure smooth adoption of wCBDC, we recommend that the prudential treatment for wCBDC should be the same as for other forms of central bank money (e.g., cash, coins, and deposits held by banks at central banks).
Risk Management	"Do no harm" should be the fundamental principle followed when designing and implementing wCBDCs. A properly structured wCBDC should not negatively impact a central bank's ability to conduct its monetary policy and maintain financial stability and should assist participants in reducing and managing risks.



4 | Use Cases for Wholesale CBDCs in Capital Markets

One of the primary reasons that financial markets are able to complete large numbers of transactions in a smooth and efficient manner is because trading parties trust that the systems handling these transactions are built on effective frameworks. A framework of laws and regulations relating to fiat currencies and related payment systems has developed a level of legal certainty and a high degree of confidence as to finality of payment such that risks are generally understood, identified, managed, and mitigated.

Securities transactions are legal phenomena – the robustness of a security settlement system is primarily a phenomenon of its legal status, thus confidence in market settlement is largely driven by the legal structures in individual jurisdictions that have been developed to support these market practices. These legal structures are supported by legislation that recognizes: (i) that uncertificated securities may be transferred, (ii) that beneficial owners have proprietary rights in the underlying securities, and (iii) that a transaction involving those rights is enough to transfer ownership.

The introduction of CBDCs and other digital assets on permissioned or permission-less systems such as DLT and, in particular, the advent of wCBDCs will require an equivalent level of confidence in the effectiveness of transactions. Otherwise, these new currencies will not become widely used.

4.1 Use case: Securities settlements

As we have discussed, one of the potential use cases of wCBDCs in the wholesale arena would be to improve the efficiency of securities settlements over DLT. As securities transactions have two legs, a payment leg and a securities leg,

the relative benefits of using wCBDCs as the payment leg depend directly on whether the securities leg of the transaction settles over a compatible platform.

Gains in efficiency could come in a scenario where wCBDCs are issued on a DLT platform that interoperates with the platform on which the relevant securities have been tokenized or natively issued (the Securities Platform). However, this is challenging in the short-term because many legal systems do not currently permit native digital securities issuances. It is more likely in the immediate future that wCBDCs will have to interact with traditional securities settlement systems through integration mechanisms.

Potential future changes to securities settlement models incorporating wCBDCs must also take into consideration the market product, operational, and capital considerations connected to the broader settlement cycle, and in particular the challenges associated with settlement cycles shorter than T+1. An extended discussion of these considerations and the effort underway in the US to accelerate the securities settlement cycle to T+1 can be found in the Appendix 5.2.

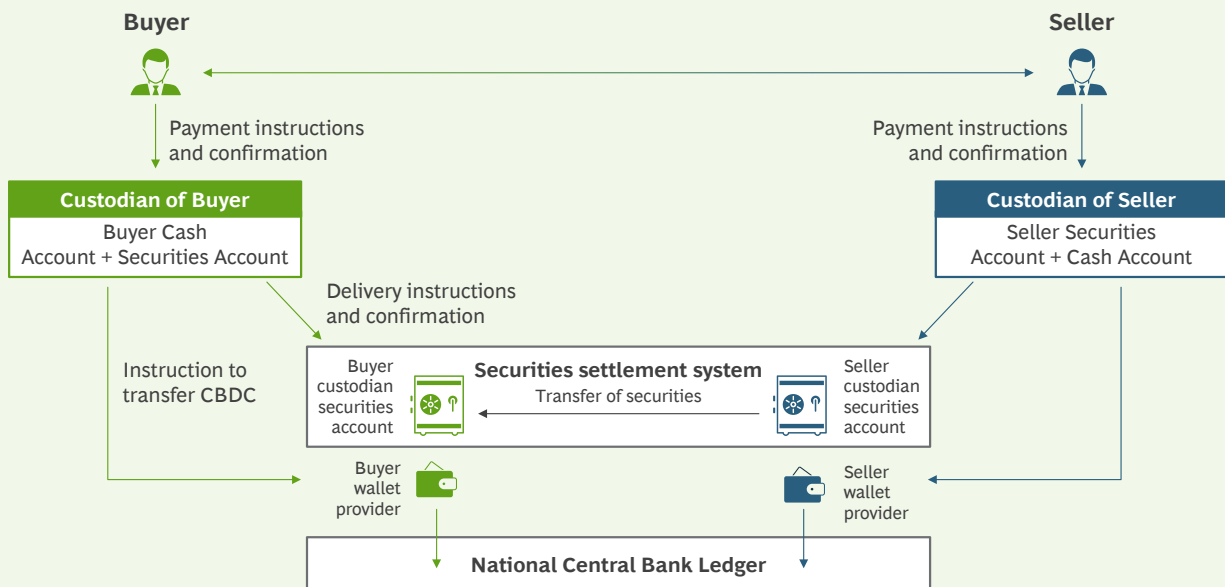
In circumstances where wCBDCs are used to settle transactions in Securities Platforms, smart contracts on a permissioned, shared ledger could be used to program instantaneous amendment of both, thereby creating factual delivery vs. payment and potentially eliminating counterparty and settlement risk arising from non-simultaneous delivery vs. payment. However, there are still some counterparty risks that could emerge in bankruptcy that aren't solved by smart contracts unless legal/statutory settlement finality rules address these risks. Furthermore, this setup would also transfer the

functions currently being performed by a Central Counterparty (CCP) and a Securities Settlement System (SSS) as well as potentially Central Securities Depositories (CSDs) to the relevant platforms. See Figure 4 below for a simplified example. Such structures have already progressed to the proof-of-concept stage in a number of jurisdictions (for example, project Helvetia ²³).

