Bank of Japan Review

2024-E-9

Deposit Tokenization: Survey of Overseas Initiatives

Payment and Settlement Systems Department
SUGIMURA Kazutoshi, BESSHO Masaki*

August 2024

Recently, initiatives related to "deposit tokenization" have begun to expand globally. With the emergence of stablecoins, these initiatives seem to seek an extension of functionality in payment and settlement systems by applying new technologies, such as distributed ledger technology (DLT), to bank deposits as a traditional means of payment. The main reason such initiatives prefer leveraging deposit money is said to be its affinity with the two-tier monetary system and possibly with existing laws or regulations. However, there remain some issues that require further clarification on how payments with tokenized deposits are categorized in the private law system, and how smart contracts provide implications for non-functional requirements and legal certainty. Multifaceted discussions on deposit tokenization will therefore continue to be necessary, with an eye toward future payment and settlement systems.

Introduction

Initiatives on so-called asset tokenization have been emerging recently. While the definition of tokenization varies from one person to another, in the field of payment and settlement, it often refers to the introduction of new technologies into payment and settlement systems to extend their functionality or enhance their performance in such a way that is only possible with digital technologies.

For example, the Financial Stability Board (FSB) defines tokenization as "[t]he process of creating a digital representation (token) of an asset and putting it on a distributed ledger," [1] while the Bank for International Settlements (BIS) defines tokenization as "the process of recording claims on financial or real assets that exist on a traditional ledger on a programmable platform."[2]

Among these, initiatives on deposit tokenization have recently begun to expand globally. One of the reasons is thought to be the impact of the emergence of stablecoins. Stablecoins have been structured with an eye to pursuing stability of their values as alternatives to "traditional" crypto assets, which were found to be hard to use for payments because of their volatility. That said, as various issues have also been pointed out regarding stablecoins, it appears that the idea of deposit tokenization has gained attention.

This paper provides an overview of overseas initiatives related to deposit tokenization and points out some issues that require further discussion.

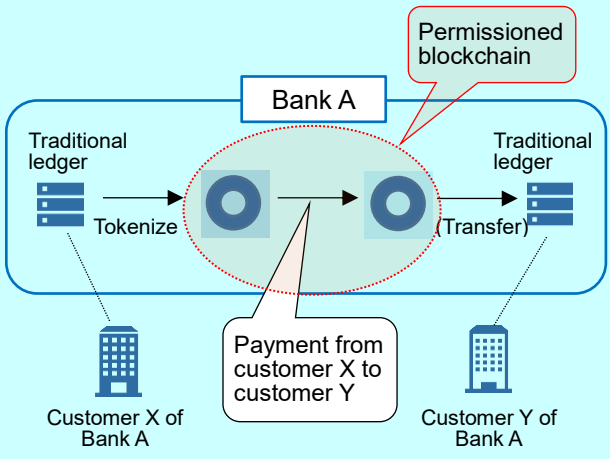
Payment within a Single Bank

JPM Coin

A pioneering example of deposit tokenization is JPM Coin, developed by JPMorgan (Chart 1).[3] It uses a permissioned blockchain to manage the deposit account's ledger and provides its customers with payment options in U.S. dollars and euros. JPM Coin aims to facilitate payments between corporate clients. Multinational corporations are said to see the benefit of instant cross-border payments in U.S. dollars and euros on an always-on platform.

JPM Coin is a system exclusive to the customers of a single bank. In other words, it does not envisage payments to customers of other banks, which is

[Chart 1] Conceptual Diagram of JPM Coin



Note: Based on Oliver Wyman and Onyx (2023).

possible with traditional fund transfer services by banks.

Project Guardian

Project Guardian, implemented by the Monetary Authority of Singapore (MAS), is working on asset tokenization through public-private collaboration. In the project, pilots and experiments have been carried out on atomic settlement (i.e., a settlement mechanism that links delivery of several assets, the details of which are mentioned later) between different assets.[4] The unique feature of this project is that it uses a public blockchain. Under the first industry pilot, a live cross-currency transaction involving tokenized deposits was conducted.[5]

Project Guardian envisions multiple issuance approaches to deposit tokenization.[6] An example would be a token that represents a deposit managed outside of the blockchain, while another would be a native token in which the primary record of deposits is on the blockchain. For instance, JPMorgan has issued a Singapore dollar-denominated deposit token on a public blockchain in a manner that allows the issuer to grant access only to qualified users. Although this deposit token differs from the above-mentioned JPM Coin in that it is issued on a public blockchain, what they have in common is that a single bank is the issuer of the deposit token throughout the entire process of the payment transaction.

Payment across Multiple Banks

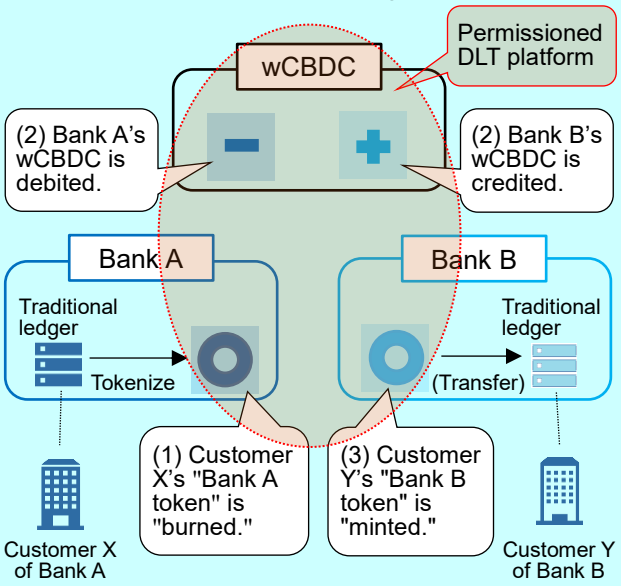
On the other hand, ideas for schemes that can be used to make payments across multiple banks have also begun to emerge recently, as illustrated below.

Regulated Liability Network

Citigroup proposed a concept termed the Regulated Liability Network (RLN), based on which members of the financial services sector and the Federal Reserve Bank of New York have conducted a proof of concept.[7] In order to improve the efficiency of U.S. dollar payments, the members of RLN are envisioning the construction and operation of an always-on system that will enable instant payments. It adopts permissioned distributed ledger technology (DLT) and aims to take advantage of its features such as programmability (i.e., the ability of computer programs to automate behavior, the details of which are mentioned later).[8]

The payment arrangement in RLN is a simultaneous execution of the following three processes (Chart 2): (1) the originator's bank (Bank A) debits customer X's wallet (i.e., Bank A token is destroyed or "burned"); (2) the central bank debits the wholesale CBDC (wCBDC) of Bank A and credits the wCBDC of the beneficiary's bank (Bank B); and (3) Bank B credits customer Y's wallet (i.e., a Bank B token is created or "minted"). The beneficiary (Y) has the option to transfer the funds to its deposit account that exists outside of the distributed ledger and is managed under the traditional banking system.

[Chart 2] Conceptual Diagram of RLN



Note: Based on RLN (2022). (1), (2) and (3) in the chart are executed simultaneously.

In addition, based on the findings of RLN, the Securities Industry and Financial Markets Association (SIFMA) announced in May 2024 that it will be serving as program manager for the Regulated Settlement Network (RSN) proof of concept.[9] RSN will simulate delivery-versus-payment (DvP) transactions denominated in U.S. dollars. Specifically, it will explore the feasibility of programmable shared ledger technology to settle tokenized assets (e.g., U.S. Treasury securities) and tokenized money (commercial bank money and wholesale central bank money).