Where integration does not exist – in other words, where there is no single “system” capable of being recognized by settlement finality

legislation – parties will have to transfer securities on one platform against tokens being transferred on a different platform. In those cases, to overcome settlement finality issues, an overarching contract (usually a system rulebook) governing the entire transaction is necessary. This suggests that the role of CCPs and SSS in such transactions may shift significantly: they may become operators of Securities Platforms, or act as wallet providers or intermediaries providing access to these platforms. See the diagram below

Figure 4 | Securities settlements with wCBDCs



²³ See BIS, “Project Helvetia: settling tokenized assets in central bank money” December 3, 2020, “Project Helvetia Phase II: settling tokenised assets in wholesale CBDC”, January 2022. For other examples, also see Banque de France, “The Banque de France conducts a successful experiment on the use of central bank digital money with a consortium of actors driven by LiquidShare”, and Hong Kong Monetary Authority, “e-HKD: A technical perspective”, October 2021.

This use case assumes:

- The relevant buyer and seller of the securities do not have direct access to the wCBDC DLT Platform or to the Securities Platform.
- Access is intermediated by a custodian wallet provider

The effect of using wCBDCs for settling the transaction does not substantially change the existing transaction flow because it relies on intermediation. However, there are likely to be practical advantages to the use of wCBDCs in terms of speed of settlement and credit risk exposure of the counterparties when settling tokenized securities or native digital securities, and there will be a reduction in end-user transaction costs if intermediating entities pass on those efficiencies to their clients.

To create comparable efficiencies, one alternative would be to develop and use a form of token for payment, which might be developed by the private sector if central banks decide not to proceed with wCBDCs. A token used for this purpose would ideally have 24-hour transferability, would not bear interest and would not contain restrictions on the identity of the holder of the token.

These considerations point towards the following preliminary observations:

- Account-based and token-based wCBDCs could represent a fundamental change in the legal classification of the contractual obligation between the central bank and account holder or token holder. It is absolutely necessary to clarify as a matter of law what this relationship amounts to, and in particular whether such instruments are directly fungible with fiat currency.
- It cannot be assumed that wCBDC settlement would be adopted across all securities transactions. A more likely conclusion would be that it will co-exist with traditional settlement arrangements for central bank money. It is necessary to consider what the financial stability and

monetary implications of such a situation would be.

- Where wCBDC settlement is adopted, its benefits largely depend on the ability to also settle the securities leg using DLT or similar arrangements. This requires interoperability of the wCBDC platform with the Securities Platform. It should be noted that significant issues remain involving the design of securities settlement systems, and in particular the desirability of T+0 settlement. The introduction of a wCBDC (or a private token) for settlement purposes does not prejudice this issue, but merely facilitates the implementation of whatever is considered to be the optimal approach. See Appendix 5.2.

4.2 Use case: Cross-border FX transactions

A typical use case of wCBDCs would be to improve on the existing cross-border payments infrastructure. In the wholesale markets space this primarily involves cross-border foreign exchange (FX) transactions. The underlying objective of this approach would be to reduce settlement risk.

Settlement risk in FX transactions arises where there is a need to settle transactions involving currencies whose central banks are located in different time zones and, thus, have different opening hours. This may mean that it is impossible to settle both legs of the transaction at the same time, with the resulting delay to one leg creating a credit exposure between parties.

Currently, this risk is mitigated for some banks through Continuous Linked Settlement (CLS) Bank, which provides a window during which simultaneous settlement processes are available for supported currencies that enables PvP settlement. However, CLS Bank is only accessible by a limited number of banks that meet its membership criteria, and only provides services in 18 currencies.

If a wCBDC settlement platform was able to swap wCBDC pairs through the use of DLT, such an arrangement could provide an additional tool to mitigate the underlying settlement risk. Such a platform would have to interoperate with numerous different wCBDC DLT platforms. This would create a number of challenges, including a requirement for common data standards and protocols as well as alignment on settlement windows and operational times. These challenges should not be underestimated. Overcoming them would require significant political and inter-institutional will among all levels of government, regulatory authorities and financial system oversight agencies to enable the dialogue that would result in a consensus on interoperability rules. Also, it would be necessary to ensure that policies involving legal certainty and settlement finality are comprehensive and strong.

From a legal perspective, to the extent that a DLT platform can achieve PvP settlement of two currencies, settlement risk would be reduced. See diagram below.

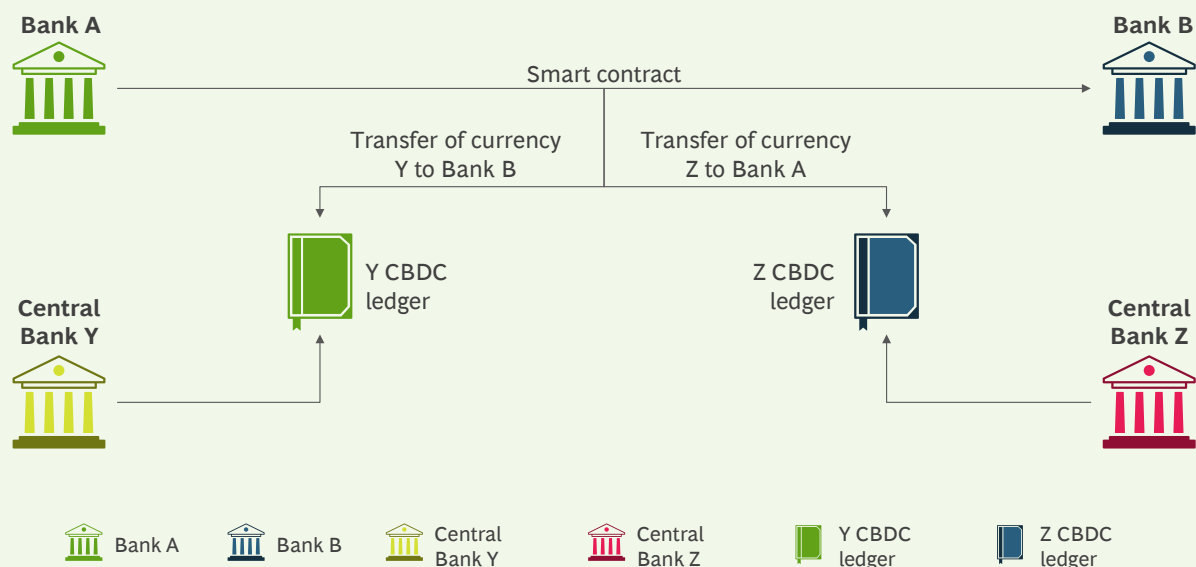
This use case assumes:

- Both wCBDCs are issued on an interoperable or the same DLT Platform allowing for smart contracts to interact with each wCBDC
- Both banks have access to the wCBDC ledger of both wCBDCs

When using wCBDCs for settling FX transactions, DLT platforms obviate the need for a central counterparty and facilitate efficient settlement through smart contracts. However, unless the wCBDC platforms are interoperable, or both sit on the same DLT platform, the benefits of using wCBDCs for FX transactions are reduced.

One significant legal issue arises: Whether and to what extent will individual legal systems recognize the discharge of payment obligations in a cross-border FX transaction through the transfer of wCBDCs on an interoperable platform. For example, would settlement finality protections be available at the moment the payment instructions are made on the platform or upon settlement?

Figure 5 | Cross-border FX transactions with wCBDCs



This, in turn, leads to the following preliminary observations:

- The use of DLT has the scope to reduce or eliminate some of the risk that currently exists in FX settlement, and this will be true whether or not wCBDCs are created or are used for this purpose. The key requirement in this regard is to implement a PVP process (such as by means of a shared, permissioned ledger) that is capable of achieving legal finality.
- The use of wCBDCs for cross-border payments is highly dependent on the interoperability and standardization between wCBDCs. Is it even possible to interoperate account-based and token-based wCBDCs without intermediating entities and increasing cross-currency settlement risk?
- As long as all wCBDCs are not interoperable it is likely that private sector solutions would have to step in as intermediaries between wCBDCs or between wCBDCs and traditional settlement systems. In this context, it is necessary to recognize that existing solutions, although slower than wCBDC settlement, effectively reduce cross-currency settlement risk.

4.3 Use case: Liquidity and collateral management

The ease with which wCBDCs could be transferred within a DLT based platform make wCBDCs a candidate for use as collateral in financial market transactions – such as derivatives or securities lending – instead of or in addition to conventional cash collateral.

In this context, some of the legal considerations that have been raised in the other use cases in

this paper also apply. However, there are some additional and different dimensions that must be taken into account in order to adopt wCBDCs in this way.

The fundamental function of collateral is to provide a potential financial buffer in the event of the default or non-compliance of a counterparty. As such, at its core, the posting of wCBDC collateral must successfully provide legal title transfer in favor of the security taker. Many proponents of wCBDCs take the view that this is achieved merely by transferring wCBDCs to the security taker's wallet.

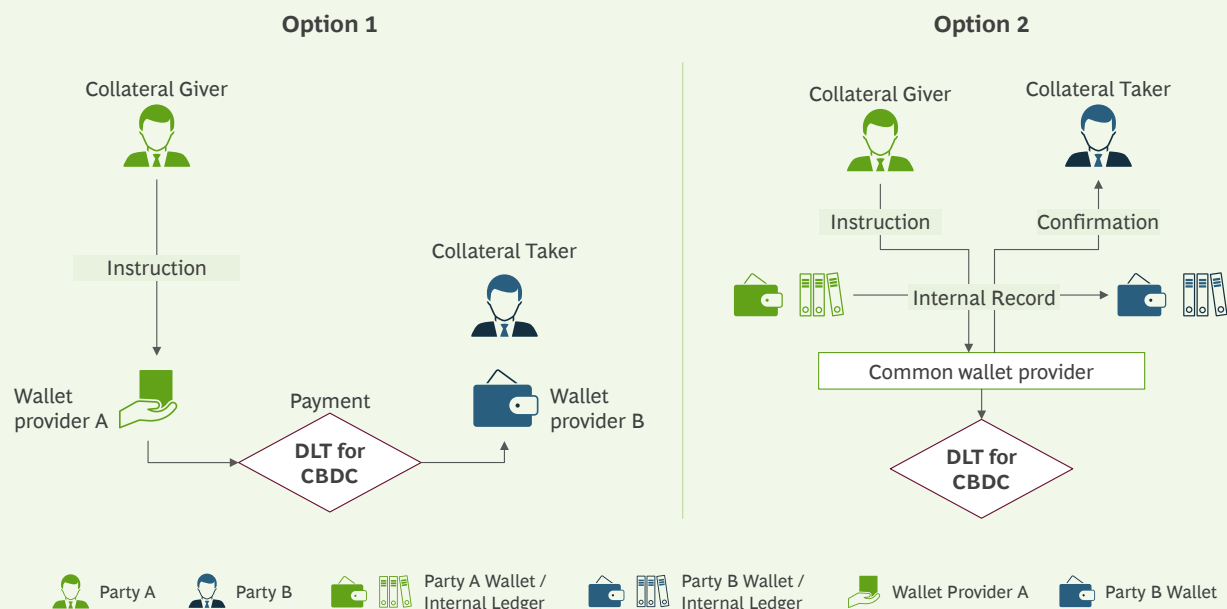
While the receiving counterparty may be in a position to hold the necessary cryptographic keys and decision-making power for the transferred wCBDCs, it is not clear that this would mean transfer of title under law without clear legal provisions that supports this position. Some legal studies²⁴ have argued that control of cryptographic keys could be determinative in demonstrating possession of the wCBDCs and should by law serve as the basis for demonstrating proprietary rights to the wCBDCs controlled through the cryptographic keys. But this issue is not settled. As such the starting point for designing wCBDCs to be used as collateral arrangements should be to create sufficient legal certainty about ownership when they are transferred.