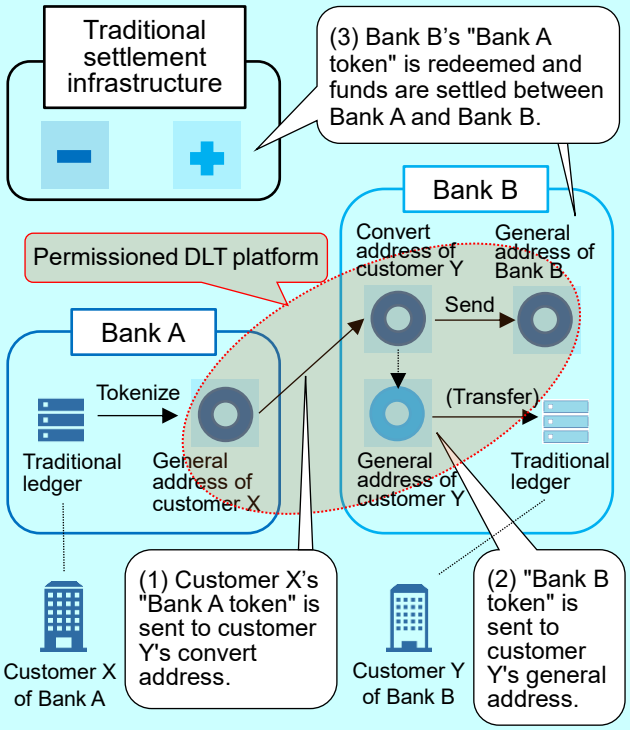
German Banking Industry Committee

The German Banking Industry Committee (GBIC) has also published a whitepaper on the Commercial Bank Money Token (CBMT).[10] It supports automatic processing and smart contracts using a permissioned DLT platform, and is intended for B2B use cases such as DvP. A customer would have two types of addresses: a general address and a convert address, the latter being designed to prevent the storage of CBMT.

The payment arrangement is as follows (Chart 3): (1) Payer X (customer of Bank A) sends the CBMT

issued by Bank A (Bank A token) to the convert address of the payee (customer of Bank B); (2) Bank B sends the token to its own general address and simultaneously sends an equivalent amount of CBMT (Bank B token) to customer Y's general address; and (3) the exposure between Bank A and Bank B is settled through an interbank infrastructure. For interbank settlements, it is assumed that the traditional settlement infrastructure is used with an eye to both gross and net settlement. The latter could save liquidity. After receiving the CBMT, payee Y can change the token into commercial bank money by transferring it to the Bank's general address. In addition, if Bank B's customer has also completed the KYC (Know Your Customer) procedure of Bank A, the customer may continue to hold the CBMT issued by Bank A by transferring it to his or her general address.

[Chart 3] Conceptual Diagram of GBIC



Note: Based on GBIC (2023).

Other recent initiatives

In South Korea, a live pilot of deposit tokens, involving 100,000 individuals, will start from the October-December quarter of 2024.

In addition to the above, Project Agorá, led by the BIS Innovation Hub, together with seven central banks including the Bank of Japan and commercial banks from each jurisdiction, will test for improvements in the speed and cost of cross-border payments by utilizing technologies such as tokenization and smart contracts.[11] Specifically, the project will discuss multi-currency cross-border payments with tokenized commercial bank deposits and tokenized wholesale central bank money. The idea behind this is that it would be more efficient as a payment and settlement system if various assets in different currencies were held and settled on a common platform called a unified ledger (BIS [2023]).

The aforementioned RLN and RSN differ from Project Agorá in the range of target use cases and target currencies. However, they seem to be similar in their idea of tokenizing both commercial bank deposits and central bank money and placing them on a common programmable ledger to realize atomic settlement in an efficient manner.

Why Tokenization?

Although the above examples have different characteristics in terms of the use cases and technologies they employ, they seem to have the following commonalities in terms of underlying ideas.

Programmability

First, many initiatives have in common the aim for extension of functionality in the payment and settlement systems by applying the idea of programmability. Programmability in payment systems refers to the ability of computer programs to control and automate system behavior in the circulation of funds and securities.[12] It is true that there are several possible ways to achieve this, but most discussions surrounding deposit tokenization seem to involve implementing smart contracts on a distributed ledger. A smart contract is a self-executing application of a programmable platform that can trigger an action if pre-specified conditions are met (BIS [2023]).

In the crypto asset community, users and developers are already being able to deploy smart contracts that enable additional service functions, which are utilized in decentralized finance (DeFi) services. Under these circumstances, it seems that deposit tokenization initiatives attempt to apply a similar idea to payments using bank deposits, which is a form of traditional financial transaction.

One of the programmability aspects that is specifically considered in deposit tokenization initiatives is atomic settlement. Atomic settlement refers to a sequential process where either all settlements are successfully executed or none of the settlements take place. In the case of the delivery of two assets, it refers to a settlement mechanism that links them and ensures that delivery of one asset occurs if

and only if delivery of the other asset takes place.

Although DvP, which is an atomic settlement of funds and securities, and PvP (Payment versus Payment), which is an atomic settlement of different funds (for example, Japanese yen and U.S. dollars), are realized in existing payment and settlement systems, it is said that these could also be achieved on a DLT platform,[13] as discussed in the second phase of Project Stella, jointly implemented by the European Central Bank and the Bank of Japan,[14] and in MAS's Project Guardian.

In addition, many initiatives refer, as an advantage of tokenization, to interoperability between deposits of different banks or of different currencies, and also the ease of exchanging deposits for other tokenized assets (RLN [2022], MAS [2023a], BIS [2023]).

Advantages for non-functional requirements

Some initiatives point out that the non-functional requirement of constant (24 hours a day, 365 days a year) operation is one advantage of adopting DLT (RLN [2022], Oliver Wyman and Onyx [2023]). Especially in the context of cross-border payments that involve time differences, this feature is said to be a potential strength (RLN [2023b][15]).

Others point out that, as multiple parties share the same state of ledger, DLT has the advantage of more easily ensuring tamper resistance, failure tolerance, and ease of recovery in the event of failure.

Why Deposits?

The abovementioned points aimed at by tokenization have already been widely acknowledged in recent discussions regarding the enhancement of payment and settlement systems, and are not necessarily unique to deposit tokenization. So why are these initiatives targeting deposits rather than other assets?

Affinity with the two-tier monetary system

First, there are arguments that emphasize that deposits are a component of the two-tier monetary system (BIS [2023]). From the perspective of supplying money, which is a means of settling transactions, central banks exclusively supply central bank money such as banknotes and central bank reserves, while commercial banks supply bank deposits through credit creation. Under this two-tier structure between the central banks and commercial banks, a framework of so-called singleness or uniformity of money[16] has also been put in place, through the development of bank supervision and deposit insurance systems, in order to ensure that various types of money including commercial bank deposits are convertible to cash at par. Such a system serves as an effective means of supplying money widely throughout society. At the same time, there is the advantage of allowing the allocation of financial resources by private-led initiatives, where commercial banks, which are skilled in gathering and analyzing information on borrowers, lend and provide deposits to firms and other customers (Ueda [2024][17]). It is also argued that the flexible creation of money by commercial banks under this two-tier structure makes it easier to respond nimbly to funding needs for settlements, especially in large-value B2B transactions (BOJ PSSD [2024][18]).

While there are various ideas, including stablecoins, regarding new forms of money that could enhance the functional and non-functional aspects of payment systems, it seems that deposit tokenization is considered to be a potential approach that is affinitive with this two-tier monetary system.

In addition to this, deposits are backed by a bank's entire balance sheet under fractional reserve banking (DEA [2023][19]). Especially in contrast to the case of stablecoins backed by high-quality liquid assets, it is also pointed out that the characteristics of deposits would make it possible to avoid locking up such assets (Garratt et al. [2022][20]).

Besides these points, concerns about cryptocurrencies undermining monetary sovereignty (RLN [2022]) and those about the impact on financial intermediation related to the issuance of CBDC (GBIC [2023]) are also noted as motivations for considering deposit tokenization.