Once it is established that transfer of wCBDCs from one account to another actually equates to title transfer, the question of what type of asset has been transferred can be addressed. This is particularly important in circumstances where one or both of the contracting parties holds wCBDCs via an intermediary. See diagram below

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²⁴ See Financial Markets Law Committee, “Response: Law Commission Call for Evidence on Digital Assets”, July 2021.

Figure 6 | Liquidity and collateral management with wCBDCs



This use case assumes:

- In Option 1 – Party A does not have direct access to the wCBDC DLT Platform
- In Option 1 – Party B has direct Access to the DLT Platform and operates its own wallet
- In Option 2 – The Common Wallet Provider has access to the wCBDC Platform and holds the CBDCs for both parties. It reconciles the transaction through an internal ledger

When both parties using wCBDCs do not operate their own wallet, transaction flow is relatively unchanged compared to the current practices.

The adoption of wCBDCs for collateral arrangements will depend to a significant extent also on whether or not the current process for establishing security interests for existing financial collateral arrangements would be available. In many jurisdictions, rules involving the taking and enforcing of security arrangements for financial contracts are more beneficial and less cumbersome than those

covering security interests for other transactions. For example, they:

- eliminate certain formalities, including signing and registration requirements;
- allow the collateral-taker to appropriate the collateral on enforcement (without a court order);
- ensure security interests are effective and enforceable even when a party enters into administration and is subject to a stay on enforcement of other types of obligations (such as borrowed money indebtedness);
- disapply certain provisions of insolvency law providing for the avoidance of contracts; and
- limit the application of mandatory set-off provisions.

All of this leads to the following preliminary observations:

- The use of wCBDC as a collateral arrangement requires clear recognition in law in order to gain the same legal certainty that exists around conventional cash

collateral for financial contracts that are protected under existing law;

- Collateral arrangements in wCBDCs must be able to be established with similar ease as other functional collateral arrangements.

4.4 Conclusion

It should not be assumed that existing legislation, market practices and template documentation for wholesale market transactions can simply be used in order to eliminate or mitigate relevant legal risks for CBDC. A central bank should have

clear authority underpinning its issuance of a wCBDC.

Depending on the specific legislative underpinning of a particular wCBDC, regulations and legal frameworks involving its use for wholesale market transactions will have to be given separate considerations, taking into account the type of transaction, its governing law and the location of the counterparties. As we have demonstrated, there are crucial legal and documentation issues to address. These are summarized with relevant recommendations in the table below:

Table 2 | Summary for wCBDC Use Cases and Legal Implications

Recommendations	
Application of standard market protections to transactions with wCBDC	The use of wCBDCs for the purposes of settlement of securities transactions on a DvP basis may necessitate legislative frameworks to equate wCBDCs payments with cash payments. This would also require legislative frameworks to expressly recognize settlement finality, netting and other typical protections for payments made with wCBDCs that may be outside the scope of a Securities Settlement System or Central Securities Depository.
Recognition of foreign wCBDCs as legal tender	Disparate legal systems may adopt dissimilar legal approaches to their wCBDCs. These differences should not be allowed to result in different legal treatments for individual wCBDCs within any single jurisdiction.

5 | Appendix

5.1 What is a CBDC

The concept of CBDC is still under development and lacks a consensus definition. However, some common themes or features are beginning to appear across the most commonly cited references to CBDC.

The Committee on Payments and Market Infrastructures (CPMI), the world bank, the Bank for International Settlements (BIS), and the International Monetary Fund (IMF) define a CBDC as “a digital payment instrument, denominated in the national unit of account, that is a direct liability of the central bank²⁵.” Meanwhile, the U.S. Federal Reserve considers CBDC “a generic term for a third version of currency that could use an electronic record or digital token to represent the digital form of a nation's currency. CBDC is issued and managed directly by the central bank and could be used for a variety of purposes by individuals, businesses, and financial institutions²⁶.” Bank of England (BOE) and European Central Bank (ECB) views a CBDC with a retail lens, “A Central Bank Digital Currency (CBDC) would be an electronic form of central bank money that could be used by households and businesses to make payments”, and “an electronic form of central bank money accessible to all citizens and firms”.

Based on the uses, we can infer the following features of a CBDC:

1. CBDC is an electronic or digital form of money;
2. CBDC is denominated in the national unit of account;

3. CBDC is a direct liability of the central bank;
4. CBDC is a payment instrument.

The combination of the above features makes CBDC a unique monetary instrument compared to existing instruments. For example, cash has all the above features except for 1, and commercial bank deposits may have all the above features except for 3.

For the purposes of this paper, we use the definition proposed by IMF and BIS, and define CBDC as “a digital payment instrument, denominated in the national unit of account, that is a direct liability of the central bank”.

Central banks can design CBDCs for retail use or wholesale use. Additionally, CBDCs can be designed to facilitate cross-border payments through interoperating central bank digital currencies forming multi-CBDC arrangements.

5.1.1. Retail CBDC

A retail CBDC (rCBDC), or general-purpose CBDC could, be designed to be accessible by individuals and businesses for payments, which tend to be high volume and low value. rCBDCs would enable individuals and businesses to directly hold central bank money beyond cash and coins rather than being limited to maintaining money through commercial bank deposits. Upon their advent, rCBDCs will be denominated in the national unit of account, medium of exchange and store of value. The ability to store value in central banks directly by

²⁵ See the Committee on Payments and Market Infrastructures, the BIS Innovation Hub, the International Monetary Fund, and the World Bank, “[Central bank digital currencies for cross-border payments](#)”, July 2021.

²⁶ See Board of Governors of the Federal Reserve System, “[What is a Central Bank Digital Currency? Is the Federal Reserve moving toward adopting a digital dollar?](#)”.

individuals and businesses could create significant risks for banking and capital markets in terms of availability of funding, cost of funding, and ultimately the cost of credit to the real economy.

By design, rCBDCs can be token-based or account-based. A token-based CBDC is a digital version of physical cash. A token-based CBDC requires validation of access to the wallets but does not require identity validation during a payment process, similar to the use of cash. By contrast, an account-based CBDC system requires central bank accounts or wallets that are operated by the central bank or designated financial institution. During a payment process, the identity of a payer is verified, and the payment is completed by transferring account balances from the payer's account to the buyers. As such, a token-based rCBDC construct raises AML/CFT/Sanction questions that need to be properly addressed. In addition to account-based and token-based CBDCs, the Eurosystems High-level Task Force ²⁷ explored the concept of "offline CBDCs," which would be an offline version of the digital euro intended to provide anonymity in payments (and data privacy) like cash.

5.1.2. Wholesale CBDC

A wholesale CBDC (wCBDC) is designed to facilitate wholesale market transactions, such as inter-bank payments, and direct access to the wCBDC may be limited to appropriately regulated financial institutions and payment service providers (PSPs).

This idea would follow the current two-tier structure which places central banks at the foundation of the payment system, while assigning end-user facing activities to financial institutions and other PSPs. For example,

wholesale payments today are used to settle securities and foreign exchange trades, payments to and from central counterparties, and other interbank funding transactions. These are typically large-value payments that often need to settle on a particular day and sometimes by a particular time. Although fewer wholesale payments are made than retail payments, their significantly larger value make these payments systemically important, thus generally owned and operated by central banks²⁸.

While the current wholesale payments ecosystem is well functioning, there are several challenges. For example, the current system is not available 24/7; it has cut-off and closing times. wCBDCs can potentially address some of these challenges through its design and implementation.

5.1.3. Multi-CBDC arrangement

CBDCs can also help in improving cross-border transactions. Increased cross-border economic activity, a result of globalization, has shed further light on the major inefficiencies of cross-border payments, described by BIS as "High cost, low speed, limited access and insufficient transparency²⁹." To resolve these inefficiencies, BIS has floated the idea of multi-CBDC (mCBDC) arrangements, which are intended to create interoperability of CBDCs across jurisdictions. BIS envisions three different mCBDC models with various levels of integration:

- Model 1 – compatible wCBDC systems: enhanced compatibility with technical and regulatory standards and overlapping participation.
- Model 2 – interlinked wCBDC systems: interlinking through shared technical interfaces or by use of a centralized or decentralized clearing mechanism; and

²⁷ See European Central bank, "Digital euro experimentation scope and key learnings", 2021.

²⁸ See Bank for International Settlement, "Innovations in payments", March 2020.

²⁹ See the Committee on Payments and Market Infrastructures, the BIS Innovation Hub, the International Monetary Fund, and the World Bank, "Central bank digital currencies for cross-border payments", July 2021.

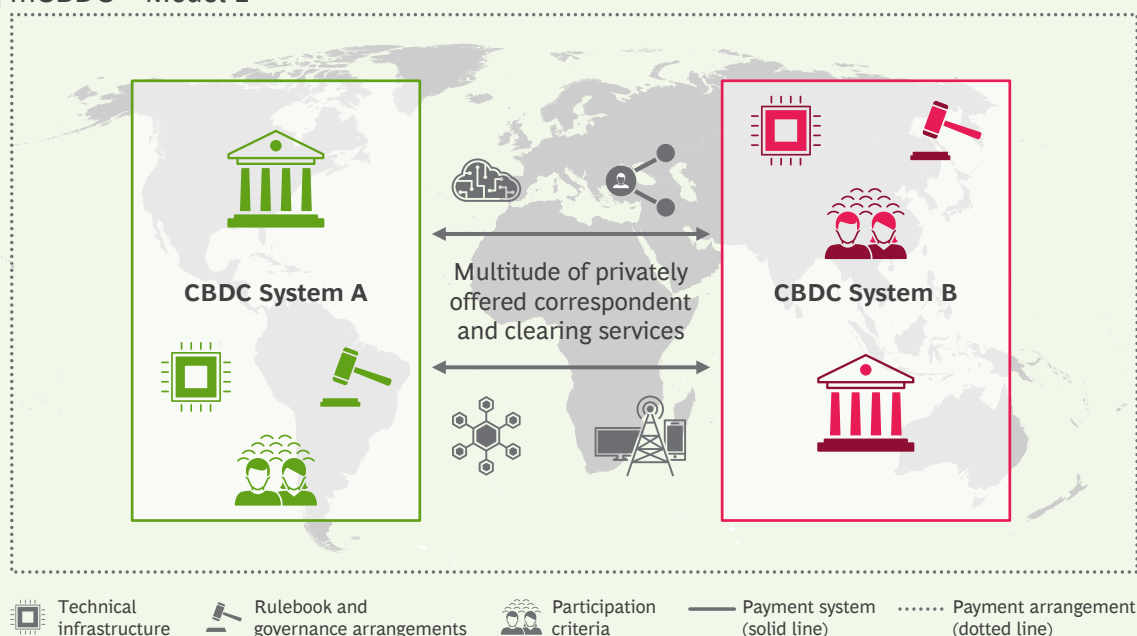
- Model 3 – integration into a single system; multiple wCBDCs can be run on a single platform

Model 1 is closer to current cross-border payment mechanisms than model 2 and model 3. For model 1, the transfer of wCBDCs operates on private solutions or clearing services and each central bank maintains its own wCBDC designs, including participation criteria, infrastructure, governance, etc. The benefits derive from aligned legal, regulatory, and supervisory standards, and technical standards. Certain central banks, including the Bank of Canada, the Bank of England, the Bank of Japan, the European Central Bank, the Federal Reserve, Sveriges Riksbank, the Swiss National Bank and the BIS, have already indicated support for enhancing compatibility for cross-border payments. However, central bank or jurisdictional alignments for enhancing cross-border payments are not wCBDC dependent,

which makes the case for Model 1 mCBDC less compelling.