Potential affinity with existing laws and regulations

Some initiatives point out the possibility of referencing existing banking regulation as an advantage of deposit tokenization. For example, from the perspective of AML/CFT (Anti-Money Laundering and Combating the Financing of Terrorism), system design choices that limit the owners of tokenized deposits to the bank's customers are said to be an important aspect of regulatory compliance (BIS [2023]). In this regard, there is also a view that tokenized deposits can be designed to ensure that they are transferred only to those who have completed a KYC procedure with at least one financial institution, while crypto assets and stablecoins traded on permissionless blockchains could have the risk of being transferred to those who have not passed a KYC check (Garratt and Shin [2023][21]).

In addition, some initiatives point out that if these

can be categorized as "deposits," their legal status or treatment of deposit insurance could fall under existing arrangements (as pointed out under U.S. law, RLN [2023c][22]).

Issues regarding Deposit Tokenization

Thus far, this paper has provided an overview of overseas initiatives related to deposit tokenization. Based on this, some issues that are perceived as requiring further consideration are pointed out below.

Legal status

One of these issues is the legal status of deposit tokenization.

First, the legal nature of deposit tokenization in the private law system would be an important issue. A definition of tokenization is to "integrate the records of the underlying asset normally found in a traditional database with the rules and logic governing the transfer process for that asset" (BIS [2023]). However, rules for the transfer of interest, including that of deposit claims, are established by the private law system of each jurisdiction, such as by the stipulations in the Civil Code, other specific legal provisions, and/or by case law. Under these circumstances, it is necessary to deepen the discussion on how consistently the "burning and minting" or "assigning" of tokens in payment transactions across multiple banks is categorized within the private law system (see, as an analysis under U.S. law, RLN [2023c]).

In such discussions, it would be desirable to design a system that makes it possible to identify the entity to whom the tokenized deposit belongs in a manner that provides legal certainty even when, for example, the payer goes bankrupt or when a discrepancy has occurred between the payer's manifestation of intent and the record of the token on the ledger. In particular, when a token represents a deposit managed in a traditional banking system outside of the distributed ledger, consideration will be required as to whether the timing of the payment becoming final is understood to be one of the following: (1) when the payee's token is recorded or minted; (2) when the payee's deposit account is credited on the traditional banking system; or (3) otherwise.

This point should also be made sufficiently clear in relation to the nature of smart contracts, which are self-executing computer programs that can trigger certain actions automatically if pre-specified conditions are met. Specifically, it will be necessary to deepen discussions from the perspective of how the existence of smart contracts may affect legal certainty, assuming various scenarios such as withdrawal of manifestation of intention to pay, seizure of deposit claims, bankruptcy of the payer, malfunction of smart contracts, and disruption of communication. If an undesirable outcome is expected, it would be necessary to consider how smart contracts should be designed in advance to avoid such an outcome.

In addition, attention would be paid to the treatment under the deposit insurance system. Whether or not tokenized deposits are insured should be determined by each jurisdiction based on the design of the deposit insurance system and each tokenization scheme. In this regard, RLN (2023c) and Cunliffe (2023)[23] point out the possibility of applying or utilizing the existing deposit insurance schemes in the U.S. and U.K., respectively. On the other hand, GBIC (2023) suggests an option to create a dedicated deposit insurance fund. From a practical point of view, even if tokenized deposits were insured, in a jurisdiction where an insurance limit per depositor is applied, there would be a risk of impairing fair and prompt protection of depositors unless there was an effective method of aggregating all deposit accounts that each depositor has at the bank.

Technology and design choices based on functional and non-functional requirements

The technology and design that should be adopted will also be an issue.

Many of the initiatives summarized in this paper have adopted a permissioned DLT platform, while there is also a case for testing a permissionless DLT platform (MAS [2023a]).

Reasons for choosing a permissioned DLT platform include perspectives of allowing various parties to participate in transactions while complying with regulations (RLN [2023a]) and of complying with AML regulations (GBIC [2023]). Looking at these arrangements, it is a characteristic feature of payments across multiple banks that, instead of directly transferring the originating bank's token, a beneficiary bank's token is minted and paid to the payee. This is different from stablecoins on permissionless DLT platforms in which the payer's token is transferred to the payee in such a way that it maintains its identity or continuity. In some cases, a DLT platform and traditional core banking systems coexist, and value may be transferred between the two.