Model 2 requires more collaboration from central banks. Each participating CBDC system must agree upon on a shared technical interface or clearing mechanism, which can be either centralized or decentralized. Unlike Model 1, Model 2 requires significant cross-jurisdictional efforts to develop a new interlinked wCBDC system. On the other hand, similar to Model 1, within each wCBDC system, the central bank would still maintain its own wCBDC features and functions, such as participation criteria, infrastructure, governance, etc. Several initiatives have been or are being conducted to explore Model 2 setups. For example, through project Jasper-Ubin, the Monetary Authority of Singapore and Bank of Canada successfully experimented settling CBDC payments directly without involvement of a private platform³⁰.

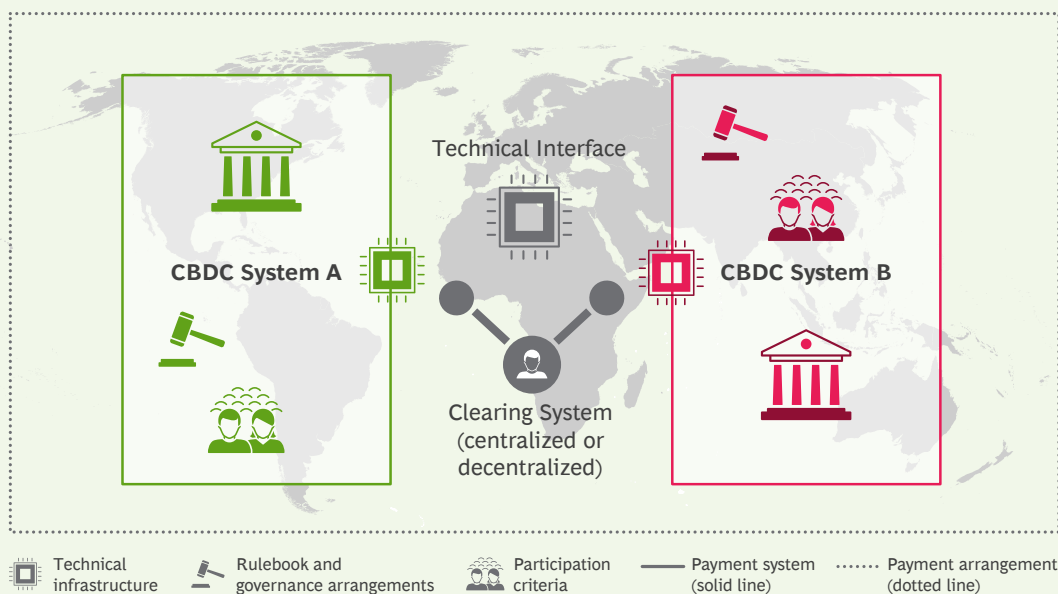
Figure 7 | mCBDC – Model 1



Source: R Auer, P Haene and H Holden, "Multi-CBDC arrangements and the future of cross-border payments", BIS Papers, no 115, March 2021

³⁰ See Bank of Canada, Monetary Authority of Singapore, "Enabling Cross-Border High Value Transfer Using Distributed Ledger Technologies", May 2019.

Figure 8 | mCBDC – Model 2

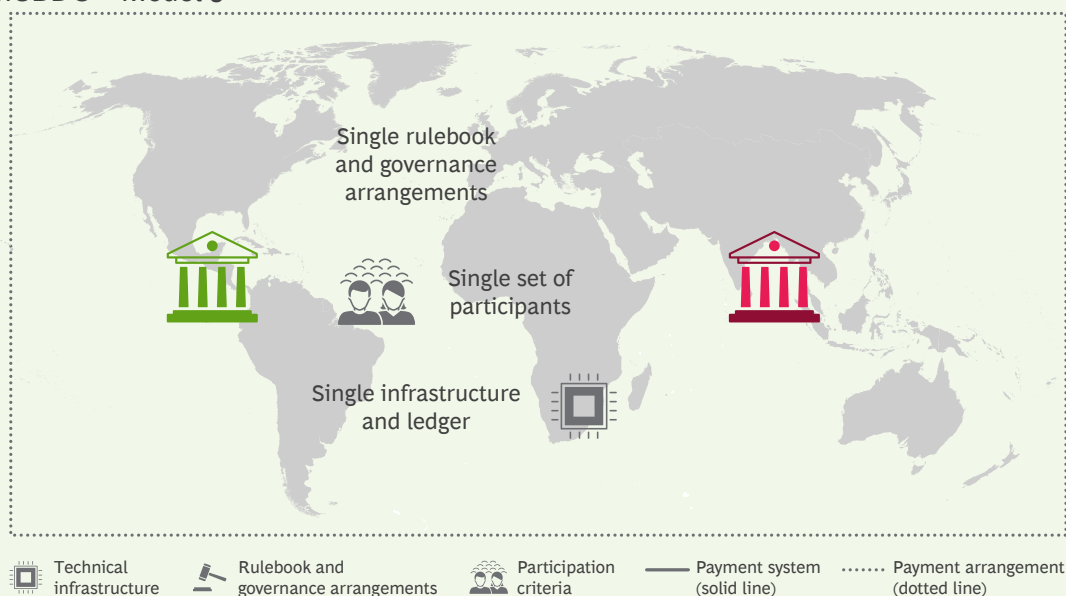


Source: R Auer, P Haene and H Holden, "Multi-CBDC arrangements and the future of cross-border payments", BIS Papers, no 115, March 2021

Model 3 is fundamentally different from model 1 and 2 in that participating central banks will have to agree on infrastructure, participation and access design, and bookkeeping and ledger maintenance. This level of integration requires

close collaboration between central banks and across jurisdictions. Model 3 implementation is the most difficult of the three due to increased governance, control and policy hurdles. But Model 3 can unlock significant integration and operational benefits via a single mCBDC system.