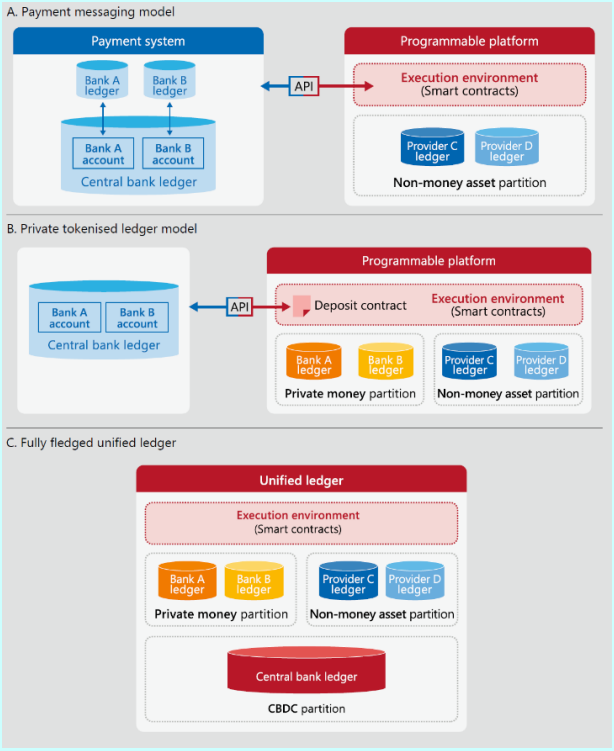
Further research is required to understand the extent to which smart contracts can handle the complex functions of atomic processing of burning, transferring,

and/or minting multiple tokens issued by each bank while ensuring the stability and efficiency expected in actual transactions. It is also necessary to explore how to ensure the governance and auditability of smart contracts.

On the non-functional side, when implementing tokenized deposits in society, it is necessary to consider scalability to accommodate an increase in transactions. In addition, as mentioned above, some initiatives point out as advantages the interoperability and always-on operation that come with adopting a DLT platform.

As shown by BIS (2023), there are several possible patterns for interoperability (Chart 4). In Chart 4, A and B are methods of connecting a DLT platform to existing payment and settlement systems using an application programming interface (API), while C is a method of settling various assets on a unified ledger. In the former methods using API, the assumption is that the assets are locked on the existing system and the tokens are unlocked on the programmable platform. While it has been argued by some that C will be more useful if emphasis is placed on affinity with programmability such as atomic settlements, A and B may also enable existing payment and settlement systems to be utilized more effectively.

[Chart 4] Interoperability and "Unified Ledger" Proposed by BIS



Source: BIS (2023).

UK Finance, a trade association for the U.K. banking and financial services sector, has examined the RLN concept in the context of use cases in the U.K.[24] It has presented several architectural options including (1) connecting existing payment systems to the shared ledger via API, (2) settling some tokens on the shared ledger while connecting to some payment systems via API, and (3) settling all tokens on the shared ledger.

In relation to ensuring interoperability of DLT platforms, MAS and some major financial institutions across jurisdictions, including JPMorgan, have begun an initiative named Global Layer One (GL1) to explore the design of an open and digital infrastructure for tokenized financial assets. [25] Regarding the interoperability of tokenized deposits with central bank money or other financial assets, it is necessary to compare these approaches and elucidate which approach has relative advantages.

Concluding Remarks

Throughout this paper, we have surveyed overseas initiatives on deposit tokenization. While outside of this scope, domestic studies are also being conducted on payment instruments based on tokenized deposits.

There are various ongoing discussions about the future form of money, but as mentioned above, it is considered appropriate to maintain the two-tier monetary system of central banks and commercial banks. Especially with large-value cross-border payments in mind, it seems necessary to take note of the possibility that the solution of deposit tokenization will be evaluated as making some kind of contribution to resolving pain points in current business practices. From this perspective, we will accumulate knowledge through participation in Project Agorá. It is also necessary to learn from the upcoming findings of various other experiments.

With an eye toward future payment and settlement systems, multifaceted discussions on deposit tokenization through deeper analyses of the issues raised in this paper will continue to be necessary.

* Currently at the Kobe Branch

[1] Financial Stability Board (2023), "The Financial Stability Risks of Decentralised Finance."

[2] Bank for International Settlements (2023), "Blueprint for the future monetary system: improving the old, enabling the new."

[3] Oliver Wyman and Onyx by JPMorgan (2023), "Deposit

tokens: A foundation for stable digital money."

[4] Monetary Authority of Singapore (2023a), "Project Guardian: Enabling Open and Interoperable Networks."

[5] Monetary Authority of Singapore (2022), "First Industry Pilot for Digital Asset and Decentralised Finance Goes Live."

[6] Oliver Wyman Forum, DBS Ltd, Onyx by JPMorgan, and SBI Digital Asset Holdings (2022), "Institutional DeFi: The Next Generation of Finance?"

[7] The Regulated Liability Network (2022), "Digital Sovereign Currency: Whitepaper."

[8] The Regulated Liability Network (2023a), "Technical Report."

[9] Securities Industry and Financial Markets Association (2024), "Members of the U.S. Financial Sector to Explore Multi-Asset Settlement Using Shared Ledger Technology."

[10] German Banking Industry Committee (2023), "Working Paper on Commercial Bank Money Token."

[11] Bank for International Settlements (2024), "Project Agorá: central banks and banking sector embark on major project to explore tokenisation of cross-border payments."

[12] HOJO Masashi and HATOGAI Junichiro (2022), "Realizing Programmability in Payment and Settlement Systems." (Bank of Japan Review 2022-E-8).

[13] SUGIE Jiro and HATOGAI Junichiro (2023), "Efforts to Improve Payments Using DLT: Focusing on Wholesale CBDC Experiments in Various Countries." (Bank of Japan Review 2023-E-9).

[14] European Central Bank and Bank of Japan (2018), "Securities settlement systems: delivery-versus-payment in a distributed ledger environment."

[15] The Regulated Liability Network (2023b), "Business Applicability Report."

[16] Committee on Payment and Settlement Systems (2003), "The role of central bank money in payment systems."

[17] UEDA Kazuo (2024), "What to Know about Central Bank Digital Currency."

[18] Bank of Japan, Payment and Settlement Systems Department (2024), "FIN/SUM 2024: 'Future of Wholesale Payments' - Session 3: 'Future of Wholesale Payments' Key Discussions -."

[19] Digital Euro Association (2023), "Banking on Tokens: A Primer on Tokenized Commercial Bank Deposits."

[20] Garratt, Rod, Michael Lee, Antoine Martin, and Joseph Torregrossa (2022), "The Future of Payments Is Not Stablecoins," Federal Reserve Bank of New York *Liberty Street Economics*.

[21] Garratt, Rodney, and Hyun Song Shin (2023), "Stablecoins versus tokenised deposits: implications for the singleness of money," *BIS Bulletin*, No 73.

[22] The Regulated Liability Network (2023c), "Legal Report."

[23] Cunliffe, Jon (2023), "The shape of things to come: innovation in payments and money."

[24] UK Finance (2023), "Regulated Liability Network: UK Discovery Phase."

[25] Monetary Authority of Singapore (2023b), "MAS Partners Financial Industry to Expand Asset Tokenisation Initiatives."

The Bank of Japan Review Series is published by the Bank to explain recent economic and financial topics for a wide range of readers. This report, 2024-E-9, is a translation of the Japanese original, 2024-J-10, published in June 2024. Views expressed are those of the authors and do not necessarily reflect those of the Bank. If you have any comments or questions, please contact FinTech Center, Payment and Settlement Systems Department (E-mail: post.fintech@boj.or.jp). The Bank of Japan Review Series and the Bank of Japan Working Paper Series are available at https://www.boj.or.jp/en/index.htm.