Figure 9 | mCBDC – Model 3



Source: R Auer, P Haene and H Holden, "Multi-CBDC arrangements and the future of cross-border payments", BIS Papers, no 115, March 2021

5.2 Wholesale payments and security settlements

In many markets today, an equity, corporate bond, municipal bond, or FX transaction settles two days after the trade (T+2). In some legal systems, whether or not the securities actually transfer title at that time, the buyer in law acquires a statutory equitable interest in it at the moment of settlement. Government securities and options tend to settle the day after trading (T+1). Once a transaction is matched and when sufficient quantities of the relevant security or derivative and cash/credit is available, it is put on settlement queues. The only mainstream securities to settle in less than a day are money-market instruments, such as CDs, CPs and certain collateral movements, which settle on a same day basis in-line with market conventions.

Shorter settlement cycles can bring many benefits to the industry, including cost savings, reduced market risk and lower margin requirements, particularly in periods of volatility. There is a US-focused industry initiative, led by the Securities Industry and Financial Markets Association (SIFMA)³¹, the Investment Company Institute (ICI), and The Depository Trust & Clearing Corporation (DTCC), looking at shortening the settlement cycle for equities and certain other securities to one business day after the trade is executed (T+1)³². Currently T+1 is expected to be adopted in U.S. markets by 2024.

However, there will also be challenges as the industry moves towards shorter settlement time. Settlements closer to real time impose significant liquidity pressures on market

participants. Indeed, while offsetting mechanisms, such as technical netting, partial settlements, and settlement optimization can ease these pressures somewhat, banks still must anticipate their liquidity needs to facilitate the securities settlement process. In this context, effective allocation of cash and careful management of funding opportunities are essential for banks to forge relationships with multiple central banks especially when multiple currencies are involved. In addition, corporate treasurers must optimize cash flows among a number of clearinghouses and constantly ensure they have sufficient funds.

The possibility of shifting from T+1 to T+0 is also being discussed and researched. However, this potential transition is on another scale of complexity and difficulty from the shortening of the settlement cycle from T+2 to T+1. DTCC has identified several important barriers³³ which make such a change impractical at present for the broader U.S. securities markets including:

- Moving to T+0 on a transaction-by-transaction basis will remove the liquidity and risk-mitigating benefits of current netting features;
- Fails may increase due to lack of netting as transaction volume rises;
- Funding needs will be less predictable and transparent until end of the trading day; and
- Developing real-time reconciliation processes to comply with regulations will be difficult.

³¹ SIFMA is the leading trade association for broker-dealers, investment banks, and asset managers operating in the US and global capital markets. On behalf of our industry's nearly 1 million employees, we advocate for legislation, regulation, and business policy, affecting retail and institutional investors, equity and fixed-income markets, and related products and services. We serve as an industry coordinating body to promote fair and orderly markets, informed regulatory compliance, and efficient market operations and resiliency. We also provide a forum for industry policy and professional development. SIFMA, with offices in New York and Washington, DC, is the US regional member of the Global Financial Markets Association (GFMA). For more information, visit <http://www.sifma.org>.

³² The move to T+1 is expected to cover equities, corporates, municipals, and UITs, while Fed eligible securities would be considered out of scope. See SIFMA, Investment Company Institute (ICI), DTCC and Deloitte, "Accelerating the U.S. Securities Settlement Cycle to T+1", December 2021.

³³ See DTCC, "Advancing together: leading the industry to accelerated settlement", February 2021.

SIFMA further accentuated the T+0 challenges in its August 13, 2021 letter³⁴ to SEC Chairman Gary Gensler. In the letter, SIFMA confirmed its support for and confidence in shortening the settlement cycle to T+1, but also highlighted four specific areas that would be impacted significantly if T+0 was adopted:

- Processes for global settlements, FX, margin investing, and securities lending would have to be redesigned to meet regulatory and contractual requirements in less than 12 hours;
- Retail investors would likely have to pre-fund accounts;
- Smaller firms and vendors may not have the resources necessary to complete a move to T+0 and, hence, could find their competitive position weakened; and
- Industry stakeholders – including the Federal Reserve’s payment systems – would have to maintain services for more hours during the day than currently, which could increase the potential for operational failure.

5.3 Current state of CBDC development

Three CBDCs are currently live and in use. In October 2020, Central Bank of The Bahamas officially issued digital Bahamian dollars (B\$), the first live CBDC in the world, with the Sand Dollar initiative. B\$ is a retail focused CBDC backed by the country’s foreign reserves. B\$ aims to reduce payment costs and increase payment efficiencies by achieving interoperability among existing and new channels of payment systems. It also supports offline transactions. Currently B\$ is limited to domestic users. Following B\$, on April 1, 2021, the Eastern Caribbean Central Bank launched its CBDC, the DCash. This is the first example of

a central bank within a currency union to go live with a CBDC. DCash users can buy the digital currency with cash or through their bank accounts. Currently DCash is used among St Kitts and Nevis, Antigua and Barbuda, Grenada, and Saint Lucia. The most recent launch is eNaira by Central Bank of Nigeria; the first CBDC in Africa, it debuted on October 25, 2021.

Some notable CBDCs experiments: as of June 2021, the Chinese pilot of e-CNY has gathered over 3.5 million business wallets and 20 million individual wallets and reached more than 70 million transactions totaling 34.5 billion CNY³⁵. Other noteworthy efforts include the Swedish Riksbank e-krona pilot launched in 2020, the European Central Bank’s exploration of a potential digital euro that would be introduced in 2024 or 2025, and the joint CBDC Task force by the Bank of England and HM Treasury considering a potential UK CBDC.

5.4 Review of recent CBDC studies

There has been extensive published research pertaining to CBDCs. Following is a summary of a number of them from key institutions:

BIS explored CBDC for cross-border payments in its papers “Central bank digital currencies for cross-border payments”³⁶ and “Multi-CBDC arrangement and the future of cross-border payments.”³⁷ From BIS’s point of view, CBDCs have the potential to enhance the efficiency of cross-border payments. BIS points out that multilateral collaboration across central banks and agreement on key design principles will be critical for new cross-border payment channels and ecosystems.

IMF has issued three working papers on CBDC, including Legal Aspects of Central Bank Digital Currency,” “A Survey of Research on Retail

³⁴ See SIFMA, ICI and DTCC, “Accelerating the Securities Settlement Cycle to T+1 in the United States”, August 2021.

³⁵ See People’s Bank of China, “Progress of Research & Development of E-CNY in China”, July 2021.

³⁶ See the CPMI, BIS, IMF, and the World Bank, “Central bank digital currencies for cross-border payments”, July 2021.

³⁷ See BIS, “Multi-CBDC arrangements and the future of cross-border payments”, March 2021.

Central Bank Digital Currency,” and “Designing Central Bank Digital Currencies.” The IMF working paper “Legal Aspects of Central Bank Digital Currency: Central Bank and Monetary Law Considerations”³⁸ analyzed the legal foundations of CBDC under central bank and monetary law. The paper concluded that most central banks laws do not currently authorize the issuance of CBDCs to the public, and from a monetary law perspective, it is not evident that “currency” status can be attributed to CBDC. Hence, the issuance of CBDCs will require an assessment of the existing central bank and monetary law, and in some cases may pose fundamental legal policy challenges.

In the working paper “A Survey of Research on Retail Central Bank Digital Currency,” IMF explored the key considerations involving rCBDCs. IMF highlighted that central banks need to define objectives and assess overall benefits, costs and risk. The balance between user and data privacy and financial integrity should be carefully thought through. Central banks will also need to address the challenges raised by CBDC legal tender and new roles for players. In the working paper “Designing Central Bank Digital Currencies,”³⁹ IMF discussed whether CBDC should resemble cash and whether it should be interest-bearing. IMF concluded that the best design for CBDCs is as distinct from existing payment instruments as possible in economies where the central bank’s role is limited. And network effects can be a major consideration factor for whether CBDCs should be interest-bearing: if network effects could negatively impact payment variety, an interest-bearing CBDC is optimal.

The World Economic Forum (WEF) published a whitepaper in November 2021 called “Digital Currency Governance Consortium White Paper Series.”⁴⁰ The paper covered three themes, including regulatory choices, value proposition, and technology choices as well as eight subtopics. The paper advocates for global collaboration, including the private sector, and recommends that regulators monitor and control potential risks from stablecoins and CBDCs. To address the policy gaps, the paper supports a measured, coordinated, multi-jurisdictional and inclusive approach to the creation and implementation of policy, laws and regulations. Regarding stablecoins, the paper further pointed out that for the general public, it is uncertain whether stablecoins present a clear case to reduce financial inclusion barriers. The paper also encourages public and private sectors to set common standards and define common taxonomies to improve interoperability.

Central banks have also provided a wide range of views. Bank of England (BOE) discussed CBDCs broadly in its discussion paper “Central Bank Digital Currency: Opportunities, Challenges and Design.”⁴¹ BOE noted that if and when it introduces a CBDC, it would be a) placed alongside traditional central bank or commercial bank money; b) denominated in sterling and carry the same value as banknotes; c) an innovation in money for the public and payments infrastructure; and d) not necessarily based on distributed ledger technology. The European Central Bank (ECB) discussed the issuance of digital euros in “Report On A Digital Euro,”⁴² with a focus on the retail design, legal, and technical implications of a digital euro. ECB further issued a report “Digital euro experimentation scope and key learnings,”⁴³

³⁸ See W Bossu, M Itatani, C Margulis, A D.P.Rossi, H Weenink, and A Yoshinaga, “Legal Aspects of Central Bank Digital Currency: Central Bank and Monetary Law Considerations”, November 2020

³⁹ See I Agur, A Ari and G Dell’Atriccia, “Designing Central Bank Digital Currencies”, November 2019

⁴⁰ See World Economic Forum, “Digital Currency Governance Consortium White Paper Series”, November 2021

⁴¹ See Bank of England, “Central Bank Digital Currency: opportunities, challenges, and design”, March 2020

⁴² See European Central Bank, “Report on a digital euro”, October 2020

⁴³ See European Central bank, “Digital euro experimentation scope and key learnings”, 2021.

which concluded that “there were no major technological restrictions for any of the topics assessed (which) indicates that there is the wherewithal to accommodate the design requirements discussed in the Report.” Essentially, the ECB is arguing that technology is not restrictive to issuing a digital euro.

In September 2021, a group of seven central banks and BIS issued a series of reports⁴⁴ on rCBDC, a continuation of research from their report in October 2020. At the time of publication, none of the seven central banks had decided to proceed with a rCBDC. However, as indicated in the reports, the central banks believe that a CBDC can “enhance financial stability, harness new technologies and continue serving the public” if it is carefully designed.

Further, on January 20, 2022, the Federal Reserve published its discussion paper⁴⁵ that examines the pros and cons of a potential U.S. CBDC for general public and invited public comments⁴⁶ on more than 20 questions related to CBDC benefits, risks, policy considerations, and designs. The central banks noted that public and private sector collaboration is needed to ensure an effective CBDC system, maintain a balanced delivery of public policy and enable innovation. The central banks also believe that future use cases and innovations will drive CBDC adoption and corresponding strategies. As stated within, an effective CBDC system requires domestic and global interoperability as discussed in section 3.2, and careful treatment of access and payment data.

⁴⁴ See Bank of Canada, Bank of England, Bank of Japan, European Central Bank, Board of Governors of the Federal Reserve, Sveriges Riksbank, Swiss National Bank, Bank for International Settlements, “[Central bank digital currencies: foundational principals and core features](#)”, October 2020.

⁴⁵ See Board of Governors of the Federal Reserve System, “[Money and Payments: The U.S. Dollar in the Age of Digital Transformation](#)”, January 2022

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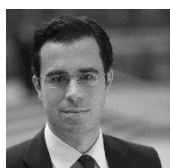
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